### Sunday 4th November 2018

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>6:30pm – 9:00pm</td>
<td>Meet &amp; Greet Reception. All welcome to join to meet fellow THE CAAV attendees. Montrose Mansion, The Inn at Villanova.</td>
</tr>
</tbody>
</table>

### Monday 5th November 2018 Location: Ballroom, The Inn at Villanova.

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>7:30am – 8:45am</td>
<td>Continental Breakfast &amp; Registration</td>
</tr>
<tr>
<td>8:45am – 8:50am</td>
<td>Dr. Frank Klassner, Director of Center for Excellent and Enterprise Technology</td>
</tr>
<tr>
<td>8:50am – 9:00am</td>
<td>Welcome Dr. Amanda Grannas, Associate Vice Provost for Research, Villanova University</td>
</tr>
<tr>
<td></td>
<td>Emma-Jane Alexander, President of THE CAAV and Manager of the Shell 3D Visualization Center, University of Wyoming</td>
</tr>
<tr>
<td>9:00am – 9:45am</td>
<td>Keynote Address: Virtual reality V2.0: opportunities and challenges Dr. Carolina Cruz-Neira, Executive Director of the Emerging Analytics Center, University of Arkansas.</td>
</tr>
<tr>
<td>9:45am – 10:00am</td>
<td>Round room introductions</td>
</tr>
<tr>
<td>10:00am – 10:10am</td>
<td>Break &amp; Technical Showcase</td>
</tr>
<tr>
<td>10:10am – 10:35am</td>
<td>Presentation Immersive Visualization in the Time of Commercial VR Headsets, Oliver Kreylos (Associate Researcher, University of California, Davis)</td>
</tr>
<tr>
<td>10:35am – 11:00am</td>
<td>Presentation PITCHvr, Mark Jupina (Assistant Professor, Electrical and Computer Engineering, Villanova University)</td>
</tr>
<tr>
<td>11:00am – 12:00pm</td>
<td>Lightning Talks</td>
</tr>
<tr>
<td>12:00pm – 1:00pm</td>
<td>Lunch &amp; Technical Showcase</td>
</tr>
<tr>
<td>1:00pm – 1:25pm</td>
<td>Presentation</td>
</tr>
<tr>
<td>Time</td>
<td>Event</td>
</tr>
<tr>
<td>--------------</td>
<td>-----------------------------------------------------------------------</td>
</tr>
<tr>
<td>1:25pm – 1:50pm</td>
<td>Presentation Immersive Scholar: Building a Community of Practice &amp; Progress Updates</td>
</tr>
<tr>
<td>1:50pm – 2:15pm</td>
<td>Presentation Developing a User-Friendly Architecture for a CAVE2</td>
</tr>
<tr>
<td>2:15pm – 2:30pm</td>
<td>Break &amp; Technical Showcase</td>
</tr>
<tr>
<td>2:30pm – 2:35pm</td>
<td>THE CAAV Past, Present and Future</td>
</tr>
<tr>
<td>2:35pm – 3:30pm</td>
<td>Panel – Starting up and Sustainability</td>
</tr>
<tr>
<td>3:30pm – 3:40pm</td>
<td>THE CAAV Survey</td>
</tr>
<tr>
<td>3:40pm – 3:55pm</td>
<td>Break &amp; Technical Showcase</td>
</tr>
<tr>
<td>3:55pm – 4:20pm</td>
<td>Presentation Visualization in a Browser</td>
</tr>
<tr>
<td>4:20pm – 4:45pm</td>
<td>Presentation – IN PART REMOTE. An Exploration of General-Use Immersive Visualization Applications for Head Mounted Displays</td>
</tr>
<tr>
<td>4:45pm – 5:10pm</td>
<td>Presentation - REMOTE Loving Your New Home: How Virtual Reality will Revolutionize Architecture</td>
</tr>
</tbody>
</table>

Day 1 – [Survey Link](#)
<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>7:00am – 8:30am</td>
<td>Continental Breakfast &amp; Registration</td>
</tr>
<tr>
<td>8:30am – 9:20am</td>
<td>Invited Talk&lt;br&gt;Mr. Luca Della Giovampaola, Head of Information Technology Office, Vatican Museums</td>
</tr>
<tr>
<td>9:20am – 9:30am</td>
<td>Break &amp; Technical Showcase</td>
</tr>
<tr>
<td>9:30am – 9:55am</td>
<td>Presentation&lt;br&gt;Sensitivity in Dynamical Systems, James Sochacki (Department of Mathematics and Statistics, Center for Computational Mathematics and Modeling, James Madison University)</td>
</tr>
<tr>
<td>9:55am – 10:20am</td>
<td>Presentation&lt;br&gt;VR Return on Investment, Mike McDaniel (Mechdyne, Marketing Manager)</td>
</tr>
<tr>
<td>10:20am – 10:45am</td>
<td>Presentation&lt;br&gt;Immersive Virtual Reality Experiences at Boise State University, Steven Cutchin (Director Research Computing, Department of Computer Science, Boise State University)</td>
</tr>
<tr>
<td>10:45am – 11:10am</td>
<td>Presentation&lt;br&gt;Immersive Pedagogy at Temple University’s Digital Scholarship Center, Alex Wermer-Colan (Temple University)</td>
</tr>
<tr>
<td>11:10am – 12:00pm</td>
<td>Panel - Tools and Technologies</td>
</tr>
<tr>
<td>12:00pm – 1:00pm</td>
<td>Lunch &amp; Technical Showcase</td>
</tr>
<tr>
<td>1:00pm – 1:45pm</td>
<td>Panel - Multidisciplinary Applications of Viz, VR/AR</td>
</tr>
<tr>
<td>1:45pm – 1:55pm</td>
<td>Proposal on membership change</td>
</tr>
<tr>
<td>1:55pm – 2:20pm</td>
<td>Presentation&lt;br&gt;Extending the use of VR environments, Patrea Andersen (Academic Director Simulation and Visualization, University of the Sunshine Coast, Australia) Mark Barry (Visualization Facilities Manager, University of the Sunshine Coast, Australia)</td>
</tr>
<tr>
<td>2:20pm – 2:30pm</td>
<td>Break &amp; Technical Showcase</td>
</tr>
<tr>
<td>Time</td>
<td>Event</td>
</tr>
<tr>
<td>--------------</td>
<td>----------------------------------------------------------------------</td>
</tr>
</tbody>
</table>
| 2:30pm – 2:55pm | Presentation  
GPGPU Enabled Adaptive Volume Visualization for Immersive Systems, James H. Money (Applied Visualization Laboratory Lead, Idaho National Laboratory) |
| 2:55pm – 5:30pm | Tour of Villanova CAVE and VR data facilities                          |
|               | Day 2 – [Survey Link](#)                                               |

**WEDNESDAY, 7th November 2018**

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>7:00am – 8:30am</td>
<td>Continental Breakfast &amp; Registration</td>
</tr>
</tbody>
</table>
| 8:30am – 8:55am | Presentation  
Building a development team for creating educational 3D artefacts – the USC experience, Mark Barry (Visualization Facilities Manager, University of the Sunshine Coast, Australia) |
| 8:55am – 9:20am | Presentation - REMOTE  
Augmented Reality for Language and Culture Revitalization, Phineas Kelly (Instructional Technologist/Doctoral Student Cultural and Linguistic Anthropology University of Wyoming) |
| 9:20am – 9:45am | Presentation  
Data-Rich Observation of Humans in Virtual Worlds, Lee Boot and Ryan Zuber (University of Maryland, Baltimore County) |
| 9:45am – 10:00am | Conference closing remarks, Emma-Jane Alexander                      |
| 10:00am – 11:15am | THE CAAV Annual General Meeting (Executive Committee)                |
|               | Please take a boxed lunch for your departure                          |
|               | Day 3 – [Survey Link](#)                                               |
Technical Showcase

Extending the use of VR environments - Patrea Andersen (Academic Director Simulation and Visualization, University of the Sunshine Coast, Australia)

SAGE2 platform for student data - Christopher Dunstan (McNair Scholar Computer Science & Mathematics, University of Maryland, Baltimore County)

3D Heatmap – Michael Stauffer (Data Visualization Developer, Inst. for Biomedical Informatics, Perelman School of Medicine, Univ. of Pennsylvania)

VR Buffet - Ryan Zuber (Technical Director for Modeling and Animation, Imaging Research Center, University of Maryland, Baltimore County)

Designing in the Dark - Kyle D. Summerfield (Virtual Reality Developer, Shell 3D Viz Center, University of Wyoming)

LiDAR point cloud viewing application – Ross Tredinnick (Systems Programmer, Wisconsin Institute for Discovery)

Non-Conventional Use of 3d Infrastructure – Steve Heckman (University of Maryland, Baltimore County)

Google Cardboard
To experience 360 degree 3D data captures for University of Wyoming teaching and research projects, please search the Play store for the UWVC Stereo Viewer. You have a free Google Cardboard in your conference bag!
Presenter Biographies and Abstracts

Emma-Jane Alexander
Shell 3D Visualization Manager
University of Wyoming

With a computing and mathematics degree in Visualization from the University of Teesside and an Executive MBA from the University of Hull (both UK), Emma-Jane takes great pleasure in utilizing both technical and management skills to explore and nurture the successful adoption of technology and software in visualization centers. Currently the manager of the Shell 3D Visualization Center based within the School of Energy Resources, Emma-Jane enjoys the challenge of bringing together 3D visualization technical experts with teaching/ research faculty and students to enhance teaching and learning. Emma-Jane is eager to seek out and develop new multi-disciplinary collaborative relationships with faculty at UW to leverage research opportunities. Emma-Jane has focused research interests in the application of therapeutic virtual reality treatment of obesity and is developing a business exploration concept called 3D Future Form.

