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LEONARDO DIALOGO, A PERMANENT ART INSTALLATION AT THE CENTER FOR ADVANCED BIOMEDICAL IMAGING RESEARCH IN HOUSTON, TX.
Photo Credit: Ken Frederick and Jimmy Hemphill

Collaborative Design: Art, Science & Interiors

by Peter Carey

In every built environment, collaboration among various trades and philosophies is required, not only to build the space, but also for the space to function as intended after construction. Increasingly, we are realizing the great need for collaboration in the design process, architects with engineers and interior designers; interior designers with a growing panoply of others. While all design collaboration can be a bit tricky, incorporating fine art sensibilities into the process brings an extra level of complexity: most artists tend to have a singular vision, and finding others to assist in carrying one's creative torch can be challenging, to say nothing of the need for the artist to work smoothly with others.

ARTIST JO ANN FLEISCHHAUER
Photo Credit: Ken Frederick and Jimmy Hemphill

Still, a true collaborative effort can produce unusual results, and a wonderful example of this recently opened at the **Center for Advanced Biomedical Imaging Research** in Houston, TX. There, artist **Jo Ann Fleischhauer** took advantage of many perspectives, approaches and levels of experience to create a site-specific art installation called **Leonardo Dialogo**. The work of art, which began with an artist-in-residency project with nanotechnology expert **Dr. Mauro Ferrari**, soon transitioned into a permanent installation as Texas-based architectural firm **PhiloWilke** was outfitting the interior spaces of Dr. Ferrari's new research facility.

It is not about you, it is about the project.

Drawing upon inspiration from creative individuals of the past as diverse as **Buckminster Fuller** and **Leonardo da Vinci** to describe the forward-thinking work happening inside the lab, mathematics became the common language that leads visitors through Ms Fleischhauer's amazing and creative open-ended narrative.

"The building was already designed and under construction when I became involved," said Ms. Fleischhauer. " so my work had to fit within very distinct parameters. I did not go into this project wanting to illustrate what they were doing in their laboratories. Rather, I typically do a lot of historical research, and I was interested in

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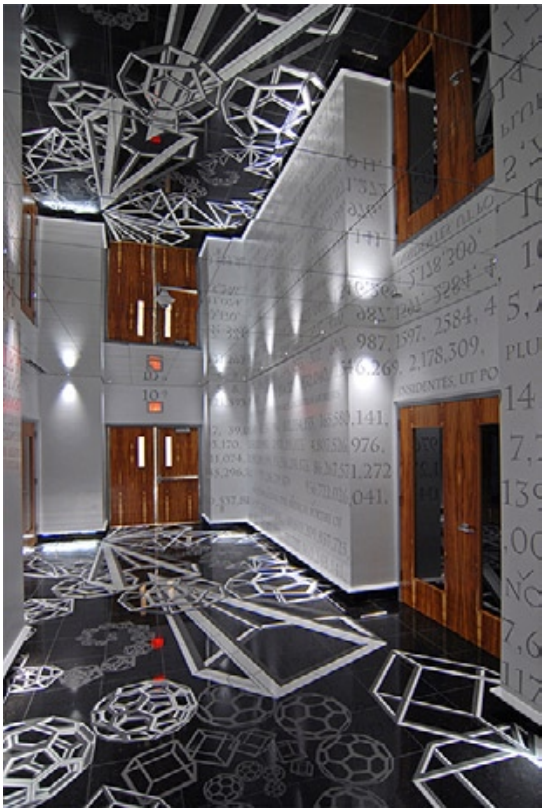
making historical connections and art connections between how art relates to science and science relates to the arts."

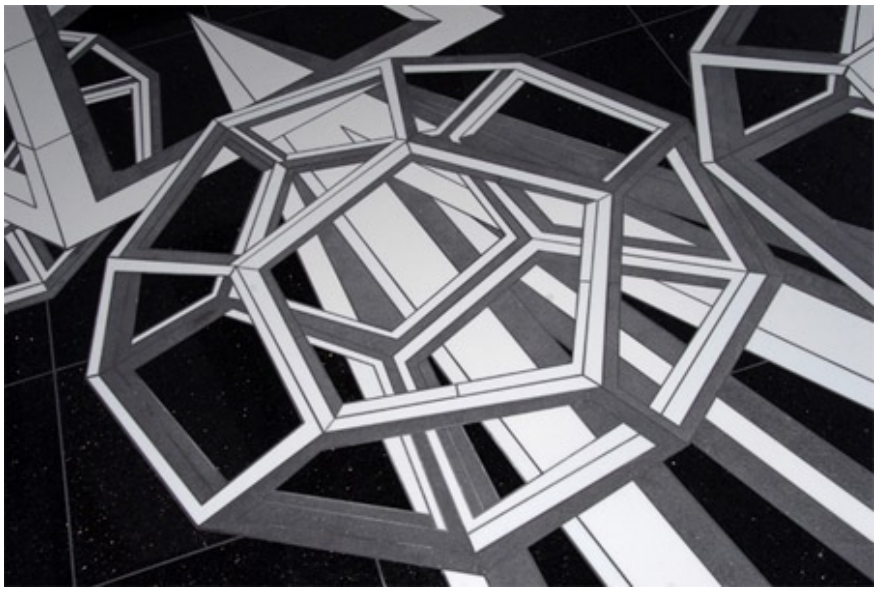
Starting with an inlaid granite floor design of intertwining polyhedral shapes, Ms. Fleischhauer's research led to forms used by Leonardo over 500 years ago; they also happen to depict the building blocks of nanotechnology theory and practice. In keeping with the Renaissance spirit of open-minded discovery, she portrayed the twisting polyhedra in the Fibonacci sequence, one that begins with two numbers, usually zero and one, with each subsequent number the sum of the preceding two. For example, the first few numbers in the Fibonacci sequence are: 0, 1, 1, 2, 3, 5, 8, 13, 21, 34 and so on.

The dynamic black, white and grey entrance floor to the lab is reflected entirely in a mirrored ceiling. "I wanted visitors to experience an awe-inspiring space," said Ms. Fleischhauer. "We could not build it physically because we are on the top floor of the building, with the mechanical equipment above us. Dr. Ferrari suggested the idea of using mirrors. My creative springboard for the entire project was to look at Leonardo, who is the quintessential artist/scientist, and mirrors made the perfect complement for the project." It is well known that Leonardo often wrote in his private journals backwards for security purposes; the best way for modern researchers to decipher his work is to study them in a mirror.

"To me," said Ms. Fleischhauer," this work was about making sense of



THE CORRIDOR ENTRANCE OF THE NEW CENTER FOR ADVANCED BIOMEDICAL IMAGING RESEARCH IN HOUSTON, TX. Photo Credit: Ken Frederick and Jimmy Hemphill



A DETAIL OF THE INLAID GRANITE FLOOR AT THE CENTER FOR ADVANCED BIOMEDICAL IMAGING RESEARCH. Photo Credit: Ken Frederick and Jimmy Hemphill

THE MIRRORED CEILING REFLECTS THE INLAID GRANITE FLOOR. Photo Credit: Ken Frederick and Jimmy Hemphill

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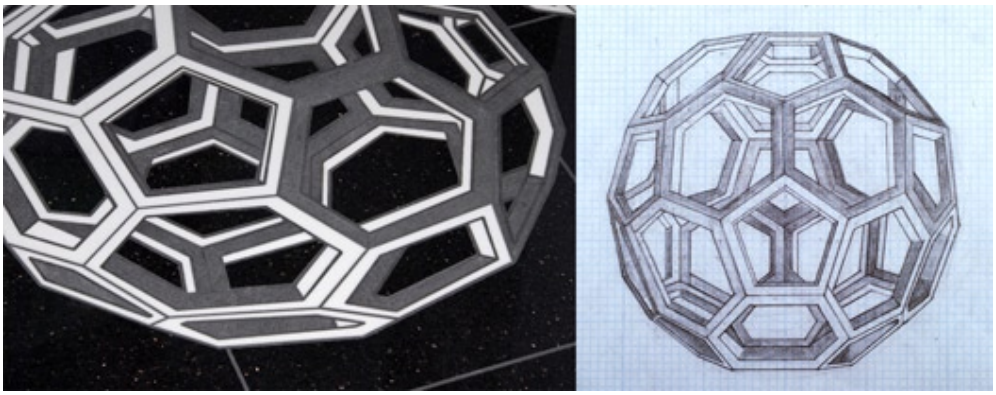
a world that, at first, does not make sense. The world of nano is so small and it is not visual in the way we typically view the world. You have to use a great deal of imagination to be able to visualize it." The platonic solid polyhedral shapes that appear on the floor were created from Leonardo's drawings," she said. "It was important for me to draw the initial sketches by hand and not use a computer. The scientists were surprised by my reasons. One of the first challenges of the project was the disjuncture between the scientists and the artist and how they approach things. They did not understand why I wanted the imperfection of the hand."

The walls that enclose the entrance to the facility are covered with numbers that also refer to the Fibonacci sequence. This sequence is an infinite series of numbers; as the numbers get larger, the limit reached by dividing each number by the previous is 1.618, an irrational number which is familiar to us as the Golden Ratio, somethings referred to as the Golden Mean. "The Golden Mean is symbolic of balance and harmony," said Ms. Fleischhauer. "I thought that was a great way to integrate a language that was common to everybody. The scientists in this space work on cancer research, and much of their nano-research is based on drug delivery. They are trying to target tumors without producing the toxic side-effects of chemotherapy. I wanted to reference the balance of nature by using the Golden Mean number to symbolize the effort of the scientists to bring balance back into a body ravaged by cancer."



FROM IDEA INTO REALITY: JO ANN FLEISCHHAUER'S PRELIMINARY SKETCH AND THE FINAL INLAID GRANITE FLOOR

WALLS OF THE CENTER FOR ADVANCED BIOMEDICAL IMAGING RESEARCH IN HOUSTON, TX. SOME OF THE TEXT CAN ONLY BE READ IN THE REFLECTED CEILING. Photo Credit: Ken Frederick and Jimmy Hemphill

Entering the Center for Advanced Biomedical Imaging Research makes one wonder what the array of numbers means, regardless of whether you recognize the sequence. One of the physicists working in the lab thought they were numbers of the laboratory's patents. "Although he did not immediately recognize the display as a Fibonacci sequence, it triggered something within him," said Ms. Fleischhauer. Additional text, written by Dr. Ferrari, is hand stenciled on adjacent walls; some is readable only when viewed in the mirrored ceiling. "It is," she said, "an integrated corridor of text, material and visual shapes that I brought together that, together, resonate with what the research team is doing, what their mission is, and also what their minds are doing."

Before entering the actual research facility, visitors encounter a pair of doors veneered with Yew wood, an ancient tree species rich with myth and metaphor. From the bark of the Yew tree, scientists are able to extract a compound called Taxol, which is used as a chemotherapy drug for treatment of many types of cancers. Passing through the doors reveals the final stroke in Ms. Fleischhauer's creative installation – a floating glass

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ceiling consisting of laminated panels containing geometric patterns with waterjet cut voids that echo the spiraling polyhedra theme begun on the entrance floor outside the space.

The 47 unique ceiling panels are each 22 x 30 inches and consist of three layers of low-iron float glass laminated to a piece of handmade glass, commonly known as Lamberts glass. It is mouth-blown in Germany and imported exclusively by **Bendheim** in North America. Each finished panel weighs 55 pounds and is suspended by metal rods. LED downlights embedded in the ceiling cast elaborate shadows from the undulating surface and small air bubbles of the Lamberts glass; the geometric patterns further enhance the play of light in the space.

ONE-OF-A-KIND GLASS CEILING AT THE CENTER FOR ADVANCED BIOMEDICAL IMAGING RESEARCH IN HOUSTON, TX. Photo Credit: Ken Frederick and Jimmy Hemphill

MARTIN AND ERIK DEMAINE AT MIT. Photo Credit: Dominick Reuter

The Lamberts glass, made as it was hundreds of years ago, and in the same facility, begins as a molten bubble blown into a cylinder; after the ends of the elongated and super hot glass balloon are cut off, the giant glass tube is cut lengthwise and flattened in an annealing oven. Inconsistent thickness, irregular shapes, air bubbles, touches of color and other imperfections are inherent to Lamberts glass; indeed, it is one reason why designers choose to use it today.

"The idea of the glass ceiling was to form a transition from the corridor into the administrative waiting area, which was going to be a much different kind of space," said Ms. Fleischhauer. Exploration of the concept of the glass ceiling took the artist to the **Massachusetts Institute of Technology**, where she eventually brought two more collaborators into the project – **Martin Demaine**, artist-in-residence at MIT and visiting scientist in computer science, and his son **Erik Demaine**, professor in computer science at MIT.

"Jo Ann first contacted us," said Martin Demaine, "because she was looking for someone who is knowledgeable about glass and about polyhedral geometry, so that she could construct an unusual kind of ceiling. I have spent maybe thirty years working with glass. Since both Erik and I enjoy doing geometry and mathematics related to those kinds of problems, it seemed like a good fit. Shortly after we started talking, we realize there was a strong collaboration potential."

As a team of artist-scientists, the Demaines work closely together and welcome projects out of their comfort zones. "Collaboration is one thing we enjoy and we try to do it in many areas," he said. "We don't have a tiny

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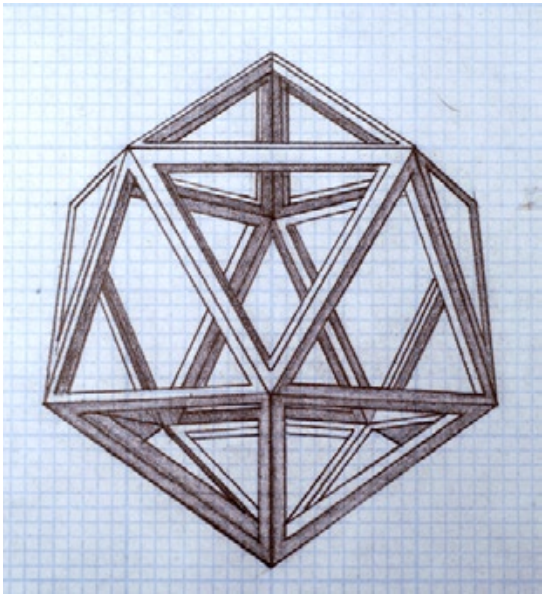
focus limited to the things that we are interested in. There was some geometry involved, and we're both artists as well as scientists."

Ms. Fleischhauer could not have found better collaborators. The Demaines share many joint works of mathematics and art; much of their work focuses primarily on the mathematics of folding and unfolding objects out of flat materials. Erik was a child prodigy; his PhD dissertation is a seminal work in the field of computational origami and he was awarded a MacArthur Fellowship at 23. Both of them have work in the permanent collection of the **Museum of Modern Art**. "Glass is very primal, like playing with fire," said Martin Demaine. "It has an intensity about it requiring you to finish something once you start; you can't just put it down and walk away. It is also something that requires teamwork. Blowing glass is collaboration and you need to work with people that relate to your body language. You can't always explain what you are doing; it's kind of known ahead of time. That was something that happened with Jo Ann. This collaboration became a very natural and automatic process."

"Technically, the Lamberts glass and the ceiling was an incredible challenge," said Ms. Fleischhauer. "First, we were going to laminate the art glass onto the float glass, and then we were going to cut it with the water jet. After that, it would need to be laminated to two more pieces of float glass for stability." Working with Massachusetts-based laminators **LTI Smart Glass**, the team of artists at first only averaged a 50% success rate for each unique panel. "There are some cut-out sheet pieces of glass that are laminated on full sheets," said Marty Demaine. "That in itself is a bit unusual and may have been the first time that has ever been done. At MIT, Erik and I cut half-inch polycarbonate inserts to fill in the voids before each sheet was laminated in the autoclave oven."



A SKETCH BY ARTIST JO ANN FLEISCHHAUER. BASED ON A LEONARDO DA VINCI DRAWING, IT ALSO DEPICTS A FULLERENE, CONCEIVED BY AND NAMED AFTER BUCKMINSTER FULLER

THE LAMINATED GLASS CEILING INSIDE THE SPACE RELATES THEMATICALLY TO THE ENTRANCE TO THE NANOTECHNOLOGY RESEARCH FACILITY.
Photo Credit: Ken Frederick and Jimmy Hemphill

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"When we thought we had the process down," said Ms. Fleischhauer, "we were under the impression that we would have the project done within three to four weeks." But all of the preliminary samples were done in a small scale. "When you get into a larger panel, the physics of everything changes," she said.

"As we started using the real sized materials," said Erik Demaine, "things became much more sensitive and challenging. We changed some of the geometry to make it more suitable for water-jet cutting. If the angles are too sharp, or parts were too small, things would tend to crack. We came up with an intuitive feel for what would make a safe design."

The end result was worth the effort. "This is something you have to be there to experience, said Martin Demaine. "Most ceilings have tiles, whether it be glass or any other material, butted up against each other. These have one inch spaces between them to create an incredible illusion of floating."

"Marty and Eric completely donated their time, intellect and effort on the collaborative parts of the project," said Ms. Fleischhauer. LTI agreed upon a flat fee at the beginning that barely covered their expenses. "If all of those factors had been figured in at their usual cost, I would not have been able to do the project."

When the process of discovering and making a glass ceiling was complete, the next step is typically to shape it into something easily repeatable to cover the costs of research and development. "As an artist, I am always excited about my next project," said Ms. Fleischhauer. "The Leonardo Dialogo project has produced some thematic ideas. On all of my projects I work with every artisan and crafts person involved. With the inlaid granite floor, I worked with the artisans to learn their process. With the people who veneered the doors, I learned how to veneer. Marty and I worked in the lamination factory. I want to be involved, and I want to do the process. With this piece I was forced to rely on the expertise of these artisans, and that also became a whole other layer to this project."

"One of the things that we are big believers in," said Erik Demaine, "is less ego in art and sculpture. There is a long tradition in art of being the sole person in charge, not taking input and each artist just doing their own thing and being very egotistical about it. We find it much more interesting just to make great projects. To us that is the goal. We find that by working with people from different backgrounds and varying interests and fields, you get ideas that, when combined, no one person could make or conceive. To do that, you have to be more selfless. It is not about you, it is about the project."

An unexpected side effect of bringing the Demaines into the project is that now they have started collaborating with Dr. Ferrari's nano research team. "Sometimes we are like translators," said Martin Demaine. "We speak two languages – technology/science and art; that can make people from different groups feel really comfortable with one another." ■

Peter Carey is President of Streamline Material Resourcing, a strategic partner for design firms and their material resources. Streamline consults on specifying building and finish materials for design projects and making design firms run more efficiently. He can be reached at pcarey@StreamlineMR.com or 347-351-1000.

THE HANDMADE LAMBERTS GLASS, ALONG WITH GEOMETRIC CUT-OUTS, CREATES UNIQUE SHADOWS IN THE NANOTECHNOLOGY RESEARCH FACILITY. Photo Credit: Ken Frederick and Jimmy Hemphill