

The David Rittenhouse Orrery of 1771
Creators: Rachel Han, Karen Her,
Sally Kong, Isabela Rovira,
Jun Xia, Wenli Zhao



An interactive virtual reconstruction of the Orrery. The original is located in the Van Pelt Library at the University of Pennsylvania.
Visit: <http://cg.cs.upenn.edu/visi/RittenhouseOrrery/index.html>

Letter from Norm Badler, SIG Center Director

On behalf of all of us at CG@Penn, we're pleased to offer this year's Newsletter. Much has been happening at Penn, and we hope you enjoy some updates on our activities and the people that make this enterprise possible. We have two new lecturers, Adam Mally and

Debanshu Singh, who are graduates from our own programs. We also have a new SIG Center Manager, Kari Gilbertson, who designed and assembled this Newsletter. (Thanks, Kari!) We are enjoying the continued presence of several visitors in the SIG Center: a research fellowship visit for Libo Sun from China (her second stay here), faculty sabbaticals for Soraia Raupp Musse and Claudio Rosito Jung from Brazil, and a visiting PhD student from China, Lu Chen. We have a number of students and alumni who have received recognition and awards – we are proud of all of them and congratulate them on their achievements! We also salute our graduates as they embark on excellent careers across many well-known computer companies.

In this issue we're also highlighting an unusual corporate spin-off from the graphics lab. Many of you will recall the major commercial project we launched: the *Jack* human modeling system, now owned and distributed by Siemens. But lesser-known and yet experienced by thousands of students every year is the software called *MarchingOrder*. It's an interesting tale of Penn students attacking a problem, mastering the opportunity, and serving a previously-neglected niche: graduation ceremonies.

You are welcome to visit our webpages to learn more about our recent publications and projects. We're very happy that our latest book, *Virtual Crowds: Steps Toward Behavioral Realism*, has been published by Morgan & Claypool. Many of our papers are accessible online.

Last summer a great team of students from Penn and other schools built a 3D model of the famous Philadelphia landmark, the Reading Terminal Market. We expect to have an active summer internship program again in the SIG Center in 2016. Next stop: Virtual Reality!

-Norm Badler



If you would like to be added to our mailing list, send your address/email to cginfo@seas.upenn.edu
Join our Facebook group at CG@Penn!

Introductions in the SIG Center



Introducing Adam Mally

We are extremely pleased to introduce Adam Mally as one of our new lecturers. Adam co-teaches three courses: CIS 277 (Introduction to Computer Graphics), CIS 460/560 (Computer Graphics: Physics-Based Rendering), and CIS 497 (DMD Senior Project). He studied computer graphics at Penn in both the undergraduate Digital Media Design program and the masters Computer Graphics and Game Technology program, graduating in 2013 and 2014, respectively. His focus in teaching these courses has been to revamp their curricula such that they are more challenging classes, but ultimately more rewarding in terms of material learned and projects completed. Inside and outside of teaching, Adam's main interests are interactive computer graphics and game design.

Introducing Debanshu Singh

We are equally pleased to introduce Debanshu Singh as another new Lecturer. Debanshu teaches the course CIS 563: Physically Based Animation. He studied computer graphics at Penn in the Computer Graphics and Game Technology program. Prior to Penn, Debanshu worked at Dreamworks Animation as a Technical Director for 3 years. He has worked on animated movies such as Megamind, Madagascar 3, and Rise of the Guardians. He likes teaching and is excited to share his breadth of industry knowledge about character simulation, procedural modeling & rendering.



Introducing Kari Gilbertson

We are also delighted to announce that Kari Gilbertson is the new Associate Director of the SIG Center for Computer Graphics. As Associate Director, Kari manages and maintains the diverse technology of the SIG Center and serves as the Graduate Coordinator of the CGGT program. Previously, Kari received her Bachelors of Science in Computer Engineering with a minor in Interactive Multimedia at The College of New Jersey. She is currently working on getting her Master of Science in User Experience and Interaction Design at Philadelphia University. Her main interests include singing and video games.