Dr. Patrea Andersen
Associate Professor
University of the Sunshine Coast

Patrea has extensive academic experience in Nursing Education. As Academic Director for Simulation and Visualisation for the University of the Sunshine Coast (USC), Patrea’s primary focus is on utilisation of advanced technologies in simulation and curricula integration. Her research interests include clinical education, simulation (including visualisation and game-based simulation, AR and VR applications), patient safety, professional competence and issues impacting on the preparation and development of health professionals. Her success is evidenced in collaborative research grants, publications, keynote and referred conference presentations. Patrea was the recipient of an OLT citation for leadership in simulation in 2015 and is a Higher Education Academy (HEA) Senior Fellow. Patrea holds a number of governance roles. She is Portfolio Leader for Simulation and Practice Learning for Undergraduate Programmes for the School of Nursing, Midwifery and Paramedicine at USC, Chair of national simulation education collective InSPIRE and The Australian chair for SimGHOST Australia.

Abstract
Extending the use of VR environments: Using 3D artefacts in teaching and learning to enhance learning outcomes in undergraduate health degrees
Historically VR environments such as CAVE2TM have been used predominantly in research to manage large data. There is a growing body of knowledge in human information processing supporting the use of visualisation methods in education. Low (2001) posits that employing the use of animation can remove barriers to understanding by simplifying complex cognitive processes associated with learning. The translation of science theory and concepts into practice can pose a barrier to student learning and understanding. While there is a growing body of literature describing the use of three-dimensional (3D) visualisation for teaching science concepts, there is little evidence regarding the efficacy of immersive visualisation in teaching and its impact on learning (Richardson et al., 2013). Nonetheless, research has identified that visualisation methods that employ the use of animation can remove barriers to understanding by simplifying complex cognitive processes associated with learning (Low, 2001). Using animation as a visual aid has advantages over static pictures and diagrams as it mitigates the initial cognitive effort of having to mentally work out the processes involved (Low, 2001). This reduction in cognitive load allows the mind to concentrate on the content, address visual abstractions and results in a quicker grasp of concepts. In this way, animation and visualisation technology is able to deliver more information than that available in a static diagram (Yeung et al., 2007). In doing so the explanatory nature of animation increases understanding and provides a visual and conceptual perspective of processes that are not demonstrated in static models. These factors are responsible for enhancing motivation and engagement with difficult concepts and accelerating learning. For these reasons the University of the Sunshine Coast, Australia has strategically supported and employed the use of visualisation as a primary educational modality in undergraduate education.

This presentation will include a demonstrate how CAVE2TM is being used in undergraduate education for teaching core content in science, midwifery and nursing. Four case studies showcasing 3D artefacts will be presented and pedagogy discussed.

In addition to the case examples, learnings arising from employing pedagogy using 3D artefacts, research outcomes and insights into practices that help and hinder learning in visualisation environments will be presented.

References:
Mr. Mark Barry
Visualization Facility Manager
University of the Sunshine Coast

Mark has worked in Information Technology roles for over 30 years and is currently the Manager Visualisation Facilities at the University of the Sunshine Coast (USC). Mark’s primary focus is enabling the use of the advanced visualisation capabilities of USC facilities in USC’s academic programs by combining his educational background (high school mathematics and physics teacher), scientific visualisation and computing skills. Mark has extensive experience in liaising between academic staff and IT professionals with the goal of harnessing the available technologies to achieve positive outcomes. Mark also has extensive experience in managing and support high performance computing facilities. He has a special interest in 3D scanners and geometry.

Abstract
Building a development team for creating educational 3D artefacts – the USC experience

So, you’ve ordered the infrastructure that is the hard part done, right? What about selecting the people who are going to build your content? This presentation will explore the types of skill sets and work environments that required to make practical use of your infrastructure beyond the demos. How do you engage with your clients; students, academics and administrators? What types of problems, information and/or data do they have? How do they ‘get it onto your screens’? The University of the Sunshine Coast (USC) secured funding for a number of visualisation spaces including a CAVE2 TM system with the goal of using the facilities to support its teaching programs. USC started using the facilities in June 2015.

Mr. Lee Boot
Director of the Imaging Research Center/Affiliate Associate Professor of Visual Arts and Computer Science and Engineering
University of Maryland, Baltimore County

His work is research and development aimed at creating and testing novel digital media technologies, forms, and content to improve the capacity of the digital mediasphere to serve public interests. Past efforts include finding ways to convey the neuroscience and psychology of happiness to young adults; establishing online media networks that bring young peoples’ voices into the development of education policy; and designing new frameworks for communicating science to laypersons. The work been sponsored by federal agencies such as the National Institutes of Health, foundations including Surdna
and the Robert W. Deutsch Foundation, and has been commissioned by the National Academy of Sciences.

Abstract

Data-Rich Observation of Humans in Virtual Worlds
Submitted by Boot, Lee; Cheah, Charissa; Gong, Jiaqi; Jarzynski, Mark; Murnane, Mark; Zuber, Ryan Observing human subjects navigating simulations of real world environments or novel kinds of environments can reveal valuable information about their behaviors and responses. Simulated environments and experiences also have the potential to be useful for various forms of health-related treatments, or to convey knowledge. In each case, it will be critical to observe, collect data, and measure how subjects behave and react. At UMBC's Imaging Research Center (IRC), researchers working in the domains of psychology, information systems, computer science and the media arts have come together to established a research program that integrates virtual reality environments with other instruments to be able to collect data on such behaviors and responses, which can be productively analyzed if properly integrated, for example, through time synchronization. The technical capacity to simulate spatial environments is increasing significantly with the advent of virtual reality (VR) hardware and software that are robust and significantly reduce discomfort during use compared to earlier systems. Mixed reality (MR) systems that use objective cameras and green screens to produce a second video channel by which others can see subjects accurately placed within the virtual environments they are exploring, are promising channels for observing behavior within a highly controlled context. While providing the total experience of being where one is not may be a ways off, we are crossing the threshold beyond which the willing suspension of disbelief is readily available. At the same time, wearable biometric instruments that can track and record multimodal physiological sensor data from skin conductivity (an indicator of stress), eye movement, to brain activity are also developing at a fast and accelerating pace intended to deploy in real-world environments. The key hypothesis driving the IRC's observational simulation research program is that virtual simulation is already convincing enough, and instruments to monitor and record behavior as well as physiological and psychological responses are sufficiently advanced, that when combined in a laboratory, data with real value to illuminate behaviors and responses related to a wide range of challenges can now be collected. We can observe the food choices people make at a buffet or compare the effect of various visual and sonic ways of treating pain. Such data can provide immediate useful insights, and when compared to data collected in real world environments, will increasingly reveal the dynamic relations between how people experience real versus virtual worlds. Understanding that relation will help contextualize the value of observation-enabled simulated environments both for measuring, and affecting human behaviors and responses. Given the relative ease of constructing virtual, compared with real-world environments, there is significant potential for rapid, iterative testing of interventions that might shift behaviors and/or change responses. For the lab to realize the full potential of observing people in highly flexible, simulated environments, significant conceptual and technical questions and challenges remain: How and when should multiple modes of observational data be
cleaned and synchronized or merged? What instruments are most useful in a given experiment or intervention? Again, ultimately, how will data from simulated environment Laboratories compare to those from the real world, and what is the nature of the differences between the two?

