

Biomimicry: Inspired by Nature

Stephanie Peborde Burke

New Jersey City University

A science exhibit that would be a great fit for the Liberty Science Center (LSC) would be one on biomimicry. According to the Biomimicry Institute (2017), “biomimicry is an approach to innovation that seeks sustainable solutions to human challenges by emulating nature’s time-tested patterns and strategies.” Biomimicry is all around us, oftentimes without us even noticing. With connections to innovation and sustainability, biomimicry is a currently relevant topic to issues and solutions we humans, are dealing with today. Knowledge of this topic can help us think about how to create a better future and inspire the engineers of tomorrow.

This exhibit would be created based on sound design principles and purpose. The basics of how the exhibits would be used and controlled by museum goers will be rooted in Universal Design for Learning (UDL) and principles developed by Don Norman. UDL is a framework that focuses on developing skilled learners in instructional environments that may harbor inflexible curricula creating barriers to learning (CAST, 2011). According to the Center for Applied Special Technology (2011), most curricula are developed to meet the needs of average learners. UDL helps diverse learners by providing suggestions for flexible approaches, goals, resources, and assessments that will meet the needs of all learners. Even average learners could benefit from UDL suggestions to help compensate for poor curricular design (CAST, 2011).

In addition to UDL, concepts from *The Design of Everyday Things* by Norman (2013) will also be used. Norman states, “Two of the most important characteristics of good design are discoverability and understanding” (p. 3). Discoverability is when a user must figure out what actions are possible and how to execute them while understanding is figuring out what it means and how the product is meant to be used. Employing principles from UDL and Norman will facilitate the use of the exhibit and attempt to provide access to all learners as much as possible.

Technological components of the exhibit will be based on the Positive Technological Development (PTD) framework developed by Bers (2012). The biomimicry exhibit and its technological components (videos, a matching game computer program, an invention/design program) will make use of the PTD activities of content creation, creativity, and community building.

The biomimicry exhibit will be in keeping with the Liberty Science Center's (n.d.) mission which is "to get learners of all ages excited about the power, promise, and pure fun of science and technology." Biomimicry involves nature, mainly plants and animals, that have inspired inventions, innovations, or have been incorporated in a design. Animals can be motivating and fun for both adults and children (Acredolo, 2011; Gross, 2015; Nittono, Fukushima, Yano, & Moriya, 2012) making them an excellent part of a science exhibit. The educational objectives are to be able to give examples of biomimicry and ultimately design or innovate using knowledge of biomimicry.

The title for this exhibit will be *Biomimicry: Inspired by Nature* and will be a walk-through exhibit requiring museum goers to follow a path that takes them to four different stations (see Figure 1). Guests will enter a large, accommodating doorway that will have the title above it and a brief explanation of what biomimicry is with images. The exhibits will be along the perimeter of the hallway guests will travel through with plenty of space between each of the four stations. Arrows and animal footprints will direct visitors through the exhibit. Each station will be nestled into the wall of the hallway and can accommodate a group of about six people at a time. The height of each station will be accessible to standing visitors as well as individuals who may pass through in wheelchairs or other mobility devices and will feature an open area below the table top of the display so seated individuals can pull up to the display and have a place for

their legs. The walls in between each station will display biomimicry-related imagery. Lighting and color will create an inviting environment so visitors do not feel trapped as they pass through the exhibit. Any writing throughout the exhibit will be in 25 words-or-less chunks. The writing will use a large, sans-serif font contrasting in color to that of the background material of the exhibit. Above the writing will be Braille. All writing will also have a button next to it that will play an audio file of the written information. All videos will have audio with a narrator and closed captioning. Videos will be played on a screen embedded in the exhibit design.

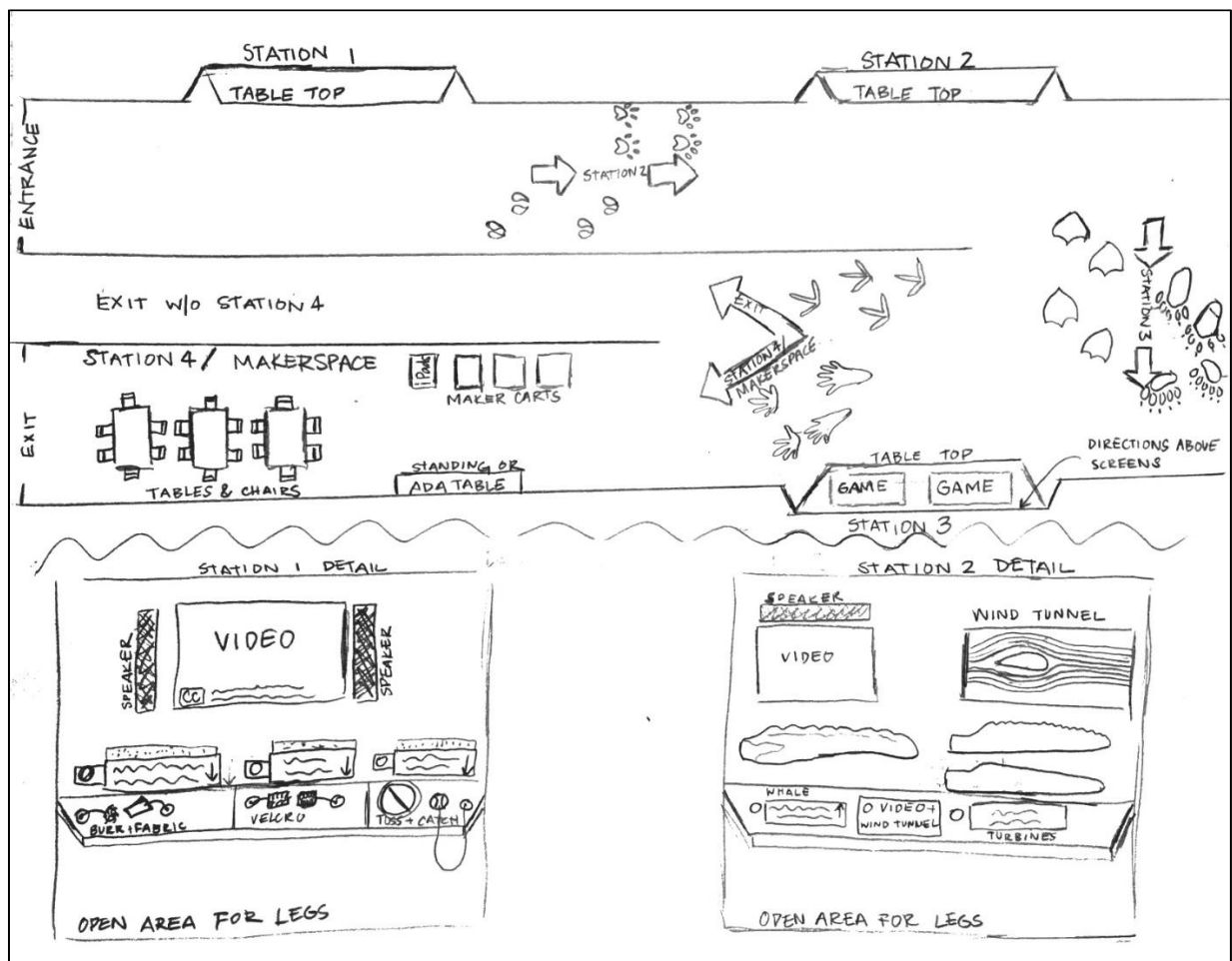


Figure 1. Visual model of biomimicry science exhibit. Layout includes four different stations in a U-shaped hallway. Below the layout depicts details for Stations 1 & 2. Drawing by Peborde Burke, S.

Regarding feasibility, this exhibit uses a fairly simple design. It would require a dedicated space, as there are multiple stations within. For safety, this may need to be a ticketed or timed exhibit, only allowing a certain number of people in at a time. Overcrowding can take away from the experience and cause a safety issue in the Makerspace. The Makerspace would also require that children be accompanied by an adult or chaperone due to the usage of materials like scissors, glue, etc. and must be maintained by one or two LSC employees. While the exhibit does try to provide a full experience for all visitors, those who are visually impaired may not be able to enjoy all aspects. There are tactile portions, Braille, and audio recordings to convey the necessary information. Probably the most challenging and most costly aspect in designing this exhibit will be the technology and creation of the proprietary matching game and biomimicry design app.

*Station 1: The Velcro Plant.* Museum guests will see the inspiration behind Velcro, which was invented by Swiss engineer, Georges de Mestral when burrs from a Cocklebur plant became attached to his trousers (and dog) (Suddath, 2010). At this station, guests will get to touch burrs to fabric (both attached to the exhibit so they cannot be removed) and compare it to the hook and loop of Velcro by touching and playing with actual Velcro. An example of a Velcro toss and catch game will be a part of the exhibit for visitors to play with (all pieces attached so they cannot be removed). Information about the Cocklebur plant, burrs, and Velcro will be written on the exhibit, with the ability to play an audio recording of the text. A video about inventing Velcro will be running on a loop.

*Station 2: Whale Turbines.* At this station, museum goers will read/listen to information about how the bumps called tubercles on humpback whale pectoral fins inspired a more efficient wind turbine blade. Displayed will be a scaled plastic model of a humpback whale pectoral fin

for visitors to touch, as well as scaled down versions of both the original turbine blade and the updated version with the tubercle influence. A mini wind tunnel operated with a button will be available for visitors to experience and see wind travel over both types of turbine blades. Additionally, a video will also be available showing the real aerodynamic tests of the turbine blades. Both will be operated simultaneously with the push of one labeled button.

*Station 3: Biomimicry Matching.* Visitors will be able to play a computer game that will have them match 10 different inventions or innovations to what it was inspired by in nature. For example, planes were inspired by birds, and radar and sonar were inspired by bats and dolphins. This will be on a color touch screen that will be narrated and have written information and directions along with pictures.

*Station 4: Biomimicry Maker.* Using their knowledge of biomimicry, visitors will be able to create their own invention, improve upon an existing product (innovate), or create a newly designed product inspired by nature. A small Makerspace on carts will have materials like crayons, pipe cleaners, safety scissors, glue sticks, cardboard, construction paper, etc. Visitors can sit at tables (different heights for adults, children, standers, and ADA required) and create whatever they like and take it with them. Proprietary biomimicry design software on tablets/iPads will be available to create something digitally for those who may not be able to easily work with arts and crafts materials or are more interested in computer modeling. Visitors can choose either the drag and drop version, a combination of drag and drop and free draw, or fully free draw. They can print out their design when done. Museum employees will be available for help and will monitor and interact with visitors.

## References

- Acredolo, L. (2011, September 12). My Kids Love Animals. *The Baby Signs Blog*. Retrieved from <http://babysignsinc.blogspot.com/2011/09/why-kids-love-animals.html>
- Bers, M. U. (2012). Designing digital experiences for positive youth development: From playpen to playground. New York, NY: Oxford University Press.
- Biomimicry Institute. (2017). What is Biomimicry? Retrieved from <https://biomimicry.org/what-is-biomimicry/>
- CAST. (2011). Universal Design for Learning guidelines, Version 2. Retrieved from [http://www.udlcenter.org/sites/udlcenter.org/files/UDL\\_Guidelines\\_Version\\_2.0\\_\(Final\).doc](http://www.udlcenter.org/sites/udlcenter.org/files/UDL_Guidelines_Version_2.0_(Final).doc)
- Gross, J. (2015, May 21). What motivates us at work? More than money. *TED*. Retrieved from <http://ideas.ted.com/what-motivates-us-at-work-7-fascinating-studies-that-give-insights/>
- Liberty Science Center. (n.d.). About Us | History & Mission. Retrieved from <http://lsc.org/about-us/history-mission/>
- Nittono, H., Fukushima, M., Yano, A., & Moriya, H. (2012). The power of kawaii: Viewing cute images promotes a careful behavior and narrows attentional focus. *PloS one*, 7(9), e46362. Retrieved from <http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0046362#pone-0046362-g003>
- Norman, D. (2013). *The design of everyday things: Revised and expanded edition*. Basic Books (AZ).
- Suddath, C. (2010, June 15). A Brief History of: Velcro. *Time*. Retrieved from <http://content.time.com/time/nation/article/0,8599,1996883,00.html>