MarchingOrder: Amazing Graduation Ceremonies



In September 2001, David Badler and Tyler Mullins were two Management and Technology students entering their senior year and taking a robotics class as an engineering elective. As they sat together to work on the first week's homework assignment they quickly realized that the course-work would consist of much more matrix-vector multiplication and much less robot building than they were hoping for, and they got sidetracked talking about a problem David had been discussing with his father, Dr. Norm Badler (then Associate Dean of the School of Engineering and Applied Science). Dr. Badler was petrified by the thought of having to sit through the long Commencement process each year, and sympathized with the family and friends (and students!) who would need to watch the whole event just to enjoy the special moment when their graduate had a turn crossing the stage to receive an Engineering degree. Together David and Tyler decided that Penn Engineering should showcase both the individualities of the graduates and the technological ingenuity a top-flight engineering program can produce by displaying a personal message and the hometown of each graduate on the JumboTron display screen for the audience during the ceremony.

Traditional presentation software could not be employed in this situation because the actual participants and the exact order in which they would be displayed would not be known prior to the event. They decided that it was necessary to design a dynamic content display system which would be able to produce any slide on-demand. Rather than finishing their homework, the two

spent a few hours fine-tuning a plan to accomplish this by assigning each student a barcode and repurposing Microsoft web server tools to generate each slide on a laptop for display on the screen. As each student's name was called their barcode would be scanned and their name, along with a message submitted by the student expressing gratitude to family, friends, faculty, or anyone else who supported them along the way, would be flashed onto the JumboTron.

Without a homework assignment to submit, things weren't looking good for the robotics class, but David and Tyler were able to change course and pursue an independent study project that semester where they would not only build a display system for the ceremony, but also create a web-based portal to collect the messages. Working with the Engineering administration they learned that paper-based forms were being used to collect participation information from graduates before the ceremony, and this could be eliminated by including these questions on the website, saving time for both students and staff.

The next two semesters were spent not only creating the technical components, but also securing the participation of five other Schools at Penn and the University of New Mexico to pilot the system, deploying a market-research survey to over 500 higher education institutions to determine the interest and viability of this as a business opportunity, and raising \$20,000 in seed money from a local venture investment team. The results were overwhelmingly positive and MarchingOrder was off the ground.

Upon graduating, David took a job at a top consulting firm. Tyler, who was from Northern California and determined to be a tech entrepreneur from a young age, decided to see if MarchingOrder could truly make it as a startup in this niche market. He was able to sign contracts with a number of Schools at Penn, along with a handful of other universities which had been survey participants, to generate some income for the fledgling operation.

The success of MarchingOrder was going to depend on having software and hardware that was simple to use, flexible, and extremely stable.

In the world of on-campus events it doesn't get much bigger than Commencement – thousands of guests, Chancellors, Presidents, and Deans in attendance expecting everything to go flawlessly, and each student's moment of recognition is one that they and their family will remember forever. Any technical issues interrupting the ceremony would be both disruptive and embarrassing. There were no shortage of unforeseen pitfalls: wireless barcode scanners would cease to function if faculty on the stage had too many cell phones in their pockets, heavy power cables for lights would create magnetic fields which would cause data transmission errors, and barcodes could be misprinted, to name a few. Also no two ceremonies run exactly the same, so constant revisions to the functionality of the system were needed in order to accommodate variations. After a few years, however, the kinks had been worked out and the system was ready for commercial deployment.

In 2008 Tyler attended a conference specifically for the people who plan Commencement ceremonies for higher education institutions – NAACO, the North American Association of Commencement Officers. The attendees loved the capability of MarchingOrder to both enhance the ceremony and to simplify the planning process with online tools, and this marked the beginning of a new phase in the business. Through collaboration with these highly-engaged and dedicated individuals Tyler was able to help address a number of other challenges they faced in executing their ceremonies by providing technological solutions to the problems. Using the shared knowledge and best-practices of a number of institutions along with technical development, MarchingOrder was able to develop a complete suite of tools to assist in any facet of the ceremony planning and execution process to help make it the greatest possible experience for graduates, guests, and administrators.