Dr. Steve Cutchin
Boise State University

Steve joined the faculty at Boise State University in August 2013. From 2008 to 2013 he was manager of the KAUST Visualization Laboratory Core Facility and the Supercomputer Facility at King Abdullah’s University of Science and Technology (KAUST) in Thuwal, Saudi Arabia. At KAUST he recruited a technical team of engineers and visualization scientists while managing the building of the state of the art scientific data visualization laboratory on the KAUST campus, forged relationships with international university and corporate partners, continued to improve the laboratory and recruit new staff. Prior to his work in Saudi Arabia, Dr. Cutchin worked at the University of California, San Diego (UCSD) first as manager of Visualization Services at the San Diego Supercomputer Center and later at California Institute for Telecommunications and Information Technology (Calit2). He has worked as a Sr. Software Engineer at Walt Disney Feature Animation developing software tools to improve animation production on feature films. He has published articles on Computer Graphics and Visualization, created animations for Discovery Channel and images for SIGGRAPH and Supercomputing conferences and journals. He received his doctorate from Purdue University in Computer Science.

Abstract

Immersive Virtual Reality Experiences at Boise State University

Boise State University is engaged in developing a cross-discipline program in virtual reality and immersive experiences. Vertically Integrated Projects in the College of Innovation and Design form teams of cross-discipline undergraduate students from Computer Science, Visual Arts, Graphic Design, and Games Internet Media and Mobile Program to develop immersive virtual reality experiences that are browsed within both virtual reality headsets as well as collaborative immersive environments. Cross-discipline teams of undergraduates are formed in multi-semester programs and sent on multiple field expeditions to collect high-resolution photographic and lidar data from various locations, past experiences have included Singapore, Hawaii, and Los Angeles. Within a laboratory setting students are trained in production of digital content and media to produce high-resolution immersive interactive environments providing them with new skills in digital production, computer science, graphic design, camera operation, system design, and direct real-world production experience. The content collected is captured at resolutions of one hundred megapixels for still content and thirty-megapixels for
stereoscopic video at sixty fps. Computer science researchers are experimenting with various techniques and tools to improve visual quality, reduce file size and enhance interactive experiences with new immersion techniques and controls. The production pipeline is being developed experimentally on AWS to determine the effectiveness of AWS for academic cloud based undergraduate experience. Content is being collected from visual art students final masters installations to produce a digital archive of Master’s final projects for long term storage and sharing. This acts as an always available portfolio of their work post-graduation.

The work being produced will be demonstrated and shown within Boise State’s upcoming immersive CAVE like environment to be installed within the new Fine Arts building on the Boise State campus as part of the beginning of the new School of the Arts program at the University. This environment, named the World Museum, is a large immersive physical environment approximately 22’ by 23’ in size with planned active seamless display walls covering three of the rooms walls plus a large portion of the ceiling to provide a collaborative environment for a variety of immersive arts projects in areas from visual arts to performing arts. The facility is scheduled to be opened in Fall of 2019.

Mr. Christopher Dunstan
McNair Scholar Computer Science & Mathematics
University of Maryland, Baltimore County

Abstract
SAGE2 Platform for Student Data

We propose to showcase our app written by an REU student for the SAGE2 platform in order to visualize student success data. The University of Maryland, Baltimore County stores a large amount of student data in its data warehouse. Some of this data includes student demographics, grades, and completed courses. Since introductory courses play a crucial role in the performance of computing majors in later classes, this data can be analyzed in order to help improve student performance. For example, discrete structures plays a critical role in an upper level course called data structures. A technique that can interpret the data is data visualization. This technique displays data over a visual interface. Additionally, data visualization can be used to see hidden patterns that other analysis techniques cannot. Due to the semester based nature of the data and the clear course path of the students, hierarchical edge bundles, sunburst charts and heatmaps can be used to map common characteristics of a group in a sequential fashion. The app's visualizations highlight information such as the math background of students and the use of office hours to show their effect on student performance. The app enables us to display these visualizations across a platform of 24 monitors in the Pi Squared lab, but is also compatible with SAGE2 setups of any size. Each monitor has a resolution of 1080p and the cave as a whole is a 50-million pixel
(50% more than 8k) display. The monitors are controlled across one computer that utilizes multiple graphics cards. The visualizations are created using a piece of software called SAGE2. SAGE2 allows JavaScript applications to be spanned across multiple monitors receiving their content from one or more computers. Additionally, the JavaScript library, D3, is built into SAGE2. D3 is a powerful tool for creating dynamic visualizations and has the potential to create animations. Presenting the visualizations on the Pi Squared monitors provides a great way to spread information about student performance in the computing majors. Additionally, utilizing SAGE2 allows the visualizations to be displayed across different cave setups and even an individual's laptop.

Dr. Don Engel
Assistant Vice President for Research, Affiliate Assistant Professor of Physics, Affiliate Assistant Professor of Computer Science and Electrical Engineering
University of Maryland, Baltimore County

Dr. Engel is UMBC’s Assistant VP for Research and an affiliate professor in both the Department of Physics and the Department of Computer Science and Electrical Engineering. Don is PI on the NSF award which established UMBC’s visualization facility (partial CAVE2 and head-mounted VR). Don’s training includes a postdoc and clinical residency in radiation oncology medical physics at Hopkins; a physics Ph.D. and postdoc at UPenn; and a CompSci master’s and Math-Physics ScB from Brown. Don spent several years as a AAAS Congressional Fellow, an APS Senior Science Policy Fellow, and a Deloitte consultant to HHS, DOT, and DHS.

Mr. Jeff Fisher
Immersive Technologies Laboratory Manager
Wichita State University

Jeff Fisher graduated from Wichita State University in 2012, with a B.S. in Aerospace Engineering. After which he took on the role of managing the university’s Virtual Reality Lab. Since then, Jeff has been a part of helping local and regional companies realize their potential with XR. From mobile training solutions to data visualization, Jeff has been ensuring the virtual experience matches expectation and function.

Mr. Jon Gardzelewski
Associate Lecturer
Civil and Architectural Engineering
University of Wyoming
Jon is an Associate Lecturer in Architectural Engineering at the University of Wyoming as well as a founding member of UW Building Energy research Group (BERG). He gained professional training practicing architecture in San Francisco, Portland, Washington DC, Paris, and London, becoming a global expert in computer modeling and simulation. As a simulation specialist, Jon has given countless professional lectures and training sessions over the past decade, including four classes at Autodesk University including as “Building Performance Stump the Chump.” As a practicing architect in Wyoming, Jon (with UW-BERG) focuses on Net-Zero Energy residential projects utilizing Virtual Reality for an improved design and decision-making process. His ethos about technology is to find the balance between exploiting new tools “at all cost” and “when it makes sense.” In his Architectural Design courses, Jon teaches students the power of using technology to understand what’s really going on in terms of visualization and building performance simulation.

Abstract
Loving Your New Home: How Virtual Reality will Revolutionize Architecture

Mr. Andrew Grace
Senior Applications Programmer and Researcher
Villanova University, Center of Excellence in Enterprise Technology

As a graduate student, his work included research in virtual reality and real-time streaming of immersive 360 degree video. His current work as a Senior Applications Programmer and Research includes extending research he began as a graduate student and to support faculty and students develop new projects.

Mr. Walt Gurley
Data & Visualization Librarian
North Carolina State University Libraries

Walt is a Data & Visualization Librarian at NCSU Libraries. He supports the NC State University community through consultation and instruction on data and visualization tools and visualization design, the facilitation of library events and programming on data and visualization topics, and digital development. His digital development projects include web-based applications and digital media that have been incorporated into large-scale, public video displays and immersive visualization spaces. Walt has a Master’s of Science degree in Earth Science from NC State University and previously worked in a public science visualization lab at the NC Museum of Natural Sciences.

Mr. Payod Panda
PhD candidate
College of Design at North Carolina State University

A designer with a multidisciplinary educational background, Panda is a PhD student at the College of Design at NC State University. As the Immersive Technology Research Assistant in the Data and Visualization Services department at NCSU Libraries he explored data visualization in Virtual Reality. His past work includes topics ranging from Virtual Reality and education to machine learning and data visualization. Panda's research interests center on Human Computer Interaction and the Learning Sciences, and he’s currently working on enabling learning through creative making for immersive environments. His overarching goal is to make knowledge more accessible to all learners.

