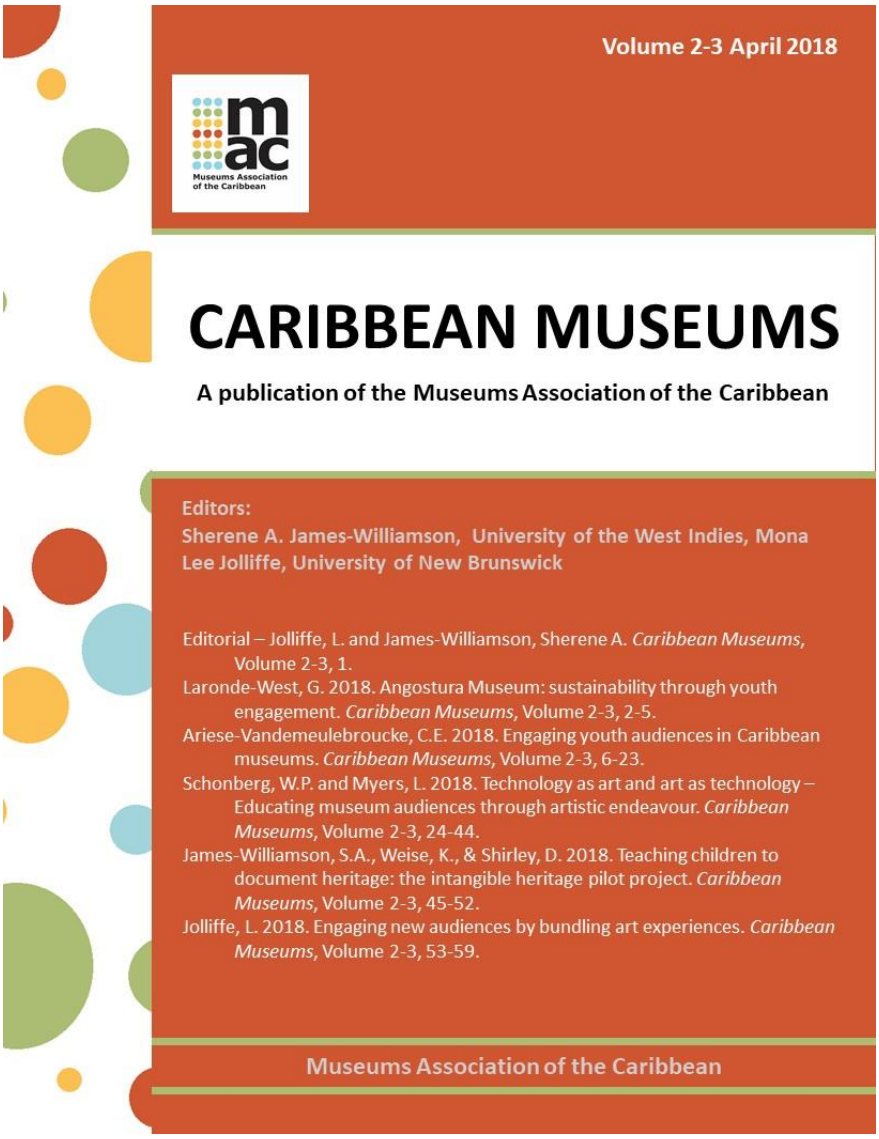


Volume 2-3 April 2018

CARIBBEAN MUSEUMS

A publication of the Museums Association of the Caribbean

Editors:
Sherene A. James-Williamson, University of the West Indies, Mona
Lee Jolliffe, University of New Brunswick

Museums Association of the Caribbean

Schonberg, W.P. and Myers, L. 2018. Technology as art and art as technology – Educating museum audiences through artistic endeavour. *Caribbean Museums*, Volume 2-3, 24-44. ©Museums Association of the Caribbean.

Technology as art and art as technology – Educating museum audiences through artistic endeavour

WILLIAM P. SCHONBERG[1] & LUCE MYERS[2]

[1]*Civil, Architectural, and Environmental Engineering Department*
[2]*Arts, Languages, and Philosophy Department*
Missouri University of Science & Technology, Rolla, Missouri, 65409. UNITED STATES

wschon@mst.edu

ABSTRACT. Technology is an integral part of our daily lives. Because it is everywhere and a part of everything we do, it shapes how our society evolves. To be a contributing member of today's society, everyone needs to be technologically literate at least at some level. This paper presents the case for providing technical literacy to a global society, and provides specific examples for how museums can participate in this process. Particular attention is focused on the implementation of such endeavors in the Caribbean, noting the important roles that local customs and traditions would play in the process.

Keywords: aesthetics, technology, technical literacy, museums, education, outreach

1. INTRODUCTION

Technology is everywhere in society. It is an integral part of our daily lives - what we do, how we learn, and how we interact with others. Because technology is everywhere and a part of everything we do, it shapes how our society evolves. To be a contributing member of today's society, everyone needs to be technologically literate at least at some level.

One way to instill a basic level of technical literacy into the general population is through education. However, not only do we need to provide a fundamental technological education, we need to teach it at some level that is understandable and useful to everyone, and not just to the demographic groups that we have traditionally engaged in the past. We need to reach out to and attract groups of students that are currently "under-represented" in technology programs. On the college level, we can, for example, implement team-based projects throughout the curriculum for all majors, structure assessment processes to ensure that our educational environment is welcoming to all and conducive to learning by all students, and involve students in universities from around the world in various educational activities. Similarly, museums can broaden their visitor base by not only continuing to enhance their collections, but also by becoming "places that people want to visit because of the way they are treated, the enjoyable experiences awaiting them, and staff that make them feel welcome and wanted." (DeVita, 2000).

Museums should also play a role in this process, especially in the Caribbean. As a region, the Caribbean continues to experience significant growth in a variety of societal, financial, and technological sectors. As part of this growth, many important decisions will need to be made about a variety of technological issues; and, in order to make

good decisions about technological issues, decision-makers and leaders must receive appropriate education and training related to engineering and technology.

Museums can participate in the process of providing technical literacy to a global society through exhibits, outreach programs, and other activities. To help ensure the success of such programs, it is important for a museum to identify its local stakeholders, a group of people that might include the community the museum serves, local artists, students and their families, educators, and technologists, and then show how each would benefit from these programs (see also Kourach and Wunar, 2013). Local customs and traditions must not only be respected, but can also be harnessed to not only enhance the local population's appreciation of technology, but also to facilitate its learning and increased understanding of technological concepts and principles. A museum that would engage in such an activity would need to develop an intention that resonates with, or celebrates, the culture of the local community, present or historic.

