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Getting to Know the Social Computing Rooms

HOW FACULTY AND STUDENTS CAN TAKE ADVANTAGE OF NORTH CAROLINA'S UNIQUE IMMERSIVE VISUALIZATION ROOMS

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Summary

The vast amounts of data and imagery pervasive in today's digital world hold great value for education and research, but working with so much information can be overwhelming. Scholars and students need innovative tools to view, manage, and understand data in order to access the full potential of these digital resources and empower true collaboration.

Social Computing Rooms (SCRs) offer a dynamic way to engage with and collaborate around data and images. These custom-designed environments use 12 projectors to display information on all four walls of a square room, creating an image-immersive environment. Groups can see, discuss, and manipulate visual data in a way they never could before. Two SCRs are available at the University of North Carolina at Chapel Hill (UNC), and one is available at North Carolina State University (NC State).

Members of the university communities have used SCRs to enhance research, provide immersive educational experiences, and communicate ideas in widely different fields, from medicine to the arts and humanities. This white paper discusses the capabilities of these rooms, explores their many creative uses, and encourages new users to discover the potential of SCRs for their own collaboration, research, and education needs.



The Challenge: Impetus for Creating Social Computing Rooms

The research world increasingly depends on data, those ones and zeroes that have come to represent nearly every interaction in today's world. Online transactions, medical records, social networking, class projects—in our digitized era, all these bits of information become terabytes and petabytes of data. That data, in order to be valuable, must be intelligible to a wider audience. Today's students and researchers, as data translators, need to be comfortable using, collaborating around, and interpreting data.

New digital tools are constantly becoming available to access and manipulate data. Researchers in fields such as mathematics and astronomy have decades of experience working with large volumes of data. Experts in other fields, such as English literature and political science, are also beginning to tap the potential of big data and complex imagery as tools for discovery, education, and communication.

One way that data has been able to permeate the academic world beyond high level science and mathematics is through the growing field of data visualization. Gifted computer graphics specialists are able to turn potentially overwhelming data into comprehensible images. These data visualizations enable viewers to “perceive visually features which are hidden in the data but nevertheless are needed for data exploration and

AT A GLANCE

- It is often logistically difficult to work effectively with large amounts of data and images, which hinders collaboration and education.
- Social Computing Rooms are custom-designed spaces where the university community can visualize, interpret, collaborate with, and virtually share data and images.
- These high-tech yet easy-to-use rooms are available to university faculty and students for free and have enormous potential for education and innovation.

analysis” (Gershon 1994). We are an image-based culture, and it is through images that we discern details, recognize patterns, and draw connections (Ware 2004). In our increasingly digital, visual world, visualization has become a dynamic, engaging way to present data.

However, working with large amounts of data and images can be challenging, especially for groups. One computer monitor or projection screen, no matter how large, is limited in how many images it can show at once. This, in turn, limits the potential for creativity, innovation, and collaboration. In addition, it is often logistically cumbersome to collaborate around images when the discussion involves multiple people in multiple locations. Yet using data to its fullest potential for research and education often requires that many people be able to simultaneously see, decipher, and understand the data.

Groups working with a great deal of data and images need a space that meets these challenges. CAVEs, domes, and display walls have tried to fill that need, but they all have drawbacks. CAVEs (Cave Automatic Virtual Environments) are incredibly immersive environments, but are also expensive, require complicated software, and allow only one user (whose movements are tracked) to be fully immersed. Images on the screens change based on that user’s movements, which can be disorienting for observers in the room. Domes use a curved-surface display to create a virtual world within a closed room, but have many of the same drawbacks as CAVEs.



FIGURE 1:
A view of the SCR at UNC–Chapel Hill’s ITS Manning building with a variety of data and images displayed on the walls.

Display walls are more common than CAVEs or domes because they are relatively inexpensive, easy to install, and straightforward to use. Many universities are hoping that setting up display walls will signal that they are on the cutting edge of technology (Young 2012).

However, one wall of screens, no matter how big, does not give a user the feeling of immersion within the data. Data must be seen, decoded, and mastered in order for students, teachers, and researchers to get the most value out of it.



Ideas Into Action:

What SCRs Have to Offer

RENCI technologists developed the Social Computing Rooms to overcome these challenges and provide new opportunities for research, education, and communication. They built the first SCR on the UNC–Chapel Hill campus in the Information Technology Services Building on Manning Drive (ITS Manning) in 2007, described in Borland et al. 2010. In 2014, a second UNC SCR, located in the Odum Institute for Research in Social Science, and one at NC State, known as the Visualization Studio and located in D.H. Hill Library, were built.

Each SCR is a square room that comfortably fits up to 15 people. Twelve projectors, three per wall, make up the continuous immersive display. Mounting the short-throw projectors to a soffit gives users an unobstructed view of all 12 images. This setup allows for maximum image projection, with minimal visible hardware and few shadows obscuring data. One computer controls the entire display with a desktop interface identical to that of a regular Windows-based computer. Users can access any standard software, such as web browsers, PowerPoint, and Matlab, for their projections.

In addition to the computer and projectors, the SCR offers many other tools to enable users to take full advantage of the room. For example, a wireless keyboard and mouse let users control the display while moving freely throughout the room. These features allow users maximum flexibility and make it easy to share control over the images, which is useful for joint presentations or active collaboration. In the ITS Manning SCR, users can activate tags with radio-frequency identification to track objects or people as they move within the room, providing opportunities for interactivity by changing the displays or sounds in response to participants' movements.

In addition, cameras, speakers, microphones, and an echo-cancelling audio system are all built into the room to support high-quality, immersive presentations and video and audio conferencing. Collage, an application custom-made to take advantage of the SCR's capabilities, is an additional tool that makes it simple to load and arrange images around the four walls.

The 360-degree display can be adapted to a wide range of purposes, and students, faculty, and researchers are encouraged to use the room as it best suits their needs. They can project data visualizations that engage other researchers in the story of their data. They can switch back and forth between several different data sets or visualizations to draw comparisons. They can compare and contrast several different ways to visualize the same data to find the best fit. They can work on the same data simultaneously and then review their collaborations immediately. They can even respond and react to the data as works of art.

These innovative rooms have attracted significant interest from the wider public in addition to their university communities, and they are regularly featured on university tours. For example, science and technology fellows from Kyrgyzstan recently toured one of UNC's two SCRs and were impressed by its ability to combine advanced technology, learning, and collaboration, and talked of building one in their country.

Designed with an overarching goal of enabling data collaboration, these unique rooms can be adapted for an enormous variety of needs. By allowing more people to interact and collaborate around images and data, SCRs help spark new ideas, insights, and innovations across the university communities they serve.

Highlights of Past Uses

Each university's SCR is open for community use for all types of learning and outreach. Professors and students in the sciences, humanities, fine arts, and the UNC School of Law have taken advantage of the room's unique capabilities. Whether they are used to present information, to provide an immersive environment for provocative art, or to help solve ancient mysteries, SCRs have proven to be tremendously valuable for visualizing, interpreting, and collaborating with data.

Medical research. Medical researchers often work with large numbers of complex digital images, such as medical scans. In an SCR, groups can both present many scans at once, and magnify them greatly. This enables researchers to work together more efficiently to identify patterns and make accurate assessments. For example, being able to compare and contrast scans on such a large scale helped melanoma researchers at UNC develop algorithms to identify tissues containing melanoma.

Classics. The SCR has helped to unlock hidden mysteries in ancient artifacts. A group of humanities scholars pored over a manuscript that included two treatises by Archimedes, found nowhere else, that had previously been erased. Scholars used the SCR at ITS Manning to examine images of the erased text at incredibly high resolution on the room's floor-to-ceiling displays. Using the SCR's multiple projectors, researchers were able to simultaneously compare multiple images of the same parchment captured at different electromagnetic frequencies to decipher the hidden text. Through this project, the SCR's cutting-edge technology was used to bring buried knowledge back to life.



FIGURE 2:
(Left) Researchers examine scanned images related to melanoma biopsies in the Social Computing Room at ITS Manning.



FIGURE 3:
(Right) The Archimedes palimpsest that was examined by researchers in the SCR.



FIGURE 4: Students in Geography 445 participate in a virtual poster session, which replaced the typical final exam.



FIGURE 5: UNC law students participate in a mock trial in the SCR, while others are projected as avatars on the screen in Second Life. Projecting avatars into the SCR for a mock trial meant more law professionals from different locations were able to participate.

Geography. With floor-to-ceiling projection, lecturer Ashley Ward, PhD, was able to revolutionize UNC’s *Geography 445* course. Instead of ending the course with a written final exam, Ward challenged students to develop virtual posters that presented their research findings in engaging, full-scale visual formats. The students, 12 at a time, displayed their final projects while the others circulated, asking questions and offering critiques. In this way, the SCR allowed the course to mimic the structure of a professional conference.

Law. In 2009, UNC School of Law third-year student Bryan Byerly organized a mock trial for students. Unlike a traditional mock trial, however, this one took advantage of the SCR and UNC’s presence on Second Life, a three-dimensional, virtual world with millions of users. The avatars of jurors were invited to “attend” the trial. Using the videoconferencing capabilities of the SCR, the virtual mock trial was able to bring lawyers, jurors, and judges together from remote locations.

Art Education. Art classes at UNC have been quick to take advantage of the SCR’s capabilities. For David Tinapple’s *Advanced Digital Media Studio* class, for example, students used the SCR to display their final projects. The works were the result of collaborations between the students and RENCI’s visualization experts. According to Tinapple, the SCR “was a powerful motivator and helped the students to see the concept of video and interaction in a new light.”

English. Rebecca Nesvet, PhD, used the SCR often in her English and Comparative Literature PhD studies at UNC and to teach *English 102, Writing in the Disciplines*. Traditional small-scale PowerPoint slides were traded out for the floor-to-ceiling, wall-to-wall desktop projection in the SCR. According to Nesvet, students were more engaged in their own and each other’s work as a result. “One of my students claimed that his SCR assignment was ‘the first presentation I’ve given that I felt was worthwhile for anything outside class,’” she said.

Computer Science. Russell M. Taylor II, PhD, former UNC professor of a graduate-level course called *Visualization in the Sciences*, used the room for interactive critique sessions for students' data visualizations. The large-scale projection of the same data, represented differently, helped students grasp whether their visualizations sufficiently told the story of the data. The SCR is an ideal location to perform design reviews, said Taylor.

Art Exhibits. The SCR can also be a venue to present artistic works, as UNC artist and associate professor Joyce Rudinski, PhD, demonstrated in 2008 with *Spectacular Justice*. The interactive media installation used the SCR's immersive projection to invite users to reflect on death penalty imagery and data. Attendees wore tracking tags. As they were drawn toward or away from different images, the computer changed what was displayed. These tracked movements changed the work every time a new group entered the room. The real-time data rearrangements made the piece truly interactive. According to Rudinsky, that was the innovative part of that project, and it would not have been possible in another space.

Performance Art. In 2014, students in *Communications 566, Media and Performance*, used the SCR's capabilities to create mixed live and digital performance pieces. One group used the walls of the SCR to create an interactive stage where performers could "touch" and manipulate images of outer space and even transform themselves into the stars and galaxies of the universe.

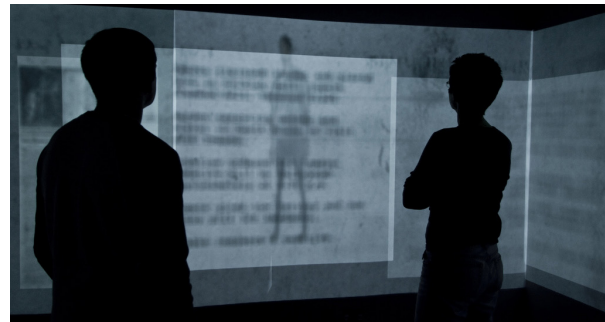


FIGURE 6:
(Above) Visitors to the SCR visit the *Spectacular Justice* installation.

FIGURE 7:
(Left) A UNC student uses the walls in the SCR at the Odum Institute to simulate creation of the universe. The SCR served as an interactive stage for students presenting final projects in *Communications 566, Media and Performance*.

The Upshot

North Carolina is home to three fully-functional SCRs, with more being planned. Members of the university communities at UNC and NC State are invited to use the rooms free of charge for any research, educational, or artistic purpose. The developers of the rooms are also available to consult on deploying similar spaces at other institutions.

To reserve UNC's SCR at ITS Manning, send your request to scr-help@renci.org. To reserve UNC's SCR at the Odum Institute, email jill_stevens@unc.edu. To reserve the Visualization Studio at NC State, visit <http://www.lib.ncsu.edu/spaces/visualization-studio>.

The Big Picture

Working with large amounts of data and imagery is a requirement in nearly every academic field today. SCRs are campus resources that give users the opportunity to do just that, while also collaborating with students, colleagues, or audiences both in real life and virtually. These high-tech, immersive spaces give groups of people the tools to work together around data, images, and sounds in a way that has never before been possible.

Designed to be as simple, intuitive, and user-friendly as possible while providing a full range of display and conferencing capabilities, the SCR unleashes the power of collaboration, imagination, and innovation for research and education.

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