Abstract (Walt Gurley, Payod Panda)
An Exploration of General-Use Immersive Visualization Applications for Head Mounted Displays

Virtual reality (VR) has matured into a widely adopted computing platform with increasingly affordable hardware and dedicated application development in fields such as gaming, art, entertainment, and education. With the concurrent growth and availability of digital data, VR stands as a possible medium for understanding complex information with new modes of insight and novel methods of presentation through immersive data visualization. As part of the NCSU Libraries support of visualization and immersive technologies we investigated the current landscape of commercial, general-use immersive visualization technologies. Our goal was to evaluate existing software applications and determine the viability of data visualization in a VR environment and our library’s possible role in supporting these applications. The scope of our analysis included VR applications that are not domain specific, do not require specialized hardware or software, and are available for use on personal devices. Through our exploration we identified and tested three applications designed for use with commercial head mounted displays. In an effort to structure assessment and standardize comparison of applications we developed an evaluation rubric to rate immersive visualization applications based on metrics for fundamental usability, functionality, and user experience. Utilizing these standardized metrics revealed some general insights into the applicability of immersive visualization applications. Furthermore, we identified possible use-cases based on varied user needs as well as the possible services the NCSU Libraries could provide around this emerging visualization tool. Our presentation will provide an overview of this research including the exploration process, the development and application of an immersive visualization evaluation rubric, and the observations and general takeaways on the current state and possible future of general-use immersive visualization applications in an academic environment.
Miss. Shelby Hallman
Fellow
North Carolina State University Libraries

Shelby Hallman is a Fellow at North Carolina State University Libraries working in the Research Engagement department and on an initiative in the Digital Libraries Initiatives department. Her initiative focuses on an Andrew W. Mellon Foundation grant titled “Visualizing Digital Scholarship in Libraries and Learning Spaces”. She recently completed a Master of Library and Information Science at the University of Illinois at Urbana-Champaign iSchool, with specializations in Data Curation and Special Collections.

Miss. Erica Y. Hayes
Academic librarian and Copyright & Digital Scholarship Fellow
North Carolina State University Libraries

Erica is currently the project manager on the "Visualizing Digital Scholarship in Libraries and Learning Spaces" Andrew W. Mellon Foundation grant focused on developing extensible models and programs for the creation and sharing of digital scholarship in large-scale and immersive visualization environments. She holds an MLS and MIS dual degree from Indiana University, Bloomington, with a specialization in Digital Libraries.

Abstract
Immersive Scholar: Building a Community of Practice & Progress Updates

● Shelby Hallman, Co-PI, Research Librarian for Engineering & Entrepreneurship, North Carolina State University Libraries
● Erica Hayes, Project Manager, NCSU Libraries Fellow, North Carolina State University Libraries

NC State University Libraries has been awarded a three-year, $414,000 grant from the Andrew W. Mellon Foundation to develop extensible models and programs for the creation and sharing of digital scholarship in large-scale and immersive environments. Entitled “Visualizing Digital Scholarship in Libraries and Learning Spaces,” or Immersive Scholar for short, the grant aims to 1) build a community of practice of scholars and librarians to help visually immersive scholarly work enter the research lifecycle; and 2) overcome technical and resource barriers that limit the number of scholars and libraries who use visualization environments and the impact of generated knowledge. The grant will fund four specific elements:

● A series of block grants for other institutions working on creating, disseminating,
validating, and preserving digital scholarship for large-scale visual environments.

- An initial gathering of the funded institutions to create a roadmap for the project.
- A residency program for scholars, artists, and content developers to create open-source, data-driven art that will be tested and evaluated at the participating institutions.
- A culminating symposium to share and assess results and transition into a new phase of scholarly communication production and support.

This talk will provide an update of grant activities to date, as a supplement to last year’s presentation. The speakers will discuss the progress of the block grant projects, outline outcomes achieved during an initial goal setting workshop attended by eight institutions, and provide an overview of the projects being conducted by two creative residencies. The speakers will highlight opportunities for partnership between members of THE CAAV and the Immersive Scholar grant in hopes of continuing to support mutual interests and relationships. In particular, the speakers will identify immersive technology tools, documentation, and digital content that can be openly utilized and adapted by interested institutions.

Mr. Steven "Kit" Heckman

Undergraduate research at UMBC IRC department.
VR research and development.

Computer Science undergraduate, member of the UMBC Game Development Club since 2015 and current outreach officer. Extensive work in the Unreal 4 and Unity software engines. Began work with the CAAV setup at Pi Squared (at UMBC) in the summer of 2018 under the guidance of Don Engel. Working on new ways to experience VR and new user experiences to create through VR. Interested in creating socially engaging experiences in VR and especially in exploring asymmetrical game play dynamics.

Abstract
Non-Conventional Use of 3d Infrastructure

My intent is to present unconventional use of the infrastructure in the CAAV display. The 3d feature is achieved by splitting each row into either a red or blue tinted line of pixels, which is to say, splitting the image into separate interlaced rows. The best demonstration of this is that a purple screen will actually be displayed as a series of red and blue rows evenly weaved into each other. At any reasonable distance this will appear purple, even though not a single pixel of the image is purple.

The 3d glasses are designed such that the left lens will see only the red bars and the right lens will see only the blue bars, and this offset will create a 3d effect. However, by modifying the glasses to have either two of the left lenses or two of the right lenses, we can create an image that is drawn on each even row of pixels and a separate image that
is drawn on each odd row of pixels, and the effect is that one player will see one image and the other player will see another, all on the same display.

This could be used in a cooperative hidden information style game where players have to coordinate with each other to solve puzzles. This could also be used to make a competitive game where each player has privileged information. At the conference I plan to have a demo utilising this to show. Obviously we can’t bring our entire setup, so we’ll have a small 3d monitor display to use instead. This subject doesn’t necessarily warrant an entire talk, but being able to present a demo would be fantastic. I wouldn’t be opposed to talking about the demo and its concepts, however.

Dr. Mark A. Jupina
Asst. Professor
Villanova University

Dr. Jupina has taught courses in electromagnetics, analog and digital electronics, FPGAs and microcontrollers, and solid state materials, devices, and fabrication. He employs “active learning” techniques both inside and outside of the classroom using various modalities, including the flipped-lab approach. Since 2015, he has used virtual reality (VR) technology in the classroom and has researched and developed VR sports training systems, including for baseball, which utilize various sensor technologies in providing feedback and control.

Abstract
PITCHvr – A Sports Training Virtual Environment

Mark A. Jupina, PhD, Electrical and Computer Engineering, Villanova University
The talk will discuss the creation of a virtual reality baseball training tool known as PITCHvr. Major League Baseball (MLB) pitch data available from the PITCHf/x database was initially used to recreate actually thrown pitches in an MLB game to validate the data and the visualization of the virtually pitched baseballs. From the PITCHf/x data parameters, a model recreates the motions of a pitched ball—including the path, velocity, orientation, and spin of the baseball—from the batters’ perspective in a virtual environment such as a CAVE, Oculus Rift, or HTC Vive. Any pitch, whether it has been thrown or not, can be created and visualized. Besides the potential for realistic gaming scenarios, a realistic training environment has been developed where baseball hitters can see more pitches, develop better pitch recognition skills, and develop a “better eye” in determining balls and strikes. This baseball realm can also be used to train catchers in developing their defensive skill set, to train umpires in honing their ball/strike calling skills, and to eventually train hitters using a real bat to “hit” the virtual ball in a system comprised of infrared trackers and high speed inertial measurement units. In addition to giving an athlete additional repetitions in the virtual realm, previous research has demonstrated that training outcomes are improved when practice is designed so that the task difficulty is appropriately matched to the performer’s skill level [1,2]. For
example, in a study on juggling, the amount of gravity or the speed of the objects was varied during virtual training. When forced to juggle at higher speeds, the group that received the additional virtual training performed significantly better than the real training only group [3]. Beyond this, in the virtual realm, it is limitless as to how the training experience can be varied and analyzed. In cooperation with the faculty in the psychology department, the developers are looking to design new technologies that will enhance the user’s dynamic visual acuity training experience. A realistic pitching avatar with accurate pitching mechanics, pitch grips, arm speed, etc. was developed using Adobe Fuse and Mixamo along with Autodesk’s Motion Builder. The avatar was placed in a realistic ball park setting. Vizard VR software (Python based) was used to create the current version of the animation. The animation currently runs in the Villanova CAVE and on the Oculus Rift or the HTC Vive platform. To recreate an accurate depiction of MLB pitches, a data file from a PITCHf/x database containing the nine initial parameters of motion (position, velocity, and acceleration in all three dimensions) of pitches thrown by a MLB pitcher on a certain date is downloaded. Using dynamic systems simulation software, the equations of motion for a thrown baseball [4] are used to recreate the path, velocity, orientation, and spin of the pitches as a function of time by using the nine initial parameters of motion. The data files created by the dynamic systems simulator are used as input to the Vizard VR software.