In Spring 2009 Arizona State University announced that newly-inaugurated President Barack Obama would be speaking at their commencement. The announcement was made on a Friday afternoon and on Monday morning the commencement office had 400 voicemails from students who had planned to skip the ceremony but now wanted to attend with guests. ASU had

no existing reservation system in place because their ceremony was to take place in a 70,000 seat football stadium and capacity was not an issue in the past. But now they needed to figure out a way to have students register for the event, issue tickets for a limited number of guests, collect identity information about the guests for security purposes, and do this in a matter of days. ASU had just contracted MarchingOrder for display and Melissa Werner, Director of University Ceremonies, called Tyler to ask if he could help create this registration system. He agreed, not realizing how many offices on campus would want to be involved with this Presidential event. He spent the next two weeks fielding emails and calls from various departments, including technology, legal, marketing, facilities, and of course, commencement. Little did they realize their requests all ended up in the same person's (Tyler's) inbox, who had to correspond with them all day and code all night to hit the deadline. Opening day saw an immediate server crash due to overload by eager students, but within an hour it was smoothed out and everything worked great. ASU is still MarchingOrder's largest single client, with over 50 ceremonies every year. They also use MarchingOrder to create custom registration systems for various on-campus events ranging from concerts to staff appreciation parties.

MarchingOrder ("MO") is currently used in over 150 institutions throughout the US, Canada, and the Caribbean. MO has developed tools that:

- Visually acknowledge each graduate on screen, either in conjunction with a video shot of that person or as a standalone full-screen slide featuring messages and/or photos provided by the graduate;
- Provide a single online resource for students to handle all details related to Commencement, such as registering for the event, securing tickets for guests, ordering regalia, providing information to the photographers so they can receive prints of their photos, filling out surveys, and more. As traditional on-campus bookstores close their doors and everything moves online, this proves to be a valuable tool for schools which can no longer have students come in to a physical location to handle commencement details;
- Enable every graduate's name to be pro-

nounced correctly at the ceremony, every time;

- Allow school administrators to use barcodes to get real-time counts of ceremony participants, keep track of hours worked for their staff, and authenticate guest tickets at the door.

MarchingOrder is proud to partner with fiercely loyal clients, many of whom heard about MO through word of mouth or from attending another school's ceremony. 2016 will bring the first large-scale marketing campaign, so expectations are high for many more partner schools in the near future.

The MarchingOrder team is comprised of dedicated professionals from diverse backgrounds who all contribute a specific skill in providing these highly specialized tools. There are 7 people currently working for the company, plus contractors working part-time, with experience in such things as ceremony planning, corporate consulting, web design and development, and audio engineering. This knowledge is combined to produce a well-rounded, polished product which can address specific areas of this market as effectively as possible, and to provide a strong support system to help clients tailor implementations to best suit their needs.

Tyler Mullins, SEAS M&T graduate, is the MO President. Tyler oversees all aspects of the business, and no two days are the same. Part of the excitement of being a small business owner is that you don't know what challenges will come next, but it's up to you to find a way to overcome every one of them. Penn Engineering was instrumental in developing problem solving skills which can be applied not only to technical issues but also to any number of logistical matters which small businesses face. There is no blueprint for how to operate in providing these tools since they are all the first of their kind, but thinking systematically using engineering concepts has proven the most effective way to game-plan service offerings.

Onsite tools are all custom-built to perform their specific function in an intuitive, flexible, and reliable manner. MO has developed a proprietary display system which is run locally on a windows or mac laptop, and uses a barcode to retrieve any information relating to a specific graduate and create that person's slide. The names can be queued and advanced manually by a person

watching the video shot, which helps ensure that the right name is on screen with the right person, or can be displayed immediately when scanned. This is particularly helpful when an audio or video file will play to announce the graduate, since a staff member probably wouldn't be able to identify which student corresponds with a given name just by looking at that person on video, but if the camera shot is set to show them as soon as the name is scanned then everything lines up perfectly. Using pre-recorded audio files for announcing each name ensures that the pronunciation is always accurate and creates a smooth and consistent on-stage flow for the ceremony.

