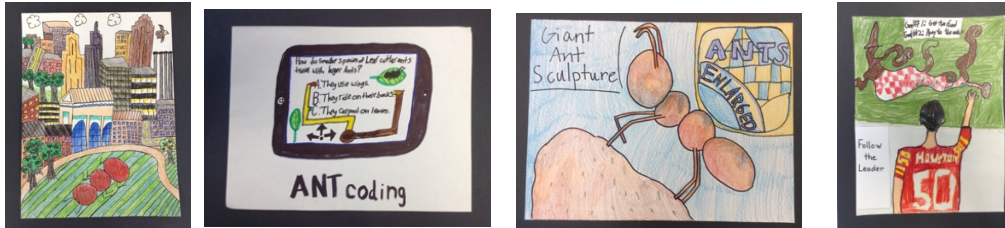


## ANTS ENLARGED: Learning from Ants



### CREATIVITY & INSPIRATION

People may think of ants as the tiny six-legged creatures that ruin picnics and steal their food, but there is so much more to know! We have combined SCIENCE and TECHNOLOGY with ART in our exhibit, because art is a beautiful way to attract attention to the systems science of ants working together to accomplish big tasks. Our science exhibit will teach people about the efficiency of ants and how scientists and engineers look to the ant world for solutions.

Research showed us that ants are extraordinary, and they work as a team. Have you ever thought about how an ant could cross a body of water? The answer is simple; they become a team. One ant could try to cross a river by itself, but it probably wouldn't make it. Ants will come together to make a living ant raft that is strong enough to hold together and float across a river. In the October 2014 issue of *Discover Magazine*, there was an article called "Building Better Shipping Networks with Ants." It explained how two civil engineers from the University of South Carolina named Omar Sharif and Nathan Huynh are studying ants and their efficiency in bringing a food source back to the nest. Sharif and Huynh are trying to bring this efficiency to an international shipyard. The engineers designed a plan to create a digital scent to move crates and containers from trucks to boats and *vice versa* just as ants leave a scented trail in nature. Ants as individuals may be small, but together their efforts are BIG.

Ants are interesting! There are eight different types of soldier ants. Some scientists believe that the *Peidole* ants have a gene that makes super soldier ants. The gene has been exaggerated over the last 35 to 60 million years, making the heads extremely big. The article "Anty Venom" in *Discover Magazine* is a great article to learn about the strengths and weaknesses of other ants such as the *Nylanderia Fulva* and the *Solenopsis Invicta* ants. Bully ants and slave ants often live in the same anthill but are from entirely different colonies. The reason is the *protomognathus americanus* steal *temnothrax longispinosus* ants to use them for slaves! Our tile exhibit provides information about different types of ants and where they are found in the world.

Ants are inspiring innovation. For instance, Southwest Airlines systems analysts modeled an airline boarding system after the simple procedures that ants follow to accomplish a complicated task. What is the most efficient way to board passengers on a plane? Look at ant behavior! The answer is open seating, which has fewer people getting up to let others get to the seats they want. Simple procedures can produce big results. Look at the leaf-cutter ant. It doesn't even eat leaves, but the ants work together to carry leaves back to the colony to create an edible fungus. They even give rides to other ants as they work. Now that's teamwork! Our beautiful fountain will show leaf cutter ants working together as a team.

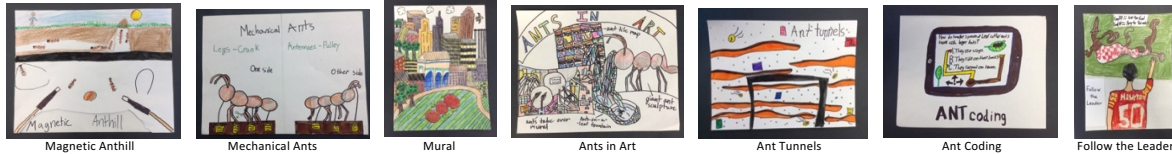
**STEM concepts:** Entomology is the scientific focus, but we can learn about the systems science of how a group of low-cognitive-ability insects can perform tasks efficiently when they work together. Robotics is a field that can use computers and electronics to program bio-inspired robot ants. When ants work together, they are able to do their own type of engineering. Humans in the fields of architectural, civil, environmental, and industrial engineering can learn about ants for real-life applications.

**Inspiration:** We began by looking through *Discover* science magazines for different ideas. We came across an article about building better shipping networks using the same kind of system ants use. It was a strategy for real people to use based on ant behavior. Students in our class started sharing what they knew about ants, and we thought there would be so much more to learn. We started researching on the internet to find out more. When the information started to pile up, we found ourselves geared toward the topic of ants. After discussing it more, we decided that ants would be a good topic, and here we are!

### Relevance for the Future:

1. Studying ant characteristics teaches us how to improve systems of doing work, such as making a shipping process more efficient or speeding up the seating process on an airplane.
2. We can study the behavior of ants and learn about life lessons such as cooperation and collaboration. Ants have the ability to get jobs done without a leader.
3. Learning about ants could inspire young people to study biology or entomology. We need scientists to improve our future!

## INTERACTIVE EXHIBIT ENGAGEMENT



**Magnetic Anthill:** Visitors learn about the structure of an anthill with this amazing magnetic play screen covered in tempered glass. People lead magnetized ants through an anthill to the food storage room, the queen's room, and more. Magnet wands keep the ants moving. When an ant reaches a particular room, a video provides recorded information about that part of the anthill.

**Mechanical Ants:** The two mechanical moving ants allow visitors to use levers, cranks, pulleys, and wheels-and-axels to move different parts of each ant. Informative labels teach about each body part.

**Anty Art:** Look at different aspects about ants through the beauty and creativity of art. Examine a mural, an elegant fountain, colorful tiles, and a metal sculpture that all teach about the wonders of the ant world! The mural connects ants to Kansas City in a fun, playful way. The fountain shows leaf cutter ants working together to transport leaves. Our tile exhibit is based on the different ant types and where they are found around the world. The tiles form an upright wall like a painting. The focal point of the entire exhibit is an ant sculpture made of coated aluminum that rises into the Kansas City sky and can be seen from a distance. Informative plaques accompany each piece of art.

**Ant Tunnels:** The ant tunnels are climbing areas where visitors can crawl, climb, and have fun. They are safe and great for kids to learn how ants get around in their homes. We were inspired by 2 existing climbing structures. A Netherland-based design group called Carve has already built an outdoor structure, and there is an indoor climbing structure at the Muncie Children's Museum. We like vented tempered glass walls for safety and rubber padding to protect knees. Information is provided by audio played through speakers when children activate them. Pictures and descriptions along the way are informative.



**Follow the Leader:** Leap Motion Technology senses hand motions and gestures to create movement on a computer screen. In this gesture-controlled activity, visitors guide a group of ants to work together on a food-gathering mission then lead them back to the anthill, but along the way they face challenges such as a storm or avoiding humans. There are similar games at the Washington DC airport and at the Phoenix Science Museum. This will be one of the most interactive and popular activities in Science City!

### BIG Questions Posted in the Exhibit:

1. Why should people spend time learning about ants?
2. How are scientists and engineers creating new technologies inspired by ants?
3. What are the fascinating characteristics of ants, and how efficiently do they operate?
4. How do ants use teamwork skills? What is an ant hierarchy?
5. What is the structure of an anthill?

**The Fun "WOW" Factor of the Exhibit:** Science, technology, art, and active engagement all work together in this exhibit. The Wow Factor is that learning can be so beautiful and so much fun! The ant tunnels are crazy-fun, and the GIANT ANT is lighted at night! Now that is exciting!

**Activities that are Challenging but Achievable for All Ages:** The Ant Tunnels are for children of all ages, and they're large and strong enough for playful adults! Ant Coding will capture the attention of all but the youngest visitors. The art will draw everyone's attention! All ages will be drawn to the the Magnetic Anthill, Mechanical Ants, and Follow-the-Leader. We predict that the gesture-controlled Follow-the-Leader activity will draw a crowd, all laughing and enjoying the experience!

**The OUTDOOR Elements of the Exhibit that Take Full Advantage of the Environment:** The Follow the Leader and Magnetic Anthill stations need protection from the weather, so we used bus stop shelters. Ant Coding is done inside kiosks that protect the electronics from the weather. The artistic elements of the ANTS ENLARGED exhibit fit right in with the outdoor art that can be seen all around Kansas City. With the backdrop of the historic rail yard, the fountain and the mural add to the Kansas City art scene. The metal ant sculpture rises up into the Kansas City sky to be seen from a distance, and the lights make it visible at night too!

## CONSTRUCTABILITY

### Durability to Wear and the Weather:

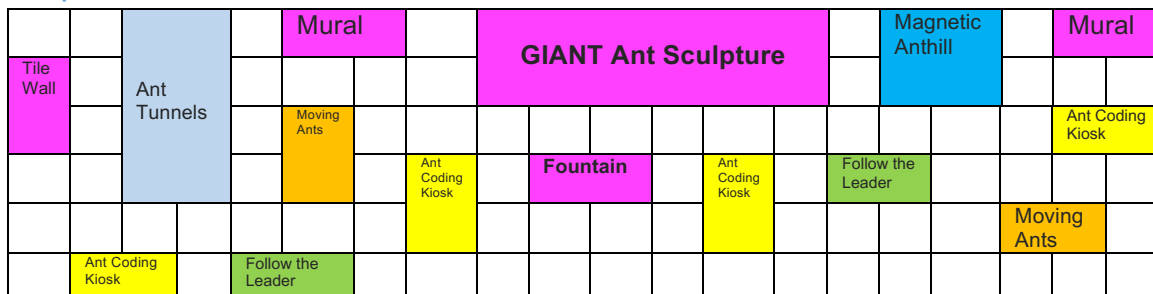
1. We chose to use tempered glass, because it is thick, strong, weather-resistant, and transparent.
2. The giant ant that rises into the sky is made of coated aluminum (similar to some outdoor furniture).
3. We combined ideas from two existing structures for the ant tunnels, one outdoor and one indoor, and we chose materials that would work outdoors. It has safely constructed tunnels with a cushioned bottom and bars for protection. Tempered glass sides and strong plastic materials are made to withstand weather conditions. Kids might be reminded of an outdoor playground, but there will be lots of information inside at their level of understanding.
4. Tiles that have information and pictures of types of ants etched into the surface are made for the outdoors.

**Safety:** The ant tunnel has safely constructed tunnels with a cushioned bottom and bars for protection. Tempered glass with vent holes prevents children from falling out of the tunnel while also allowing adults to see the children at all times. All of the materials used in the exhibit have safe rounded edges to prevent injury.

**Materials:** \$71,860

Magnetic Anthill Z.P.	Price	Qty	Subtotal		Ant Tunnels M.W.	Price	Qty	Subtotal
Metal ants (bag of 100)	\$32	1	\$32		Tunnel Playground Set	\$5000	1	\$5000
Magnet Wand	\$18	6	\$108		Tempered Glass 36"x 74"	\$1000	6	\$6000
20" TV for video info	\$80	3	\$240		Benches for parents	\$200	6	\$1200
Tempered Glass 36"x74"	\$1000	1	\$1000		(also used in other areas)			
<b>Moving Ants</b>					<b>Ant Coding S.M.</b>			
Mechanical Ants 8'x 8'x10'	\$125	2	\$250		Kiosks with Touchscreens	\$5000	8	\$40,000
Bus stop shelter		1						
<b>Anty Art K.S. E.M.</b>					<b>Follow the Leader L.G.</b>			
Mural 60' x 60'	\$1000	1	\$1000		Touch Screen 65"	\$3000	1	\$3000
Fountain	\$400	1	\$400		Leap Motion Controller	\$70	2	\$140
3"x 6" Ceramic Tiles	\$3	30	\$90		MacBook Pro Computer	\$1000	1	\$1000
Sculpture	\$10,000	1	\$10,000		Bus stop shelter	\$1650	2	\$3300

**Floorplan:** \*Build Zone: 60' x 200' (Each square is 10'x10')



## SOCIAL MEDIA & SUPPLEMENTAL MATERIALS

### Social Media Post #1:

Our ANTS ENLARGED exhibit has been designed as an exciting outdoor exhibit for Science City. You will be amazed to learn how complex ant colonies are and how scientists and engineers are modeling new systems designs after ant characteristics. Check out this CBS news article about how American Airlines used ant characteristics to make their boarding systems more efficient. <http://www.cbsnews.com/news/small-wonders-what-ants-can-teach-us/> Also read the article about the use of ant behavior to improve the efficiency of an international shipyard. <http://discovermagazine.com/2014/oct/5-cargo-ants>.

### Social Media Post #2:

Can humans learn from ants? Check out <http://gbtimes.com/world/learn-ants> to learn about how scientists look to the ant world for farming techniques, how to live longer, and solutions to antibiotics resistance. Our Battle of the Brains design idea for Science City will help you understand how scientists and engineers are looking to the ant world to inspire solutions to problems.

## STUDENT INVOLVEMENT

**What process did you use to research the STEM concepts?** We read articles in *Discover* science magazines and researched our scientific subtopics on the internet. We watched videos on Leap Motion Technology. Our work followed the Design Process: define the problem, brainstorm and analyze ideas, collect information, develop solutions, present your ideas to others for feedback, and improve your design. We discussed the construction of the components of our exhibit and searched for materials that are both safe and durable.

### **What ideas and concepts did you consider? Why were they not used?**

1. We wanted to build a Plexiglas walkway with real ants and tunnels in “good ol’ Missouri dirt.” The problems are that ants would die in our Missouri weather, and the Plexiglas would scratch easily.
2. We selected bronze for the huge ant sculpture because of its qualities for outdoor use and its beauty. Then we decided that a coated aluminum would cost less and be just as beautiful.
3. We wanted to compare the strength of an ant to a Chiefs player, but we found that other scientific topics took higher priority for us.

### **STEM Jobs Related to the Exhibit Topic:**

The field of entomology involves the study of insects, but there are many other career fields to consider when scientists and engineers learn from the behavior of ants: systems science, robotics, computers, electronics, and engineering fields such as architectural, civil, environmental, and industrial.

Watch our Battle of the Brains Video: <https://www.youtube.com/watch?v=Sn-FaKPzkuM>