References

Mr. Phineas Kelly
Instructional Technologist/Doctoral Student Cultural and Linguistic Anthropology University of Wyoming

Abstract
Augmented Reality for Language and Culture Revitalization

Dr. Frank Klassner
Professor, Department of Computing Sciences
Director, Center of Excellence in Enterprise Technology
Villanova University
Dr. Klassner has served as the second Director of Villanova's Center of Excellence in Enterprise Technology (http://ceet.villanova.edu) since 2006. He earned Bachelor of Science degrees in Computer Science and Electronics Engineering at the University of Scranton, and MS and PhD degrees in Computer Science at the University of Massachusetts at Amherst. Since starting work at Villanova in 1997 his research work has included high-level adaptive signal processing, educational robotics, simulation, and now virtual reality and 3D visualization. He has served as a member of the North America Lego Education Advisory Panel and as a consultant for the Vatican Internet Office and the Vatican Museums.

Dr. Oliver Kreylos
Researcher
University of California, Davis
Dr. Kreylos is a Research Computer Scientist with the UC Davis W.M. Keck Center for Active Visualization in the Earth Sciences (KeckCAVES, http://www.keckcaves.org). He is the primary developer of the KeckCAVES immersive visualization software stack, a suite of frameworks and applications that turns a wide range of visualization hardware into instruments for scientific research.

http://doc-ok.org
https://www.youtube.com/user/okreylos
https://twitter.com/okreylos

Abstract
Immersive Visualization in the Time of Commercial VR Headsets

The UC Davis W.M. Keck Center for Active Visualization in the Earth Sciences (KeckCAVES, http://keckcaves.org) has a long track record in using immersive visualization as a tool for scientific data exploration and analysis. Scientists from a wide range of disciplines have been using the KeckCAVES facility to view their 3D data, process their data, identify and isolate important features in their data, and create derived data by measuring and/or annotating their data. Insights and results from these analyses have led to many publications in domain science journals. However, the recent arrival of commercial head-mounted VR systems that pass the minimum threshold for practical use (such as Oculus Rift or HTC Vive) have changed the environment in which such scientific analysis takes place. Unlike expensive central facilities like KeckCAVES’ four-sided CAVE, or high-maintenance smaller “low-cost” systems cobbled together from large-screen 3D TVs and optical tracking systems, commercial VR headsets can be bought off-the-shelf, on a single researcher’s budget, and be installed by anyone anywhere. As a result, the benefits of immersive visualization are now available to a much larger potential user community, which will probably lead to wider adoption of the principles of immersive
visualization, and increased research and innovation in the field itself. That said, the
different user experience of head-mounted VR, compared to the screen-based VR
embodied by CAVEs and similar systems, poses its own set of challenges. While
visualization software designed for screen-based VR systems ports very well to
head-mounted VR, our scientists using VR headsets for practical work indicate that they
prefer screen-based VR for the same tasks. The primary cited reasons are (1) reduced
comfort, (2) increased fatigue, (3) difficulty in training new users, and (4) difficulty in
collaborative work. Some of these issues are rooted in the early stage of commercial VR
hardware, but most are fundamental to the isolating nature of head-mounted VR. In this
presentation, we will relate our experiences with building scientific visualization systems
based on commercial VR headsets, the practical issues of operating such systems in an
open, multi-user research environment, and discuss our approaches to mitigating user
comfort and productivity issues.

Dr. James H. Money
Idaho National Laboratory
Group Lead, Machine Learning, Visualization, & Software Engineering

Dr. James H. Money is Applied Visualization Laboratory Lead for Idaho National
Laboratory. He has more than 20 years of experience in a variety of fields including
immersive visualization in both academic and industry settings. His experience includes
leading the first Department of Defense initiative to provide live data sets inside a Cave
Automatic Virtual Environment (CAVE), touch displays, and large format video walls
from 2007 to 2011. Before coming to INL, he led multiple efforts in the modeling &
simulation community to bridge 30-year- old solutions to leading edge products, both in
the areas of computations and visualization. He also has worked extensively in
geospatial technologies over his career, including seven years working at National
Geospatial-Intelligence Agency (NGA) as well as several other intelligence agencies. Dr.
Money earned his doctorate and master’s degrees in mathematics from the University
of Kentucky, and a bachelor’s degree in computer science from James Madison
University. His prior academic work includes variational methods for image processing,
numerical differential equations and linear algebra, and cluster computing. His industrial
work includes large-scale data analysis of intelligence for the government and leading
clients through transformational change that has resulted in an order of magnitude of
costs savings in their projects.

Abstract
GPGPU Enabled Adaptive Volume Visualization for Immersive Systems

Volumetric rendering provides the ability to visualize the inside of 3D volumes typically
found in scans such a computed tomography and simulations using finite difference
schemes. Most of these viewers have size limitations in the hundreds of megabytes,
while the volumes are provided in gigabytes or terabytes and beyond. In this talk, we
introduce an open source general purpose graphics processing unit (GPGPU) based method for rendering these volumes in their native resolution using the Unity 3D game engine across a range of platforms including phones, VR headsets, and CAVEs. We will discuss the algorithms we developed for this viewer, results from VR and AR testing, and future ongoing work.

Mr. Mark Murnane
Faculty Research Assistant
University of Maryland, Baltimore County

After completing his undergrad degree in Computer Engineering at UMBC, Mark has spent two years working in the Imaging Research Center to develop novel data visualization and processing systems, optimize and enhance the IRC’s photogrammetry facility, and to improve the Pi Squared visualization facility.

Abstract
Developing a User-Friendly Architecture for a CAVE2

The ultimate goal of any shared visualization facility is to attract users and to provide such users with the tools to both utilize existing visualizations as well as to develop their own. Over the last two years, we have worked to lower the barrier of entry to our own visualization facility so that users with existing projects may more easily port them to our facility, and so that developers of new applications have a greatly simplified interface to learn. We will discuss the hardware and software modifications we made to our Mechdyne Arc display in order to simplify the process of developing new applications under both Unity and Unreal and make it possible to adapt existing applications using other frameworks. These changes include simplifying the architecture of our system to allow the entire screen to be driven by a single node, modifying the Unicave plugin to make a simple prefab in Unity, as well as investigations into modifying existing software to operate on a CAVE2 without recompilation. We will also talk about how extensible these changes are, and how they might be used by other members of the CAAV who operate larger displays, or those with different architecture. Finally, we have completed a brief review of upcoming technologies such as the Vulkan API, the Nvidia RTX series GPUs, and the Planar Clarity G3 display system that may impact our system and will discuss the implications they have for our system as well as similar systems. While some of changes we look at are oriented to new display purchases, many should be applicable to existing displays with little additional cost. Attendees should come away from our talk with a better idea of architectures are available for large format displays, as well as better understanding of how to increase adoption of a display facility by simplifying development.

Dr. Winifred E Newman
Homer Curtis Mickel and Leola Carter Mickel Professor of Architecture, School of Architecture  
Director, Institute for Intelligent Materials, Systems and Environments (CU-iMSE)  
Clemson University

Dr. Newman concentrates on spatial perception in architecture, ecological psychology, and neuroaesthetics with active research in data visualization, mapping, STEM learning environments, and histories of technology and science. She received funding from the NSF, FIU, University of Arkansas, the Graham Foundation and others. Dr. Newman was a Fellow at the Max Planck Institute for the History of Science in Berlin with additional fellowships from the Harvard Faculty of Arts and Sciences.

Dr. Kristi Potter  
Sr Visualization Scientist  
National Renewable Energy Lab (NREL)

Dr. Kristin Potter is a scientist specializing in data visualization at NREL. Her current research is focused on methods for improving visualization techniques by adding qualitative information regarding reliability to the data display. She is also interested in topics related to decision-making, performance visualization, method evaluation, and application specific techniques. Kristi has over 15 years of experience in visualization creation, design and deployment spanning multiple disciplines including atmospheric sciences, materials modeling, geographical mapping, and the humanities. Prior to joining NREL in 2017, she worked as a research-computing consultant at the University of Oregon providing visualization services, computational training and education, and other support to researchers across campus, and as a research scientist at the University of Utah, working on projects related to the visualization of uncertainty and error in data.

Abstract  
Visualization in a Browser

The deployment of visualization software is often complex and challenging. Advances in browser technologies and targeted development is paving the way for web-based visualization to be more powerful, dynamic, and responsive. New libraries such as D3, WebGL, and React are enabling the deployment of visualizations via a website, particularly cross-platform and cross-institution. While the development of custom visualizations may require heavy coding, there are an increasing number of platforms allowing inexperienced users to easily create 2D charts, graphs, and maps, and even complex 3D visualizations. In this talk I will tour the audience through a number of my favorite online visualization platforms, including Plot.ly, ParaView glance, and Mapbox, and discuss how I have incorporated these technologies into my visualization workflow. I will also demonstrate some custom visualizations developed with the D3 framework and point to some useful links and tutorials for further learning.
Professor James Sochacki
Director Center for Computational Mathematics and Modeling
James Madison University / CAES – Idaho National Laboratory (DOE)

He received the PhD in Applied Mathematics from the University of Wyoming in 1985. He is a professor at James Madison University where he has been since 1988. Many of the undergraduate students he has directed in undergraduate research have won national awards. Some are professors at prestigious graduate schools or working for national laboratories. He has published several papers in applied and computational mathematics dealing with solutions to initial value problems with many different collaborators. He also has published two textbooks, been invited to speak at several conferences and has received grants from the National Science Foundation.