It is important to note that we are intentionally not addressing the use of technology to enhance a patron's experience or to reinforce or explain an otherwise static exhibit (e.g. videos that a patron can view after pushing a button to get it started, or apps that can be downloaded to a cellphone that a patron can use to learn about the art that is being exhibited). Interestingly enough, this method of integrating technology into a museum visit has been met with mixed reviews. Murawski (2013) presents a good summary of the advantages and disadvantages of using technology in museums in this fashion. Rather, in this paper we address how museums can integrate the exhibitions of art as well as technology so that each provides meaningful insights into the other.

2. THE ARGUMENT FOR UNIVERSAL TECHNOLOGICAL EDUCATION

Technology is everywhere in society. It is an integral part of our daily lives - what we do, how we learn, and how we interact with others. Because technology is everywhere and a part of everything we do, it shapes how our society evolves, and where it will evolve to. To be a contributing member of today's society – and the future one, whatever may it look like – everyone needs to be technologically literate at least at some level.

Dr. Maria Klawe, former Dean of Engineering at Princeton University and currently President of Harvey Mudd College, has argued (in Klawe, 2003) that everyone needs at least some basic understanding of engineering concepts because:

1. <u>engineering and technology affect everyone's lives at every stage of life</u>. At birth, we have hospitals in case extra care is needed. In school, technology affects how, where, and what we learn. On the job, technology allows us to work with others across the globe. And finally, at death, if it is your wish, you can easily find dozens of companies that are willing to "send your loved one into space", some for as low as $2,000! (see, e.g., <u>http://elysiumspace.com/</u>)
2. <u>the rate of technological development is very rapid</u>. For example, compare the power of the computer in your purse or pocket (also known to many as a cellphone) to the one your parents used when they went to school.
3. <u>the societal impact of engineering developments is tremendous</u>. Migration is now cheaper and easier than ever before (e.g. planes, trains, and automobiles). Of course, this applies to people as well as to

diseases.

More so than ever before, because of technology, the lives of everyone on this planet are also incredibly interconnected. Sometimes this is a good thing – knowledge can be shared almost instantaneously across the globe! If you have a question about something, chances are, someone else has either had the same question or may even have an answer out there for you! Unfortunately, sometimes this global interconnectivity can lead to unintended consequences – and we end up creating incredibly complex, global problems for ourselves and for our children who, more likely than not, will be the ones having to solve these problems.

Climate change. Financial collapse. Pandemic disease. These are all inter-connected, global problems that a single group of people or country can*not* solve on its own. To be successful at solving these and other problems, we need to be able to work across borders, across oceans, and across cultures. It is critical that all the different cultures of the world work well together, and be respected for what each can offer. As we collaborate with colleagues around the world to solve problems, or perhaps to prevent them from occurring, we must understand local conditions, traditions, and customs of wherever our project may ultimately reside.

One way to instill a basic level of technical literacy into the general population (out of which will undoubtedly arise our next generation of leaders, managers, problem solvers, and decision-makers) is through education. According to the U.S. National Education Association, most current educational programs and systems were developed for a society that no longer exists. Fifty years ago we had to master the "Three Rs" (reading, writing, and arithmetic). However, in the modern world, these "Three Rs" simply aren't enough. According to the National Education Association, if today's students want to compete and become leaders in this global society, they must also master the "Four Cs" – communication, creativity (aka innovation), critical thinking (aka problem solving), and collaboration (NEA).

As such, when it comes to an engineering or technological education, not only do we need to re-think what we teach (and how we teach it), but we need to teach it at some understandable and useful level to everyone, and not just to the demographic groups that we have traditionally engaged in the past. We need reach out to and attract groups of students that are currently "under-represented" in technology and engineering programs. How is this to be accomplished?

Proper mentoring is an important way to start – and not just of those who are already there, but especially of those whom we wish to welcome into the fold. This mentoring must start early in a child's life. A recent study published by the U.S. News and World Report claims that by the time students reach fourth grade, a third of boys and girls have lost an interest in science. By eighth grade, almost 50 percent have lost interest or deemed it irrelevant to their education or future plans. This means that, in our current educational system, because of how we teach what we teach, millions of students have tuned out or don't believe they can do science or engineering (Murphy, 2011; Gerstein, 2015).

To attract a broader and more diverse group of students to science and engineering, Dr. Klawe believes that our curricula must include a much wider variety of topics, including business savvy, leadership skills, cultural diversity, and societal impact (Klawe, 2003; see also Home-Douglas,

2004). These topics are integral parts of the decision making process, and support the teaching of the four Cs mentioned previously. For example, in today's economy, business smarts can also play an important role in making good decisions (critical thinking).

To be an effective leader, people have to understand where they are following you (communication). We have all seen how quickly social media can contribute to "getting the word out", whether it's about a rally or a protest march, or about the latest missteps of a political figure. This power can certainly be used to promote the need or urgency to resolve a particular problem.

As we collaborate with colleagues around the world, being aware of cultural differences is vital in developing a useful problem solution (collaboration). Of course, merely being aware of global differences is not enough – it is even more important to actively partner with the people whose lives will, in the end, be affected by what it is we are designing, or building, or fixing.

Finally, part of being a creative problem solver is being able to understand the context in which the problem exists (creativity). Interdisciplinary teamwork is key to developing innovative solutions to technical problems because, to put it simply, people from different walks of life see problems from different points of view. The critical assessment of different possible solutions should ultimately yield the better one.

In our colleges and universities, we can implement at least the following three strategies to further the engagement of all of our students in a technical education.

1. *We can implement team-based projects throughout the curriculum for all majors*, and not just at the very end of a technology-based program of study, when a student is almost ready to graduate. In the first year of a typical four-year college education, for example, all students, regardless of major, can work on a simple, fun, team-based, "the sky's the limit" design activity. Then, as the students progress and specialize, we can ramp things up a little by introducing more and more realistic constraints – cost, materials, and culture. According to Dr. Klawe, teams should be kept small as this will allow hidden talents to emerge – with a small number of team members, students will be forced to move out of their initial comfort zones since there will be many things to do (Klawe, 2014).

2. *We need to be sure that our educational environment is welcoming TO all, and conducive to learning BY all*. This includes how we "assess" or "grade" our students. What keeps a lot of qualified students out of engineering is fear of failure – and in school, success is measured with "good" grades, so failure is measured with "bad" grades. Conventional wisdom says that there is a need to distinguish between those who do really well, and those who barely squeak by. But is that really necessary? Instead, maybe what we should stress is a mastery of a certain basic level or amount of information for all students. This would be the first step in the learning process of all students. There will then be students who do master that basic level or amount of information and who then continue to progress through their desired programs of study. These students would continue to develop their problem solving skills and collaborative experiences while learning the skills required for the application of concepts studied and for higher order thinking. Likewise, there will be students who do not master that

basic level of information and who either remain in place until they do, or switch majors and pursue programs of study that might be more aligned with their skills and their plans for their lives. This is called "Mastery Learning", and although it has recently attracted attention as one of the more popular educational "disruptors", as a concept, it can be traced back to Aristotle (Motamedi, 2001).