Various barcode configurations are used depending on what is being scanned. A simple laser-based scanner is generally used for graduate cards since these are inexpensive, durable, and very reliable through widespread use. Linear Imager scanners are used when it is necessary to scan from electronic devices as well, and guest tickets are scanned and validated using an app MarchingOrder developed which employs the camera of an Apple or Android-based mobile device or tablet as an optical barcode scanner.

Web-based tools are developed and deployed using the Microsoft .NET architecture, and hosted on cloud-based platforms. It's much easier than building and maintaining a single server, plus this allows for seamless adjustments in the resources the sites are using based on traffic – there are understandable spikes during the months preceding the May to June and December commencement seasons, and lulls during January and over the summer, so it's helpful to be able to adjust to these circumstances.

MO partnered with an IVR (interactive voice response) service to develop a tool which allows graduates to input their phone number then receive a call that allows them to record their name so the name readers will be able to hear the correct pronunciation in advance of the ceremony. A .wav file of the student saying his or her name is saved to the server and can be played back as many times as the name reader would like with web-based controls from the MO website. This was featured by NPR in Spring 2015 (<http://www.npr.org/2014/05/16/313154934/whats-in-a-name-plenty-of-ways-to-make-a-mistake>). These recordings can be used by the name reader to

either create detailed phonetic notes to print on the graduate's card to assist with reading on stage or, if they are pre-recording the name, the reader can hear the student pronounce the name as many times as they like before recording it themselves.

Norm Badler attended every Commencement while he was Associate Dean and he didn't fall asleep even once. Thanks, MarchingOrder!

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Visitors in the SIG Center

Soraia Musse

Professor Soraia Musse is visiting from the Pontificia Universidade Catolica do Rio Grande do Sul, Porto Alegre, Brazil. Soraia is working on crowd simulation with heterogeneous individuals. She is interested in investigating which individual features can be important in crowd simulation and evacuation.

Claudio Jung

Professor Claudio Jung is visiting from the Institute of Informatics, Federal University of Rio Grande do Sul, Porto Alegre, Brazil. His main goal is to detect unusual behavior in real crowds (captured by video cameras), and he wants to explore the expected behavior of crowds from simulators to detect what is unusual or not.

Libo Sun

Libo Sun is an Assistant Professor in the School of Instrument Science and Engineering at Southeast University, Nanjing, China. She is a visiting scholar in SIG for 2016. Her research focuses on crowd simulation, specifically the simulation of realistic crowd behaviors.

Lu Chen

Lu Chen is a visiting PhD candidate from Ocean University in Qingdao, China. With a major interest in crowd simulation under various environmental conditions, she has quickly become a valuable team member in the Center's research programs.

DMD Graduates

Cheers for the 2015 graduates of DMD!

Anton Bastov, Denys Bastov, David Bui, Samantha Cohen, Joseph Coto, Colin Feo, Max Gilbert, Vivian Huang, Eric Lee, Justin Dong Lee, Jessie Mao, Brian McNeely, Mitch Montaldo, Corey Novich, Theodora Pajaczowska, Emre Tanirgan, Joseph Tong, Jenny Trang

These students will be going to many companies around the world including Amazon, AthenaHealth, Disney Research, DreamWorks Animation, Essex tec, Facebook, Goldman Sachs, Google, Magic Leap Inc., Mindspark Interactive Network Inc., Riot Games, Walt Disney Imagineering, Zynga

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CGGT Graduates

And cheers for the 2015 graduates of CGGT!

Richard Arietta, Samantha Cohen, Bradley Crusco, Binglu Du, Sanchit Garg, Zhen Gou, Paula Merino, Eric Lee, Anda Li, Harmony Li, Ying Li, Cheng-Tso Lin, Beiling Lu, Yehua Lyu, Xinjie Ma, Zhenghan Mei, Renula Mitra, Megan Moore, Corey Novich, Nada Ouf, Ratchpak Pongmongkol, Daniel Rerucha, Yang Song, Emre Tanirgan, Joseph Tong, Judy Trinh, Wei-Chien Tu, Sibi Vijayakumar, Jiawei Wang, Suyang Wu, Lei Yang, Bo Zhang

These students will be going to many companies around the world including Accenture, Amazon Game Studio, Anda Exhibition (China), Disney, Facebook, Google, Intel, Microsoft, Nokia, nVidia, Oracle, Ping Insurance Group (China), Pixar, Zynga

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PhD Graduates

We are very proud to announce the successful PhD completion and defense for:

Cory Boatright – Grove City College, PA
Aline Normoyle – Moon Collider Ltd., Edinburgh
Alexander Shoulson – Ubisoft Toronto

Awards and Recognition



Dr. Catherine Pelachaud receives the ACM/SIGAI Autonomous Agents Research Award

One of the pioneers in CG@Penn history is Catherine Pelachaud, CIS PhD 1991. We are very pleased to announce that Catherine, who is now Director of Research at CNRS at Telecom ParisTech, received the ACM/SIGAI Autonomous Agents Research Award for 2015. She was honored "for her sustained and substantial contributions to the area of intelligent virtual agents." We are delighted to note that her PhD work at Penn helped launch this area. She was a co-organizer of the first NSF

Workshop on "Standards for Facial Animation," held on the Penn campus in 1994. At Penn, Catherine worked closely with Professors Mark Steedman and Norm Badler on speech visualization, lip co-articulation, and phonemic animation. Her subsequent research moved into the wider domain of body communication in face-to-face interaction, which helped set a new agenda in embodied agent research. The ACM/SIGAI Award citation concludes that Catherine has "firmly established a research area of modeling the body, its relation to the mind and its role in social interaction ... [filling] ... critical gaps in agents research often ignored by the larger community."

Congratulations, Catherine!

DMD Alumna make their mark in NYC

According to RecruitLoop, an on-line recruiting company, DMD women are ruling the full stack developer world in New York City. In their list of the top 50 full stack developers, based on their experience, qualifications and digital footprint, the 5 DMD alumna recognized represent 10% of the list! Congratulations to Tara Siegel '14, Legarlin Li '14, Jennie Shapira '14, Sasha Verma '12, and Jennifer Cahalane '14.



Max Gilbert and Jessie Mao are the winners of The Dawn and Welton Becket Award for 2015

The award is presented to the DMD senior "who exemplifies the ideals of the DMD program through outstanding academic and personal achievement, citizenship, and mentoring." This year we had two superb student leaders, so we gave them both awards. Upon graduation, Max went to Disney Research to work with Carol O'Sullivan on their crowds research project, and will return to Penn to complete his master's degree in Robotics. Jessie is working as a User Interface Engineer at Facebook.

Morgan Synder, DMD senior, named to Forbes 2016 '30 Under 30 List'

Morgan, listed with team mate Spencer Penn, created 'Sweet Bites', a company that is democratizing dental care with gum! Finalists in the Hult Prize, known as the "Noble Prize for students," the Sweet Bites team created a chewing gum with 100% Xylitol, a sweetener which helps to prevent cavities and promote dental health. The idea was born from Snyder's own experience when she took a year off from Penn to work in Bangalore, India, with an organization that helped empower children through life skills education. Since 2012, the Forbes '30 under 30' list has spotlighted "entrepreneurial-minded bright young stars who are transforming the world."





The interactive Reading Terminal Market environment is populated with stalls, seating, and structures. It was built in Maya and imported and lit in Unity. A NavMesh marks the walkable environment for ADAPT human agents, and automatic doors open and close as an agent approaches and leaves. Internship participants in this project during summer 2015 were Adam Mally, Charles Wang, Kenji Endo, Mike Rabbitz, Nihaar Narayan, and Caroline Smith. Partial support for our summer internship program from Dawn and Tripp Becket, and from Diane Chi is gratefully acknowledged!

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