Abstract
Sensitivity in Dynamical Systems

The understanding of dynamical systems – even ones that do not at first seem complicated – requires mathematical analysis, numerical analysis and visual analysis. The latter two have made significant progress because of the advancement in computing and visualization, however, as will be demonstrated these need the mathematical analysis to have meaning. The advancement of science depends strongly on this interaction which includes scientific computing and scientific visualization based on mathematical models that accurately describe the dynamics.

The importance of computing and visualization for the advancement of the understanding of dynamical systems will be presented through six important phenomena. These will be population models (growth and explosion), the mass-spring system, the pendulum system, planar particle dynamics, the single neuron dynamics and the N-body problem of Newtonian dynamics. It will be demonstrated that these systems have extremely fine characteristics that can only be appreciated through scientific visualization that includes animation.

The numerics needed for the animations will be derived using scientific computing which includes parallelization and powerful numerical methods. The numerical methods are based on using polynomial transformations, power series and Cauchy products. Using these, it is possible to address and resolve issues dealing with error analysis, stiffness and robustness across many types of dynamical systems that are modeled by differential equations.
Mr. Michael Stauffer  
Data Visualization Developer  
Institute for Biomedical Informatics, Perelman School of Medicine  
University of Pennsylvania

Michael Stauffer work at the IBI’s Idea Factory (http://upibi.org/idea-factory/). Designed to facilitate collaboration and promote new ways of communicating and presenting scientific innovation, the Idea Factory makes sophisticated data visualization and artificial intelligence analytics easy for users across the entire Penn community. Michael is working on bringing gaming and VR/AR technologies to data visualization, and researching methods for better visualizing and exploring large, high-dimensional data sets.

Abstract  
3D Heatmap

3D Heatmap is a tool that extends the standard heatmap data visualization method. It allows simultaneous visualization of up to three dependent variables in relation to a grid of two independent variables. 3D Heatmap is being developed at the Institute for Biomedical Informatics at the Univ. of Pennsylvania.

Mr. Kyle Summerfield  
Visualization Specialist and Virtual Reality Developer  
Shell 3D Viz Center  
University of Wyoming

Kyle Summerfield is the Unity developer at the Shell 3D Visualization Center at the University of Wyoming. He works with professors, faculty, and the private sector to deliver custom software to a variety of platforms to suit their needs. These range from educational and scientific programs to architecture and product visualizations. The student internship program is another passion of Summerfield’s, where he is able to teach students the entire digital asset creation pipeline (including modeling, texturing, animation, and scripting in a variety of languages). Summerfield has been with the center nearly since its inception, first as an intern and now as a full-time employee.

Abstract  
Designing in the Dark

Guiding research-driven software design with visualization: I will be presenting a real-time, interactive visualization project created with Unity to supplement an upcoming research paper about the projected outcomes of chemical reactions. The paper deals with overly optimistic projections of reaction rates, and the likelihood of defects resulting in imperfect outcomes. I will be covering the process of creating the software both for its technical considerations (efficient rendering in real-time) and its
scientific validity, mentioning where applicable steps taken for optimization of the underlying algorithms and graphical rendering in addition to remaining possibilities for increasing performance and the potential for better implementations. Additionally, I will address the degree to which the development of this software influenced the direction of the research informing it and helped to highlight areas of incomplete understanding of the mechanisms proposed therein.

Mr. Ross Tredinnick
Systems Programmer
Wisconsin Institute for Discovery
University of Wisconsin

Ross Tredinnick (pronounced: Tre-din-nick) is a fourth generation Madison native and a sixth generation Wisconsinite. Prior to working at the Wisconsin Institute for Discovery (WID), Ross worked in the video game development industry for six years as a technology programmer.

He received his Bachelor of Science, Computer Science at the University of Wisconsin – Madison and his Masters of Science, Computer Science at the University of Minnesota - Twin Cities. While at Minnesota, Ross Tredinnick’s primary research centered on combining the study of Virtual Environments and Computer Graphics with Architecture and Design. Through his work at the University of Minnesota, Tredinnick gained experience programming with a variety of Virtual Reality devices and displays such as HMD’s, tracking systems, wands, multi-projection, and dome-based displays. Since joining WID in 2012, Tredinnick has been involved in a multitude of collaborative research projects, ranging from the digital humanities to astrophysics and cultural preservation to healthcare in the home. Centered upon all of these projects is a common theme of applying virtual reality technologies to these research areas and developing computer graphics and virtual reality software to aid in answering research questions.

Abstract
Virtual Environments, LiDAR point cloud viewing application

For a CAAV 2018 Technical Showcase Project, I intend to show off a head mounted display demonstration of a LiDAR point cloud viewing application that our research group has been working on for the past three-four years. The application allows free exploration of LiDAR point clouds at frame rates of up to 90 hz. The software makes use of an out-of-core rendering algorithm that allows for high visual quality of point clouds that may exceed 1 billion points in size. I will bring a laptop and Oculus Rift head mounted display for the demonstration. I will have a variety of point clouds to show, including both interior and exterior environments, and from fields such as cultural heritage, crime scene investigation, and home health care.
Mr. Alex Wermer-Colan
Council of Library and Information Resources Postdoctoral fellow
Temple University

Alex’s research and teaching focus on the politics of literature and art through a mixed-methods approach from archival research to computational methods, text mining to immersive tech in the Digital Scholarship Center.

Mr. Jordan Hample
Academic Support Technician
Temple University

Jordan supports the Digital Scholarship Center. He is in charge of computer and software maintenance as well as training and aiding students and faculty in the use of the various hardware and software the DSC has to offer. Jordan also functions as the DSC’s R&D department, researching and testing new technology and software to add to the DSC’s ever-growing collection. With a background in programming and graphic design, his focus is on 3D and VR development using mainly Unity Game Engine.

Miss. Jasmine Clark
Resident Librarian
Temple University

Jasmine is doing rotations in digital scholarship, library administration, metadata and digitization services. Her library work experience has covered a variety of functional areas and departments, including metadata, archives, digital scholarship, and communications and development. She is interested in the ways information organizations can integrate inclusive practices into their services and management practices.

Abstract by Wermer-Colan/Hample/Clark
Immersive Pedagogy at Temple University’s Digital Scholarship Center

Henry Alexander Wermer-Colan, Jasmine Clark, and Jordan Hample will present on their work developing AR/VR resources within Temple University’s Digital Scholarship Center (DSC). This presentation will open with them discussing their work prototyping the DSC’s range of hardware and software resources and their creation of teaching materials, especially multidisciplinary lesson plans, for professors looking to introduce immersive technology into their teaching. After reviewing the multimodal functionalities offered by
immersive technology, including respatialization, mobility, interactivity, and multi-faceted visualization, this presentation will then move onto their development of immersive pedagogy through an active-learning project. This discussion will be oriented around The Virtual Blockson, a long-term, collaborative project developing a virtual recreation of Temple University’s Charles L. Blockson Afro- American Collection utilizing resources from the DSC. The final VR module will consist of the virtual Blockson research space, along with a curated set of materials from the collection. This virtual experience will serve as a course supplement to teach secondary students the basics of archival research and primary source literacy. It will also increase the opportunity for local students to experience the Blockson Collection through a new technology, one designed to enhance their current learning environment. The presentation will review the project’s workflow for photogrammetry, 3D metadata and preservation, and the complexities of game development in synchronicity with lesson plan development. Research into the accessibility challenges associated with VR, including research into accommodating users with mild to profound vision and hearing loss, will also be discussed. The presentation will conclude by exploring future plans for development of the Blockson project, as well as for future growth of the DSC’s immersive technology capacities in preparation for the upcoming move to Temple’s new Charles Library, where a separate space in the Scholar’s Studio will be curated for immersive visualizations.

Mr. Ryan Zuber

Technical Director for Modeling and Animation
UMBC

Ryan Zuber is the Technical Director of Animation at the Imaging Research Center. He has contributed his expertise to a variety of interdisciplinary projects including a digital reconstruction of Baltimore City in 1815 and a VR Buffet application to help psychologists study food choice in adolescent adults. Ryan also worked as a science illustrator at the Goddard Spaceflight Center where he created illustrations for NASA missions such as the Solar Dynamics Observatory, the NPOESS Preparatory Project, VESPER, MAVEN, and GPM. His current research involves exploring new pathways to transition 3D assets from high resolution data capture to VR.