3. *We can involve students in universities from around the world in team-based projects and in other activities*. The American Society of Engineering Education calls this global collaboration among students, "Classrooms Without Borders" (Mathews, 2015; Mazzurco, *et al*, 2013). The University of Southern California launched such a program back in 2009. According to Dr. Stephen Lu, the program's developer, how you learn what you learn depends on whom you learn it with. Although there were some rough spots along the way, this program now engages students from 10 world-class universities, students separated by geography as well as culture. Program activities can begin with simple cross-cultural exercises, like, describing a product or service that is successful in one culture, but would likely fail in another.

If we are successful in these endeavors, we will begin to provide a huge sector of our society the opportunity to play a part in shaping its and our destiny. Our leaders will possess the information and knowledge they need to make more informed decisions on issues that affect us and our planet. And, society as a whole will be better served – at that point in time *all* sectors of society will contribute their varied talents and insights to solve problems and will work together to move our civilization forward into its proper future.

3. THE ROLE OF MUSEUMS IN PROVIDING UNIVERSAL TECHNOLOGICAL EDUCATION

The arts and technology both communicate. The arts help technologists communicate more beautifully, more aesthetically. Technology helps artists to communicate in new and powerful ways, and allows artists to access larger and more diverse audiences. This, in turn, adds to the inspiration and magnitude of the subject.

Museums have a definite role to play in of providing technical literacy to a global society, but especially in the Caribbean. As a region, the Caribbean continues to experience significant growth in a variety of societal, financial, and technological sectors. As part of this growth, many important decisions will need to be made about a variety of important technological issues, especially as they relate to the traditions and customs of a particular nation (e.g. new roadways to provide access to here-to-fore inaccessible parts of an island, waste management that includes a significant recycling component in an area where such efforts do not yet exist, etc.). In order to make good decisions about technological issues, local decision-makers and leaders must receive appropriate education and training related to engineering and technology. It is so vital to this region's future that these decisions are made by individuals who are technically competent!

Museums can participate in the process of enhancing the technical literacy of the region's general population as well as its current and future leaders through exhibits, outreach programs, and other activities. To help ensure the success of such programs, it is important for a museum to identify its local stakeholders, a group of people that might include the community the museum serves,

local artists, students and their families, educators, and technologists, and then show how each would benefit from these programs (see again Kourach and Wunar, 2013). Local customs and traditions must not only be respected, but can also be harnessed to not only enhance the local population's appreciation of technology, but also to facilitate its learning and an increased understanding of technological concepts and principles. A museum that would engage in such an activity would need to develop an intention that resonates with, or celebrates, the culture of the local community, present or historic.

Of course, there are some museums of science and technology whose main purpose is to showcase technology as an end unto itself (e.g., the Museum of Science and Industry in Chicago, Illinois in the United States). They clearly play an important part in educating the general population about science, technology, and engineering. In this paper we discuss how the more traditional art museums can complement those efforts by, in effect, purposefully blurring the line between art and technology and using visual literacy to pair with technical literacy. That is, how art museums can use art to show off technological principles, and how technological marvels can be artistic, even beautiful.

3.1 Showcasing Technology Through Art

The relationship between "art" and "technology" has always been a close one. Both art-ists and technology-ists envision, plan, and create their works for everyone either to enjoy, or use, or in some cases, both. This close-knit relationship between art and technology is discussed quite well by Fantauzza (2013). As noted previously, the arts help technologists communicate more beautifully, while technology helps artists to communicate in new and powerful ways. There are many well-known works of art that can be said to showcase a variety of technological forms and advances. A few are highlighted blow; also included for each are some comments regarding the technology that they each showcase.

<u>Crown Fountain, Millennium Park</u> – an interactive sculpture in downtown Chicago that uses light-emitting diodes to display digital videos on each of two 50 ft. towers that are placed on either end of a black granite reflecting pool. It not only takes a well-deserved place among that city's other water fountains, but because the reflecting pool is not cordoned off from the public, it actually invites interaction between the public and the towering video displays (see Figure 1). As such, it is not only an engaging work of art, but it also can be used to educate people about electronics, video and image processing, and structural engineering.

<u>The Statue of Liberty</u> – a huge neoclassical sculpture in New York Harbor in New York City that was designed by Frederic Auguste Betholdi and built by Gustave Eiffel (of Eiffel Tower fame) and given to the people of the United States as a gift by the people of France in the late 1880. Its green hue (stemming from the copper content of its "skin") can be used to educate people about materials, corrosion, and erosion (see Figure 2). One only need glimpse the interior to grasp the structural engineering marvels that are used to support its various features and elements (see Figure 3).

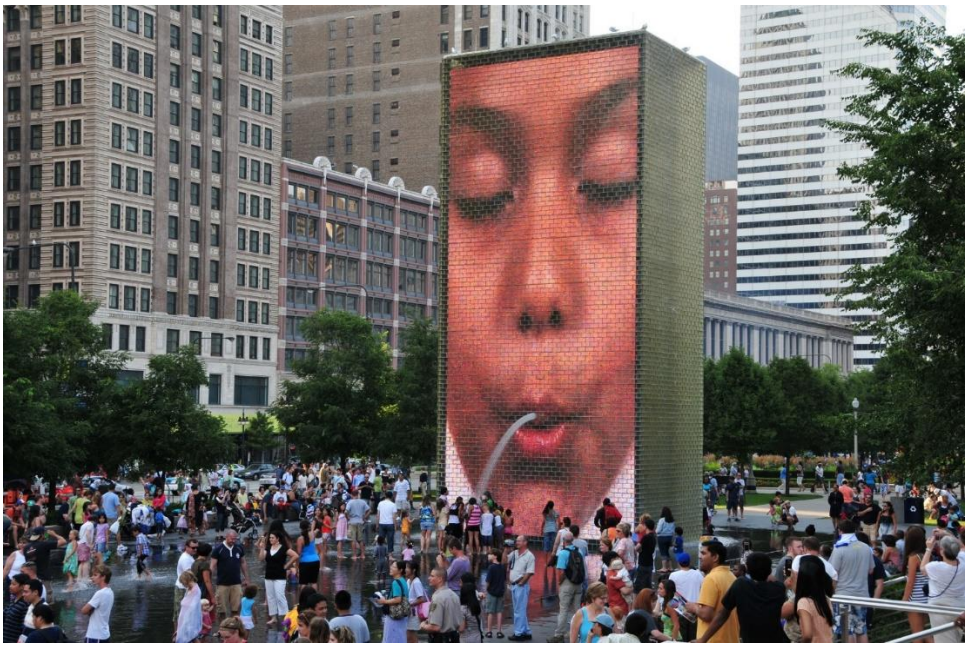


Figure 1. Crown Fountain, Millennium Park, Chicago, Illinois (Photo: Melki/Wikimedia Commons/CC BY 2.0)

Figure 2. Statue of Liberty, New York Harbor

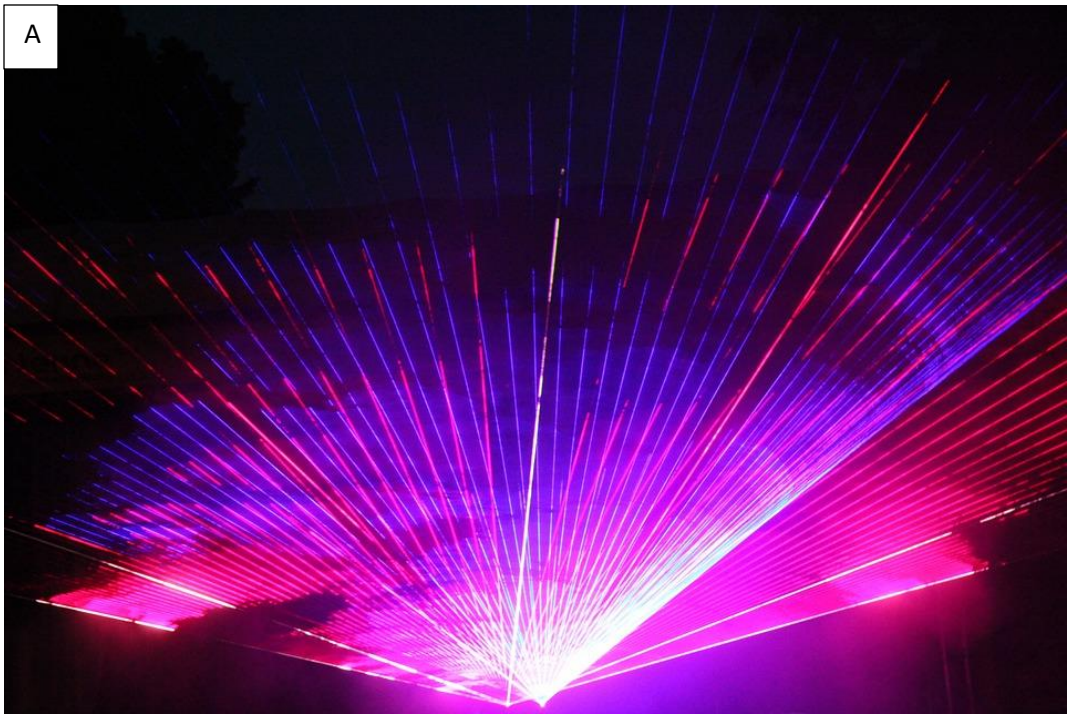
Figure 3. Inside the Statue of Liberty (Photo: Panzarella/Flikr/CC BY 2.0)

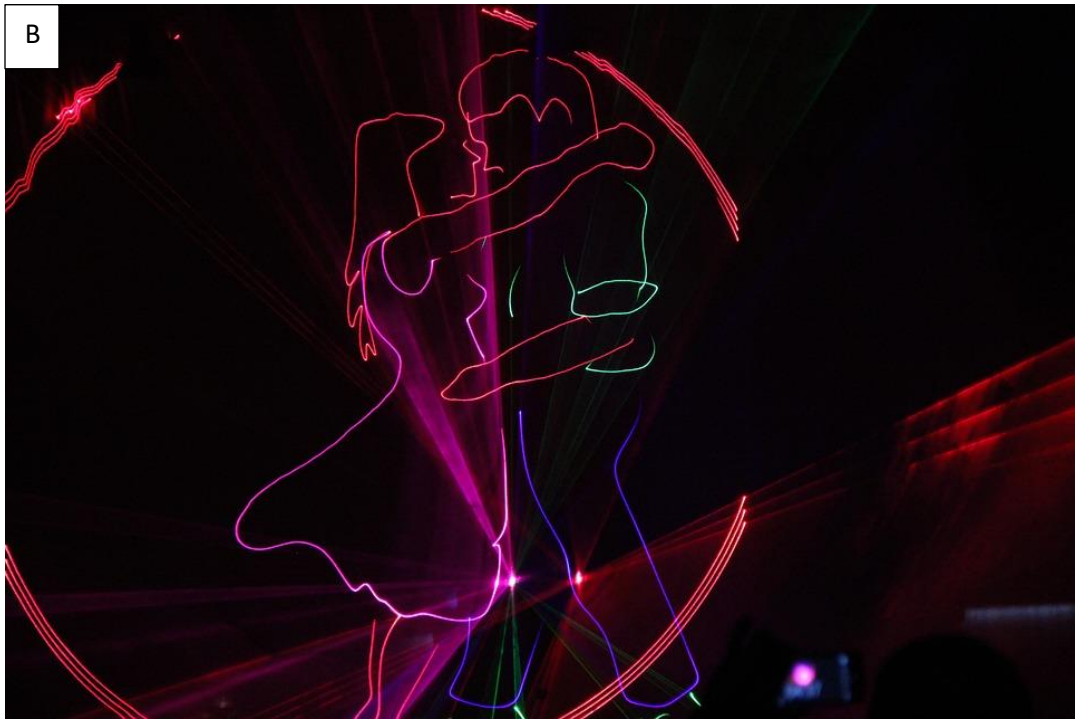
Laser Light Shows – are laser light displays that are used to entertain an audience, and are typically set to music. As an art form, they can either be simplistic ever-changing straight or curved line patterns (see, e.g., Figure 4a), or more complicated displays of still or moving images of animals, people, and everyday objects (see, e.g., Figure 4b). The technological aspects of lasers are fairly self-evident. Some art museums have planetariums, and laser shows in the domes of planetariums are a mainstay of art expression in these art museums. Such displays can be used to educate people about the physics of light and the many other used of laser beam technology, such as materials processing, and medical procedures.

Solar-Powered Building Façade – an entire exterior wall of a building at the University of Art and Industrial Design in Linz, Austria, is covered with interconnected solar cells that move to create images, texts, etc. (Figure 5) This form of art can be used not only to present passersby incredibly large renditions of classical as well as new artwork, but also to educate the public about electricity, power generation, and conservation (Shamiyeh, 2009).

3.2 Showcasing Art Through Technology

Engineering marvels are not only technological creations, they are artistic endeavors in their own right. At the turn of the century, it was common practice in Europe to award bridge design and construction contracts through juried competitions. In these competitions, not only was the soundness of the engineering design scrutinized, but so were the aesthetics of the completed products. Of particular note are the works of Robert Maillart, a Swiss civil engineer whose bridge designs revolutionized established design conventions (see Figure 6). The effects of his novel designs and use of materials influenced engineers for generations to come, both in Europe and in the U.S.





Figures 4A,B. Examples of Images from Laser Light Shows. (Photos: Boehmer/Pixabay/CC BY 1.0)

Figure 5. Solar-powered Media Building Facade in Linz, Austria. (Photo: L. Mignonneau, C. Sommerer, M. Shamiyeh; used by permission)

Figure 6. Robert Maillart's Salginatobel Bridge, Schiers, Switzerland. (Photo: Rama/Wikimedia Commons/CC BY-SA 2.0 FR)

The continued use of juried competitions to award engineering underscores the significance of aesthetics as an important component of engineering design. Local communities have engaged political leaders by calling for design competitions to be a part of the processes used in awarding contracts to replace the 6th Street Bridge in Los Angeles (see Figure 7) and the Northern Avenue Bridge in Boston (for more information, see, http://www.sixthstreetviaduct.org/, and http://www.northernavebridge.org/, respectively).

3.3 Application in Caribbean Museums

Caribbean art museums would appear to have a number of constraints that they must face as they are built and subsequently carry out their respective missions. Certainly NOT one of them is the abundance of local artists who daily create works that are worthy of exhibition! Limited land space, limited operating funds (coupled with high operating costs such as utilities), weather, and, early on, the high cost of construction, are all realities that museums must confront and conquer if they are to be sustainable.

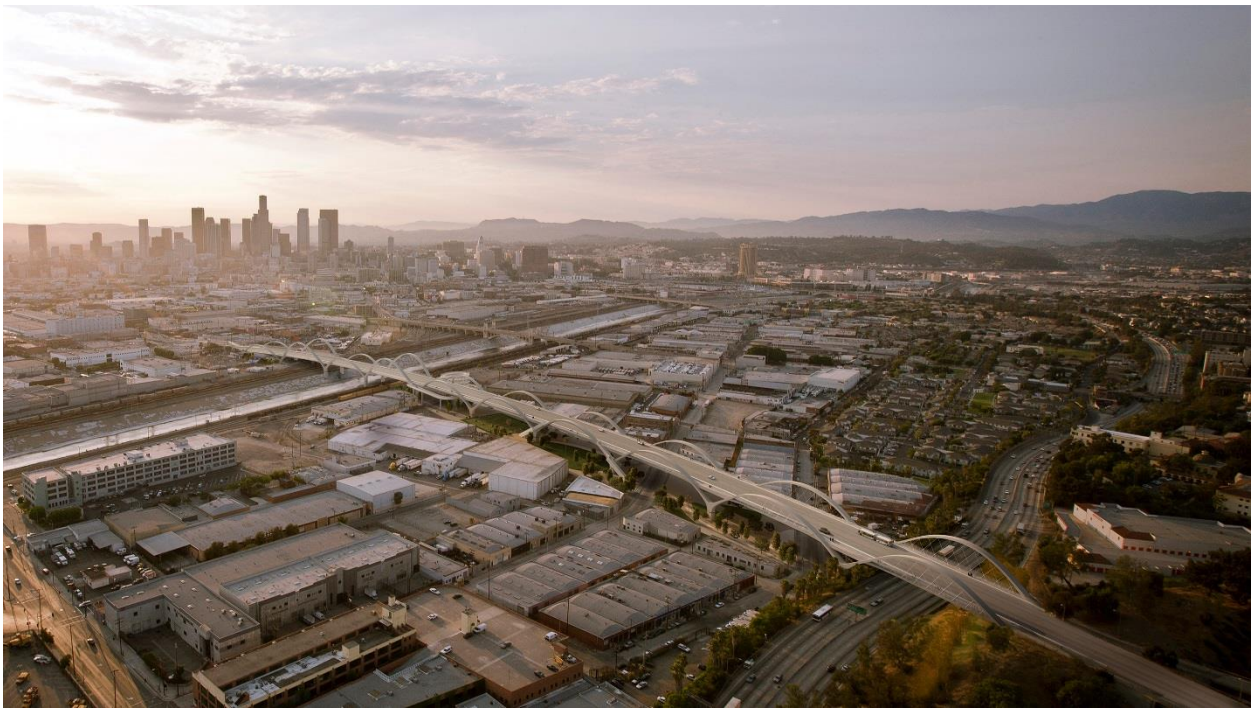


Figure 7. Artist's Drawing of Winning Design for the New Sixth Street Bridge in Los Angeles, CA (Photo: City of Los Angeles, Bureau of Engineering, Michael Maltzan Architecture, Inc. / HNTB Corporation; used by permission)

However, the nations of the Caribbean archipelago have a wonderful variety of cultures and traditions, among them strong family and regional ties, strong religious communities, and, of course, music, food, arts and crafts, rituals and festivals. The following sections present ideas on how museums can infuse themselves even further into an island's daily life by actively engaging its community not only in showcasing local talent, but also by helping to educate the general population about important technological issues.

3.3.1 Art Displays and Exhibitions

Trash to Treasures: Art from Recycled Materials This is the name of an actual program in San Francisco that provides artists access to discarded materials, a stipend and a large studio space to work in (http://sfpl.org/?pg=1012131601). Museums in the Caribbean can launch similar programs, and feature materials that may be prominent in the trash produced by residents as well as island tourists. This could include plastic bottles, Styrofoam, and other waste items that are commonly seen on the island. Recycled CDs are a very popular medium as far as fish is concerned because of their shiny, scale-like quality when overlaid or stacked correctly (see Figure 8; Laylin, 2011). Such exhibits will serve to increase awareness of technological issues such as waste management, recycling, and conservation of resources. This could also be a way to bring attention to the waste that floats up on the shores, eaten by sea birds, and affects the local ecology. These materials can, in effect, be used to speak for the natural world through art and technology. Furthermore, like the program in San Francisco, these kinds of exhibits can also promote in the public and in artists alike new ways of thinking about art and about the environment.

Human Technological Footprints as Art Using technology to create art is, of course, not new. The laser light show craze of the 1980s is a testimonial to the idea that laser-drawn shapes and colors, when put to music, can create here-to-fore unimaginable imagery, moods, and feelings. However, the clever use of technology can also result in an art form that highlights the effects of the presence of people, both local and visiting, on an island. For example, Russian artist Dmitry Morozov, has created a device that measures the amount of pollution in the air, and turns that data into stunning visual images (see Figure 9; Stinson, 2014). Other examples of using art to alert local populations (and politicians!) to environmental issues also exist (Rieland, 2014). While some are fairly sophisticated and perhaps difficult to duplicate, others can be implemented on an island to highlight the need for, say, better traffic flow management or water resource management.

Fractal Art A relatively new art-form, it is created typically by computers that execute lengthy calculations based on a specified algorithm and set of input parameters. It is stunning, colorful, and mesmerizing, especially when presented in video format. Figure 10 shows a still from a multimedia work by a former Missouri S&T student. Pastels, pencil and Photoshop tools were used to create the layered effect shown. This piece, now part of an animation, is a good example of transition art using both hand drawn tools and technical advances. This art form can be used to educate the public about computers and mathematics, of course. However, it can also inform the public about nature, the cosmos, anatomy, and history (Gunther, 2013). Sea shells, galaxies, and the internal structure of human lungs all have the hallmarks of a fractal pattern, as do many of the geometric patterns in mosques throughout the Middle East (see, e.g., Figures 11 and 12).

Figure 8. Giant Fish Sculpture Made with Recycled CDs. (Photo: Tabitha Pope; used by permission)

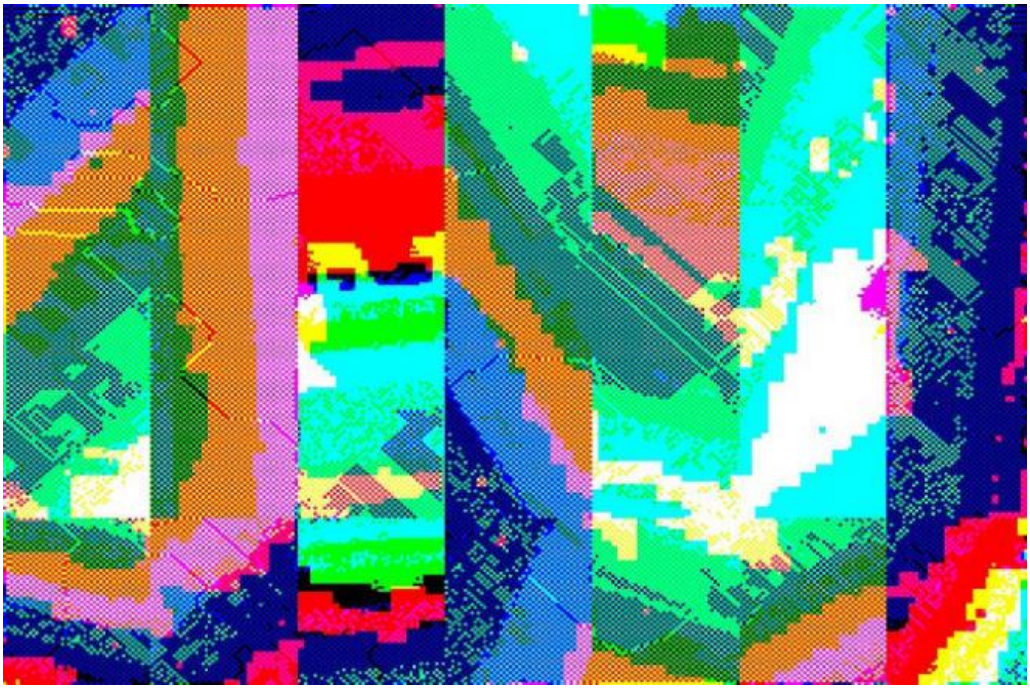


Figure 9. Pollution visualized. The bright colors signify pollutants like smoke and car exhaust. The green means fresh air. Dmitry Morozov (2014). Used by permission.

Figure 10. Maya. Pastels, pencil and digital tools create the layered effect. Derek Carpenter (2016). Used by permission.

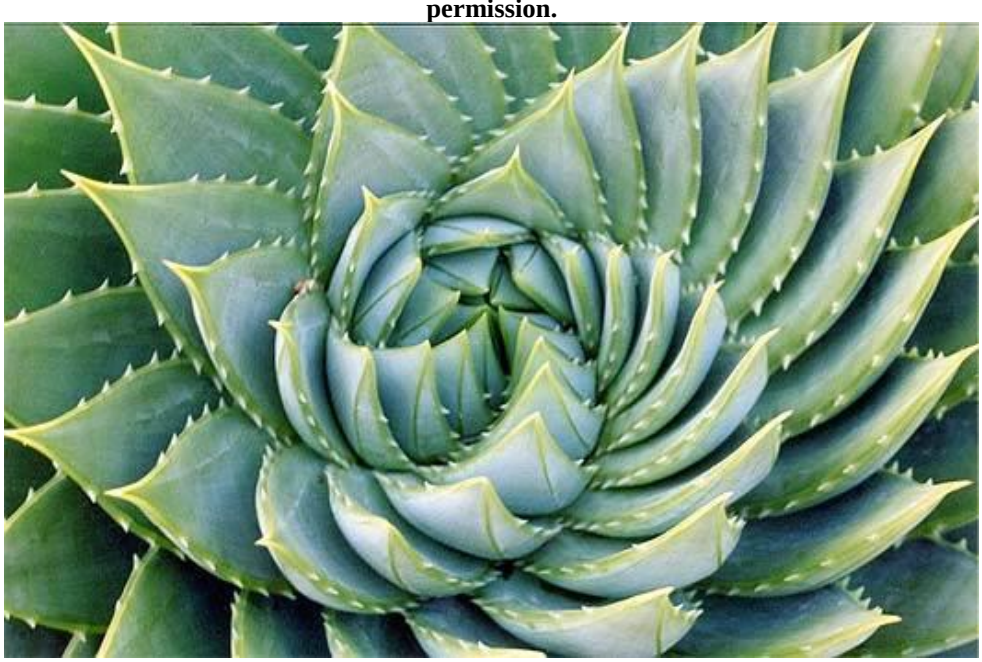


Figure 11. Fractal-like Images from Nature. (Photo: Genista/Flikr/CC BY-SA 2.0)

Figure 12. Main Dome of Selimiye Mosque with Self-Similar Patterns, Edirne, Turkey. (Photo: Wikimedia Commons/CC BY 4.0)

Camouflage Art As humans develop technology to help them attain new levels of productivity, be it in the workplace or in the marketplace, the by-products of such technological developments are often not very aesthetic. In particular, cellphone towers and windfarms have earned particularly harsh criticism from the public as eyesores. In response to such criticisms, some communities have developed clever ways of masquerading cellphone towers so that they blend more with the local geography and terrain (see Figure 13). Caribbean islands are facing similar problems stemming from similar advances in communication technology. Caribbean museums can hold juried "camouflage design competitions" or "regional bio-mimicry competitions" as a way of stimulating public interest in solving a common problem as well as a way to help technology implementers partner with the local population to avoid similar problems in the future.

Graphic Arts – Past and Present Graphic designers will likely agree that technological advances have given rise to enormous strides in graphic design. Depth of color, 3-D imaging, and other "attention grabbing" devices are possible because of technology. Caribbean museums can host exhibits of local graphic arts, comparing the past with the present (see, e.g., Figures 14, 15 which show examples of street art from Cuba and airline advertising). This would pull out archives of previous work and inspire the newest applications to show what can be done. Such exhibits would not only show the changes in the art that have occurred, but also the changes in the technology that was used to create the art. In this manner, an island's historical society can also participate in the activity, thereby spreading the appeal and reach of the exhibition (see, e.g., http://www.galeriaexodo.com/artistas/rafael_tufino/rafael_tufino.html).

Figure 13. Cell Tower Disguised as a Palm Tree. (Photo: Vorhees/Flikr/CC BY-SA 2.0)

Figure 14. Example of Popular Caribbean Art (Cuba)

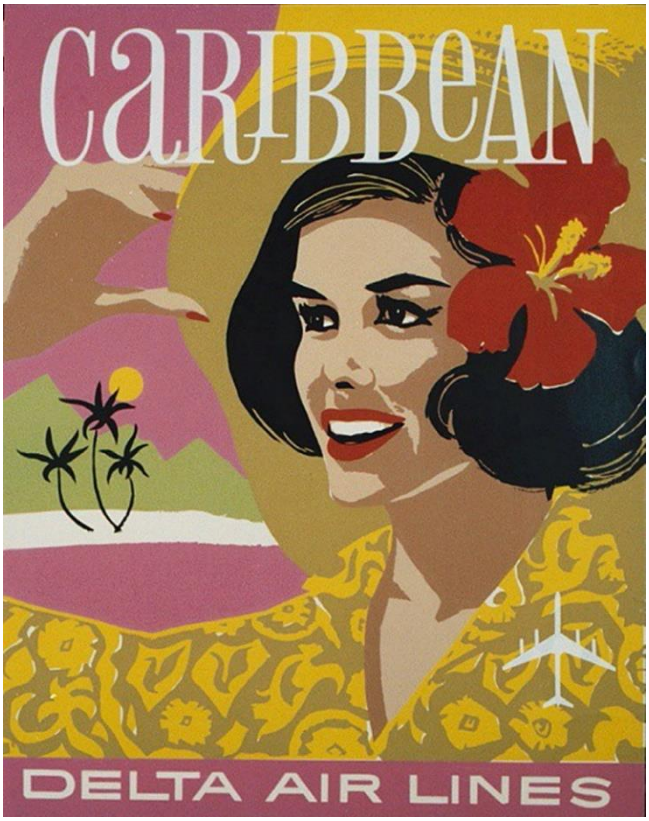


Figure 15. Caribbean-inspired Graphic Art (Photo: San Diego Air & Space. Museum/Wikimedia Commons/CC BY-SA 3.0)

3.3.2 Outreach Programs

The cultural heritage of the Caribbean is as varied as it is rich. This heritage is often celebrated through festivals and other public gatherings. At festivals where it makes sense to do this, museums could have a booth highlighting a particular on-going exhibit and the technology it reinforces or showcases. Brochures and materials can be distributed, and there can be raffles for free admission passes to the museum or the exhibit to generate some "buzz" and some interest in the exhibit.

Furthermore, when launching an Art-as-Technology/Technology-as-Art exhibit, museums can launch the exhibit with a joint panel discussion with an artist and an engineer to discuss both aspects of the exhibit and the art pieces being exhibited. Likewise, the exhibit can be closed with another artist/engineer panel discussion, but this time engage the audience in the conversation to learn what worked well and what did not.

Finally, many secondary and tertiary institutions in the Caribbean have courses or programs of study in business, communication, and marketing. Museums can work with local community school boards to develop and implement Artist-in-the-Classroom Programs, wherein local artists are engaged to help teach courses in these subject areas (see, e.g., http://www.davidoffartinitiative.com/residency/caribbean-artists). Our personal experiences indicate that if a technical presentation is well-developed visually, the presentation is usually better received, and creates fewer obstacles in the minds of the listeners. Participating artists can help students learn a sense of aesthetics that they would be able to implement into their work, thereby creating beautiful objects and intentional images, rather than just manipulating combinations of light and color.

3.3.3 Other Activities

Museums throughout the world are blessed with cadres of volunteers who give their time, talents, and energy to further the mission of the museums they serve. Volunteers can visit schools with a small, portable art exhibit showing off something from a current exhibition, and someone from either the local technical or engineering community can discuss the engineering aspects related to that particular exhibit item and / or exhibition (a STEM to STEAM, where the A is 'art', transition of sorts). Museums can also encourage a three-generational art show, whereby the younger technicians and artists are able to represent their history through a narrative given by the elders of the culture.

Additionally, cultural celebrations showcase local customs and traditions through colorful displays, costumes, music, and either stationary or moving elements such as floats, masks, and other structures. The artistry involved is evident; the underlying technology, if done well, is hidden from view. For example, Figure 16 shows a completed float from the 2011 Rose Bowl parade, while Figure 17 shows the internal supporting structure of one of the float elements. (http://www.rotaryeclubny1.com/rosebowlfloat-2011.htm). This underlying technology can be showcased if the technical preparations for such festivals included lectures, seminars, etc., or courses that were offered either in local secondary or tertiary schools. That way students can participate in the fun activities associated with the festival while learning more about some of the more advanced and technical aspects of what goes on "behind the scenes" that make it all work together so well.

Museums can also hold festivals, lectures, and exhibitions whose main purpose is to highlight the use of technology to create art and what effects such processes might have not only on the artist and the art that is created, but also on how it is shared and viewed. The proliferation of online forums has created a new venue for artists to exhibit, market, and sell their art (see, e.g. http://crosscut.com/event/crosscut-arts-salon-tech-and-the-democratization-of-art/). The arrival of televisions and the desire to show movies on televisions after their screen runs had ended had an effect on the type, nature, and composition of movies that were created. Whether or not the availability of the internet and other forms of technology are having a similar effect on how and what kind of art is produced can also be explored through focused, targeted activities (see also, e.g.,http://murmurationfest.com/art-at-murmuration/).

Figure 16. 2011 Rotary Club Rose Bowl Parade Float. Rotary E-Club of NY. Used by permission.

Figure 17. Skeleton of the 2011 Rotary Club Rose Bowl Parade. Rotary E-Club of NY. Used by permission.

4. CONCLUSIONS

The topic before us here is quite complicated, of course. However, each one of us, whether in the academy, or an aunt or uncle, or a guidance counselor, can in our own way, begin to take steps to address this issue. We can provide encouraging, appropriate mentoring to budding scientists and engineers. We can update our curricula to include subjects and skills that will be useful to students living in 2050, not in 1950. And we can explore reward systems in our schools that are not punitive, but actually encourage student engagement and student learning.

Museums can participate in the process of enhancing the technical literacy of the region's general population as well as its current and future leaders through exhibits, outreach programs, and other activities. Local stakeholders, such as the community, artists, educators, and technologists, would need to be shown how they would each benefit from these kinds of programs. Local customs and traditions can also be harnessed to enhance the local population's appreciation of technology, and to facilitate an increased understanding of technological concepts and principles. A museum that would engage in such an activities would need to develop an intention that resonates with, or celebrates, the culture of the local community, present or historic.

If we are successful in these endeavors, we will begin to provide a huge sector of our society the opportunity to play a part in shaping its and our destiny. Our leaders will possess the information and knowledge they need to make more informed decisions on issues that affect us and our planet. And, society as a whole will be better served – at that point in time *all* sectors of society will contribute their varied talents and insights to solve problems and will work together to move our civilization forward into its proper future.

Acknowledgements. The authors are grateful to their home institution for creating a vibrant learning environment that encourages engineers and artists to collaborate on meaningful projects. The authors are also grateful to the reviewers for their constructive comments, and to the many artists who allowed us to cite and share their works in this paper.

REFERENCES

Boston Society of Architects. http://www.northernavebridge.org/. Accessed 6 October 2017.

Bureau of Engineering, City of Los Angeles. http://www.sixthstreetviaduct.org/. Accessed 6 October 2017.

Cross Cut Arts Salon. http://crosscut.com/event/crosscut-arts-salon-tech-and-the-democratization-of-art/. Accessed 6 October 2017.

Davidoff Art Initiative. http://www.davidoffartinitiative.com/residency/caribbean-artists. Accessed 6 October 2017.

DeVita, M.C. 2000. Service to People: Challenges and Rewards (How Museums Can Become More Visitor-Centered), Lia Wallace-Reader's Digest Fund, New York, NY, April.

Elysium Space, Inc. http://elysiumspace.com/ (accessed 6 October 2017).

Fantauzza, J. 2013. A Third Space: Technological Art as Artistic Production and Technology Research and Development, Ph.D. Dissertation, Georgia Institute of Technology, Atlanta, Ga.

Galeria Exodo. http://www.galeriaexodo.com/artistas/rafael_tufino/rafael_tufino.html. Accessed 6 October 2017.

Gerstein, J. 2015. "STEM for Elementary School Students – How to Instill a Lifelong Love of Science", Education Insider, August 13 (http://blog.iat.com/2015/08/13/stem-for-elementary-school-students-how-to-instill-a-lifelong-love-of-science/).

Gunther, S. 2013. "14 Amazing Fractals Found in Nature", Mother Nature Network. http://www.mnn.com/earth-matters/wilderness-resources/blogs/14-amazing-fractals-found-in-nature. Accessed 6 October 2017.

Home-Douglas, P. 2004. "Painting Everyone into the Picture", Prism, American Society of Engineering Education, Vol. 13, No. 5, January.

Klawe, M. 2003. "Engineering for Everyone", Presentation to the School of Engineering & Applied Sciences, Princeton University, Princeton, N.J., May 2.

Klawe, M. 2014. "The Science Behind Graduating A Class With Majority Women Engineers", July 10. http://www.forbes.com/sites/mariaklawe/2014/07/10/the-science-behind-graduating-a-class-with-majority-women-engineers/#53f08baa2fe2.

Kowrach, N., and Wunar, B. 2013. "Reinventing the Role of Museums in Science Education", Proceedings of the Second International Conference on New Perspectives in Science Education, Florence, Italy, March.

Laylin, T. 2011. "Giant British Recycled CD Fish Invites People Into Its Mouth". http://inhabitat.com/ginormous-shimmering-recycled-cd-fish-rocks-the-glastonbury-festival/. Accessed 6 October 2017.

Mathews, M. 2015. "Classrooms Without Borders – An 11 University Series of Virtual Courses Reaches Across Oceans and Cultures to Promote Global Collaboration and Shared Learning", Prism, American Society of Engineering Education, November, pp. 34-36.

Mazzurco, A., Huff, J., and Jesiek, B. 2013. "Raising Students' Cultural Awareness

through Design Scenarios", 120th ASEE Annual Conference and Exposition, Atlanta, GA, June 23-26, Paper ID #7458.

Motamedi, V. 2001. "Mastery Learning: An Effective Teaching Strategy", http://www.nyu.edu/classes/keefer/waoe/motamediv.htm.

Murawski, M. 2013. "Museums Un/Plugged: Are We Becoming Too Reliant On Technology?" July 6. https://artmuseumteaching.com/2013/07/06/museums-unplugged/.

Murmuration Fest. http://murmurationfest.com/art-at-murmuration/. Accessed 6 October 2017.

Murphy, A. 2011. "STEM Education - It's Elementary", U.S. News & World Report, August 29 (http://www.usnews.com/news/articles/2011/08/29/stem-education--its-elementary).

National Education Association. 2012. "Preparing 21st Century Students for a Global Society – An Educator's Guide to the 'Four Cs'", National Education Association, Washington, D.C., May.

Rieland, R. 2014. "Seven Ways Technology is Changing How Art is Made". http://www.smithsonianmag.com/arts-culture/7-ways-technology-is-changing-how-art-is-made-180952472/?no-ist. Accessed 6 October 2017.

Rotary E-Club NY. http://www.rotaryeclubny1.com/rosebowlfloat-2011.htm. Accessed 6 October 2017.

San Franisco Public Library. "Trash to Treasures: Art from Recycled Materials", http://sfpl.org/?pg=1012131601. Accessed 6 October 2017.

Shamiyeh M. 2009. DOM Research Lab (http://www.domresearchlab.com/content/solar-display-self-powered-media-fa%C3%A7ade-linz-1; accessed 6 October 2017).

Stinson, L. 2014. "A Wacky Device That Turns Polluted Air into Glitch Art". https://www.wired.com/2014/07/a-clever-device-that-turns-polluted-air-into-art/. Accessed 6 October 2017.

Article submitted: November 2016
Accepted: November 2017
Published April 2018