Abstract
VR Buffet

The Imaging Research Center has been developing an observational VR lab that will allow researchers to observe human subjects in a VR environment. The first project for which we will use this system is a virtual food buffet we have created that allows us to observe participants choices of foods and portions sizes in a virtual version of an environment that they're already familiar with.
There were three main technical challenges that the IRC faced when building the VR Buffet. The first was to recreate a virtual version of the interior of a dining hall familiar to UMBC students, with its buffet tables and accessories, in a visually realistic way while maintaining the frame rate and application performance necessary for VR. The second involved modeling realistic 3D foods with dimensions that matched their real world counterparts such that viable calorie data could be accurately calculated from a participants’ digital food selections. The third was to implement a navigation and interaction system for collecting food items that would be unobtrusive and easy to learn.

To model the hall and the food items, the IRC made extensive use of photogrammetry in its asset and environment creation pipeline. We also chose an open navigation paradigm where participants' actions are similar to those they would perform in the real world version of gathering items for lunch.

We will discuss these challenges, the decisions that were made, and the workflows that were developed along the way. Attendees who are interested in capturing and integrating spaces, facilities and objects from the real world into their VR applications will become more familiar with the tools and workflows that are available and how using photogrammetry can enhance, and in some ways simplify, the process of creating environments for VR applications. They will also be exposed to some of the important factors that need to be considered when designing a VR system for academic research.
## Attendee List

<table>
<thead>
<tr>
<th>Name</th>
<th>First Name</th>
<th>University/Position</th>
<th>Email</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alexander</td>
<td>Emma-Jane</td>
<td>University of Wyoming</td>
<td><a href="mailto:emmajane.alexander@uwyo.edu">emmajane.alexander@uwyo.edu</a></td>
</tr>
<tr>
<td>Andersen</td>
<td>Patrea</td>
<td>Academic Director Simulation and Visualisation, University of the Sunshine Coast, Australia</td>
<td><a href="mailto:panders1@usc.edu.au">panders1@usc.edu.au</a></td>
</tr>
<tr>
<td>Barry</td>
<td>Mark</td>
<td>Director, Imaging Research Center, Departments of Visual Arts, &amp; Computer Science and Electrical Engineering, UMBC</td>
<td><a href="mailto:mbarry@usc.edu.au">mbarry@usc.edu.au</a></td>
</tr>
<tr>
<td>Boot</td>
<td>Lee</td>
<td>University of the Sunshine Coast, Australia</td>
<td><a href="mailto:boot@umbc.edu">boot@umbc.edu</a></td>
</tr>
<tr>
<td>Clark</td>
<td>Jasmine</td>
<td>Temple University</td>
<td><a href="mailto:jasmine.clark@temple.edu">jasmine.clark@temple.edu</a></td>
</tr>
<tr>
<td>Cruz-Neira</td>
<td>Carolina</td>
<td>Executive Director of the Emerging Analytics Center, The University of Arkansas</td>
<td><a href="mailto:cxcruz@ualr.edu">cxcruz@ualr.edu</a></td>
</tr>
<tr>
<td>Cutchin</td>
<td>Steve</td>
<td>Director Research Computing, Department of Computer Science, Boise State University</td>
<td><a href="mailto:stevencutchin@boisestate.edu">stevencutchin@boisestate.edu</a></td>
</tr>
<tr>
<td>Dalton</td>
<td>Polly</td>
<td>Royal Holloway, University of London</td>
<td><a href="mailto:polly.dalton@rhul.ac.uk">polly.dalton@rhul.ac.uk</a></td>
</tr>
<tr>
<td>Dixon</td>
<td>Brittney</td>
<td>Mechdyne</td>
<td><a href="mailto:brittney.dixon@mechdyne.com">brittney.dixon@mechdyne.com</a></td>
</tr>
<tr>
<td>Dunst</td>
<td>Christopher</td>
<td>NOT REGISTERED McNair Scholar, Computer Science &amp; Mathematics, University of Maryland, Baltimore County</td>
<td><a href="mailto:cdun2@umbc.edu">cdun2@umbc.edu</a></td>
</tr>
<tr>
<td>Engel</td>
<td>Don</td>
<td>Assistant Vice President for Research, University of Maryland, Baltimore County</td>
<td><a href="mailto:donengel@umbc.edu">donengel@umbc.edu</a></td>
</tr>
<tr>
<td>Fisher</td>
<td>Jeff</td>
<td>VR Lab Manager, National Institute for Aviation Research, Wichita State University</td>
<td><a href="mailto:jeff@niar.wichita.edu">jeff@niar.wichita.edu</a></td>
</tr>
<tr>
<td>Giovampaola</td>
<td>Luca Della</td>
<td>Vatican</td>
<td></td>
</tr>
<tr>
<td>Grace</td>
<td>Andrew</td>
<td>Senior Applications Programmer / Analyst, University of Villanova</td>
<td><a href="mailto:andrew.grace@villanova.edu">andrew.grace@villanova.edu</a></td>
</tr>
<tr>
<td>Gurley</td>
<td>Walt</td>
<td>Data &amp; Visualization Librarian, North Carolina State University</td>
<td><a href="mailto:jwgurley@ncsu.edu">jwgurley@ncsu.edu</a></td>
</tr>
<tr>
<td>Hallman</td>
<td>Shelby</td>
<td>Research Librarian for Engineering &amp; Entrepreneurship, North Carolina State University</td>
<td><a href="mailto:sjhaima@ncsu.edu">sjhaima@ncsu.edu</a></td>
</tr>
<tr>
<td>Hample</td>
<td>Jordan</td>
<td>Temple University</td>
<td><a href="mailto:jordan.hample@temple.edu">jordan.hample@temple.edu</a></td>
</tr>
<tr>
<td>Harman</td>
<td>Sarah</td>
<td>Metropolitan State University</td>
<td><a href="mailto:sharman4@msudenver.edu">sharman4@msudenver.edu</a></td>
</tr>
<tr>
<td>Hayes</td>
<td>Erica</td>
<td>North Carolina State University Libraries</td>
<td><a href="mailto:eyhayes@ncsu.edu">eyhayes@ncsu.edu</a></td>
</tr>
<tr>
<td>Heckman</td>
<td>Steve</td>
<td>University of Maryland, Baltimore County</td>
<td><a href="mailto:heckman1@umbc.edu">heckman1@umbc.edu</a></td>
</tr>
<tr>
<td>Hernandez</td>
<td>Miguel</td>
<td>University of Pennsylvania</td>
<td><a href="mailto:mherandez@upenn.edu">mherandez@upenn.edu</a></td>
</tr>
<tr>
<td>Hobert</td>
<td>Michael</td>
<td>Mechdyne</td>
<td><a href="mailto:michael.hobert@mechdyne.com">michael.hobert@mechdyne.com</a></td>
</tr>
<tr>
<td>Jupina</td>
<td>Mark</td>
<td>Assistant Professor, Electrical and Computer Engineering, Villanova University</td>
<td><a href="mailto:mark.jupina@villanova.edu">mark.jupina@villanova.edu</a></td>
</tr>
<tr>
<td>Name</td>
<td>Affiliation</td>
<td>Email</td>
<td></td>
</tr>
<tr>
<td>---------------</td>
<td>----------------------------------------------------------------------------</td>
<td>--------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Klassner</td>
<td>Frank Villanueva University</td>
<td><a href="mailto:frank.klassner@villanova.edu">frank.klassner@villanova.edu</a></td>
<td></td>
</tr>
<tr>
<td>Kopec</td>
<td>Paul University of Pennsylvania</td>
<td><a href="mailto:pkopcs@upenn.edu">pkopcs@upenn.edu</a></td>
<td></td>
</tr>
<tr>
<td>Kreylos</td>
<td>Oliver Associate Researcher, University of California, Davis</td>
<td><a href="mailto:okreylos@ucdavis.edu">okreylos@ucdavis.edu</a></td>
<td></td>
</tr>
<tr>
<td>McDaniel</td>
<td>Mike Mechdyne</td>
<td><a href="mailto:miked.mcdaniel@mechdyne.com">miked.mcdaniel@mechdyne.com</a></td>
<td></td>
</tr>
<tr>
<td>Millner</td>
<td>Aaron Digital Media, The Franklin Institute science museum in Philadelphia</td>
<td><a href="mailto:amiller@fi.edu">amiller@fi.edu</a></td>
<td></td>
</tr>
<tr>
<td>Money</td>
<td>James Applied Visualization Laboratory Lead, Idaho National Laboratory</td>
<td><a href="mailto:james.money@inl.gov">james.money@inl.gov</a></td>
<td></td>
</tr>
<tr>
<td>Murnane</td>
<td>Mark Faculty Research Assistant, University of Maryland, Baltimore County</td>
<td><a href="mailto:mark25@umbc.edu">mark25@umbc.edu</a></td>
<td></td>
</tr>
<tr>
<td>Newman</td>
<td>Winifred School of Architecture Director, Institute for Intelligent Materials, Systems and Environments, Clemson University</td>
<td><a href="mailto:elysen@clmson.edu">elysen@clmson.edu</a></td>
<td></td>
</tr>
<tr>
<td>Polly</td>
<td>Dalton Royal Holloway, University of London</td>
<td>polly <a href="mailto:dalton@rhul.ac.uk">dalton@rhul.ac.uk</a></td>
<td></td>
</tr>
<tr>
<td>Platts</td>
<td>Hannah Royal Holloway, University of London</td>
<td><a href="mailto:hannah.platts@rhul.ac.uk">hannah.platts@rhul.ac.uk</a></td>
<td></td>
</tr>
<tr>
<td>Potter</td>
<td>Kristi Senior Visualization Scientist, National Renewable Energy Laboratory</td>
<td><a href="mailto:Kristi.Potter@nrel.gov">Kristi.Potter@nrel.gov</a></td>
<td></td>
</tr>
<tr>
<td>Scholl</td>
<td>Geoffre Villanova University</td>
<td><a href="mailto:geoffrey.scholl@villanova.edu">geoffrey.scholl@villanova.edu</a></td>
<td></td>
</tr>
<tr>
<td>Sherman</td>
<td>Bill Indiana University</td>
<td><a href="mailto:shermanw@iu.edu">shermanw@iu.edu</a></td>
<td></td>
</tr>
<tr>
<td>Sochacki</td>
<td>James Department of Mathematics and Statistics, Center for Computational Mathematics and Modeling, James Madison University</td>
<td><a href="mailto:sochacs@jmu.edu">sochacs@jmu.edu</a></td>
<td></td>
</tr>
<tr>
<td>Stauffer</td>
<td>Michael Data Visualization Developer, Inst. for Biomedical Informatics, Perelman School of Medicine, Univ. of Pennsylvania</td>
<td><a href="mailto:mgstauff@gmail.com">mgstauff@gmail.com</a></td>
<td></td>
</tr>
<tr>
<td>Summerfield</td>
<td>Kyle Virtual Reality Developer, Shell 3D Viz Center, University of Wyoming</td>
<td><a href="mailto:ksummerf@uwyo.edu">ksummerf@uwyo.edu</a></td>
<td></td>
</tr>
<tr>
<td>Tredinnick</td>
<td>Ross Systems Programmer, Wisconsin Institute for Discovery</td>
<td><a href="mailto:rdtredinnick@wisc.edu">rdtredinnick@wisc.edu</a></td>
<td></td>
</tr>
<tr>
<td>Warren</td>
<td>Brian Library Technology Developer, Villanova University</td>
<td><a href="mailto:brian.warren@villanova.edu">brian.warren@villanova.edu</a></td>
<td></td>
</tr>
<tr>
<td>Wermer-Colan</td>
<td>Alex Postdoctoral Fellow, Temple University</td>
<td><a href="mailto:alex.wermer-colan@temple.edu">alex.wermer-colan@temple.edu</a></td>
<td></td>
</tr>
<tr>
<td>Zuber</td>
<td>Ryan Technical Director for Modeling and Animation, Imaging Research Center, UMBC</td>
<td><a href="mailto:zuj1@umbc.edu">zuj1@umbc.edu</a></td>
<td></td>
</tr>
<tr>
<td>TBC</td>
<td>Villanova University</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gardzelewski</td>
<td>Jon Villanova University</td>
<td><a href="mailto:jgardze1@uwyo.edu">jgardze1@uwyo.edu</a></td>
<td></td>
</tr>
<tr>
<td>Kelly</td>
<td>Phineas</td>
<td><a href="mailto:phineas@uwyo.edu">phineas@uwyo.edu</a></td>
<td></td>
</tr>
</tbody>
</table>
## Panel Contributors

### Multidisciplinary Applications of Viz, VR/AR

<table>
<thead>
<tr>
<th>Name</th>
<th>Affiliation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patrea Andersen</td>
<td>Academic Director Simulation and Visualisation, University of the Sunshine Coast, Australia</td>
</tr>
<tr>
<td>Winifred Newman</td>
<td>School of Architecture Director, Institute for Intelligent Materials, Systems and Environments, Clemson University</td>
</tr>
<tr>
<td>Andrew Grace</td>
<td>University of Villanova</td>
</tr>
<tr>
<td>Steve Cutchin</td>
<td>Director Research Computing, Department of Computer Science, Boise State University</td>
</tr>
</tbody>
</table>

### Starting up and Sustainability

<table>
<thead>
<tr>
<th>Name</th>
<th>Affiliation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shelby Hallman</td>
<td>Research Librarian for Engineering &amp; Entrepreneurship, North Carolina State University</td>
</tr>
<tr>
<td>Don Engle</td>
<td>Assistant Vice President for Research, University of Maryland, Baltimore County</td>
</tr>
<tr>
<td>James Money</td>
<td>Applied Visualization Laboratory Lead, Idaho National Laboratory</td>
</tr>
<tr>
<td>Aaron Kelly</td>
<td>Digital Media, The Franklin Institute science museum in Philadelphia</td>
</tr>
</tbody>
</table>

### Tools and Technologies

<table>
<thead>
<tr>
<th>Name</th>
<th>Affiliation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jeff Fisher</td>
<td>VR Lab Manager, National Institute for Aviation Research, Wichita State University</td>
</tr>
<tr>
<td>Oliver Kreylos</td>
<td>Associate Researcher, University of California, Davis</td>
</tr>
<tr>
<td>Mark Murnane</td>
<td>Faculty Research Assistant, University of Maryland, Baltimore County</td>
</tr>
<tr>
<td>Kristi Potter</td>
<td>Senior Visualization Scientist, National Renewable Energy Laboratory</td>
</tr>
</tbody>
</table>
Thank you to our sponsor, host, attendees and Contributors

THE CAAV is a volunteer-driven organization. Its purpose is to act as an information resource to worldwide higher education focusing on immersive visualization platforms, advanced video screen formats, advanced visualization software and issues of sustainability and operation for high-tech visualization facilities. THE CAAV prides itself on inclusivity and welcomes contributions from both those new and experienced in the world of visualization and VR. THE CAAV executive team would like to thank the sponsor, host, members, conference attendees and contributors for their much welcomed and appreciated dialogue and input.

Mechdyne Corporation: Mechdyne is one of the world’s leading providers of innovative visual information technologies. The company bends technology in ways that transform complex data into insights and ideas. To ensure clients succeed, Mechdyne provides comprehensive, customized solutions that include consulting, software, technical services and hardware integration. Visit www.mechdyne.com for more information.

About CEET: Founded in 2004, Villanova's Center of Excellence in Enterprise Technology (CEET) is an interdisciplinary research center dedicated to distinction in the discovery, dissemination and application of knowledge and solutions to contemporary software challenges. Computing solutions that cannot adapt to the enterprise-scale problems of today's world are not true solutions at all. To tackle these challenges, CEET fosters cross-disciplinary collaboration among experts from inside Villanova, and through external academic and industry partnerships. The scalable solutions of CEET research members benefit the common good within the corporate, scientific, and educational enterprise arenas.

About Villanova: Since 1842, Villanova University’s Augustinian Catholic intellectual tradition has been the cornerstone of an academic community in which students learn to think critically, act compassionately and succeed while serving others. There are more than 10,000 undergraduate, graduate and law students in the University's six colleges – the College of Liberal Arts and Sciences, the Villanova School of Business, the College of Engineering, the College of Nursing, the College of Professional Studies and the Villanova University School of Law. As students grow intellectually, Villanova prepares them to become ethical leaders who create positive change everywhere life takes them.

THE CAAV

Founded in 2015, THE CAAV is now transitioning into a non-profit organization, and hopes to achieve its official status before the end of 2018, with the support of Mechdyne. THE CAAV international membership roster now proudly rests at 186 members worldwide, represented by a wide variety of teaching and research-oriented
higher education institutions, national labs, and colleges. To become a member of THE CAAV please complete the membership form available at: https://thecaav.wordpress.com/membership-form/

For further information about THE CAAV organization, please visit the website at https://thecaav.wordpress.com/ or contact Emma-Jane Alexander, THE CAAV President at emmajane.alexander@uwyo.edu or via phone at 307.343.2926.

Notes: