



Evolved Concept Narrative
Abigail Sarver-Verhey

Evolved Overview – DRAFT

9/11/17

Big Idea (Proposed):

The process of evolution shapes how the human body looks and works.

Project Description

This exhibition was created as my Undergraduate Honors Thesis in Anthropology at The Ohio State University. Through this project I am aiming to both develop and demonstrate my abilities in exhibition development and informal science education. In partnership with COSI, I am seeking to evaluate, develop, and, if funding permits, implement one or more of the components of the exhibition at COSI.

Evolved consists of a series of interactive and observational components which each focus on an element of the human body or a human behavior that demonstrates how evolution has shaped our species. By focusing on body parts and behaviors that are universally well known, Evolved approaches the often difficult topic of human evolution from a familiar perspective that allows visitors to connect with it in a personal and practical way.

COSI does not currently have any significant exhibits on human evolution, so an exhibit of this nature would be an important addition to COSI's offerings. Related exhibitions include the upcoming AMNH Dinosaur Gallery, as well as hallway carts on the general process of evolution. Any of the components of Evolved would be an appropriate fit for the Life exhibition, as they deal with the human body and, in some cases, human health. Many of the interactive experiences can be done with a facilitator and would thus be appropriate for cart activities as well.

Educational Outcomes

Reactions	Knowledge	Skills	Attitude	Behavior	COSI Behavior
Participants will be curious about a topic with which they are likely not very familiar. In some cases participants will be wary of the	Participants will learn how evolution works and how it has shaped them as humans.	Participants will be able to relate environmental and social forces to the appearance and actions of people.	Participants will be surprised by the complex history of our seemingly simple body parts and actions. They will have a better appreciation	Participants will think more critically about how their actions in regards to personal health, social engagement, and the environment will shape future	Participants will be interested in learning more about human biology through the Life exhibition, or more about the evolution of other forms

exhibition due to their perceptions of evolution.			for how their environment and their actions shape their bodies.	generations. School-age participants will have a better foundational knowledge in biology.	of life through the AMNH Dinosaur Gallery.
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Experience Thematic Groupings

- Thematic Concept A – Being Human
- Thematic Concept B – Human Variation
- Thematic Concept C – Human Thought and Communication

Experience Groupings:

- Thematic Concept A – Being Human
 - Component 1 – Hands
 - Component 2 – Stereoscopic Vision
 - Component 3 – Teeth
 - Component 4 – Homeostasis
 - Component 5 – Locomotion
 - Component 6 – Vestigial Structures
- Thematic Concept B – Human Variation
 - Component 1 – DNA
 - Component 2 – Body Size
 - Component 3 – Skin Color
- Thematic Concept C – Human Thought and Communication
 - Component 1 – Brain Size
 - Component 2 – Speech and Communication
 - Component 3 – Art
 - Component 4 – Tool Use

COSI Project Leads

- [Name, Title]

Content Advisors

- Abigail Sarver-Verhey, Student, The Ohio State University
- Dr. Mark Hubbe, Associate Professor, Graduate Studies Committee Chair, The Ohio State University

Potential Thematic Groupings

Due to the large number of individual traits/behaviors explored in Evolved, it made sense to group them in a way that would not only make the exhibition easier for visitors to follow, but that would allow them to better conceptualize how evolution impacts every element of being human. Thus, Evolved is divided into three major groups: Being Human, Human Variation, and Human Thought and Communication. The common thread of the evolutionary process ties these groups together, and they will be interlinked by the inherent interconnectedness of the human body and human interactions that often leads to overlapping evolutionary causations or impacts.

The following descriptions are designed to bring additional clarity to each thematic grouping. While each theme is distinctly different, it should be noted that their messages will be interwoven throughout the experience.

Being Human

This group covers the basic traits that all humans share and that define us as the species *Homo sapiens*. The traits explored in this group include opposable thumbs, stereoscopic vision, varied dentition, methods of maintaining homeostasis, bipedal locomotion, and vestigial structures. These traits are shared by all humans and demonstrate the changes that occurred along our evolutionary lineage that resulted in us.

Human Variation

This group examines the factors that create the variation observed amongst humans from genetic makeup to physical features. The traits explored in this group include DNA coding and mutations, climate-based body size adaptations, and skin color variation. Looking at evolution on a more local and even personal scale, these traits show how different environmental and genetic factors result in different adaptations and variations that distinguish people from each other.

Human Thought and Communication

This section looks at perhaps the most notable human feature, our brains, in both a physical and functional sense and explores the evolutionary advantages of having such large brains. The traits/behaviors explored in this group include brain size, complex language, the creation of art, and tool use. These traits illustrate some of the major milestones in the evolution of the human brain and show particularly well how both the environment *and* culture have shaped the course of human evolution.

Experience Goal

- Give a brief introduction to the general process of evolution so that visitors will be familiar with it and can apply it to the following components.

Audience	Reactions	Knowledge	Skills	Attitude	Behavior
COSI visitors looking for a new exhibit to explore	Participants will be curious about a topic with which they are likely not very familiar. In some cases participants will be wary of the exhibition due to their perceptions of evolution.	Participants will learn how evolution works and that it has shaped all different forms of life on Earth. They will also learn what the exhibition will be about.	Participants will be able to relate environmental and social forces to the appearance and actions of different forms of life, including humans.	Participants will be intrigued by the complex history of our seemingly simple body parts and actions and will want to continue through the exhibition in order to learn more.	Participants will think more critically about how their actions in regards to personal health, social engagement, and the environment will shape future generations. School-age participants will have a better foundational knowledge in biology.

Why This Experience?

- This experience is necessary to familiarize participants with the basics of the evolutionary process so that they have a framework in which to better contextualize the activities they will do and the things they will see in the rest of the exhibition. A panel with text seemed the simplest and most expedient way to provide this introduction as it provides helpful information quickly, allowing participants to move on to the more focused and varied components of the exhibition.

Proposed Visitor Experience:

- Participants will read text and look at pictures on brief examples of how evolution works in order to familiarize themselves with the basic process of evolution.

Related Experience Theme(s)

- Thematic Concept A – Being Human
- Thematic Concept B – Human Variation
- Thematic Concept C – Human Thought and Communication

Design and Production Ideas

- Two similarly sized panels will be immediately noticeable as participants walk in. The first will be a general introduction to the exhibition with the exhibit logo and a short text about what they will be learning, and the other will outline the process of evolution.

Design and Production Concerns

Exhibit Components

- Panel with text and images (2)

Content Advisors

- Abigail Sarver-Verhey, Student, The Ohio State University
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Images/Sketches/Photos *see Evolved Sketches and Evolved Rendering

Experience Goal

- Show that our opposable thumbs are evolutionarily significant because they allow us to better manipulate tools and objects. This in turn allows us to complete tasks as simple as writing our name, or as important as hunting and butchering food as our ancestors would have done.

Audience	Reactions	Knowledge	Skills	Attitude	Behavior
COSI visitors	Participants will want to try out the challenge.	Participants will learn what an opposable thumb is, what having them allows us to do, and why, evolutionarily, our thumbs are opposable		Participants will be frustrated and amused by their inability to complete the tasks without their thumb.	

Why This Experience?

- Opposable thumbs were an important development in primate, and eventually human evolution as they allowed our primate ancestors to get around safely and eventually allowed early humans to make and use tools. This experience allows participants to experience what it would be like if we didn't have our thumbs or the fine motor control they allow us. Through the activity, they will recognize the importance of their thumbs for completing both everyday and essential tasks.

Proposed Visitor Experience:

- Participants will attempt simple tasks without the use of their thumb. A table of various objects is provided for visitors to explore as they don a set of four-fingered gloves, which prevent them from using their thumbs. The tasks include: writing their name, tying a shoe, buttoning a button, picking up a cup, sealing a Ziploc bag, picking up a coin, taking a selfie, cutting with scissors, and sewing.

Related Experience Theme(s)

- Thematic Concept A – Being Human

Design and Production Ideas

- A stand with a tray will hold all of the objects. Participants can gather around with their gloves and try using the different objects.

Design and Production Concerns

- With the large number of small pieces it is important to keep things as contained as possible within the tray or on the stand.

Exhibit Components

- Text/activity instruction panel
- Activity stand with in inset tray that holds the various task items and hooks for the four-fingered gloves
- Four-fingered gloves (2-4 pairs)
- Slips of paper
- Pencils
- Shoe with laces
- Button and button hole fabric pieces
- Plastic cup
- Ziploc bag
- Coin
- Safety scissors
- Plastic needle
- Yarn
- Felt pieces with pre-punched stitching holes

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Experience Goal

- Show the benefits of stereoscopic vision and to explain how this feature arose in our early arboreal ancestors.

Audience	Reactions	Knowledge	Skills	Attitude	Behavior
COSI visitors	Participants will want to try out the activity.	Participants will learn what stereoscopic vision is and how it was helpful in both our evolutionary past and today.		Participants will be surprised by their inability to complete the second part of the activity.	

Why This Experience?

- Stereoscopic vision arose early in human evolution, developing in our arboreal ancestors as it helped them to move through the trees more safely. It proved helpful beyond the trees too and was passed down through the human lineage to us. Through this activity, participants will see the difficulty of judging distance between objects without stereoscopic vision. They will think about the things they do everyday that require them to judge distances both large and small and how difficult those would be without stereoscopic vision.

Proposed Visitor Experience:

- Participants will take two pointed dowel rods and hold them directly in front of their face. With both eyes open they will touch the ends of the rods together. Then, they will close one eye and attempt to do the same thing, but because of the loss of depth perception that comes from using only one eye, they will miss, swinging one dowel rod in front of the other rather than bringing them together.

Related Experience Theme(s)

- Thematic Concept A – Being Human

Design and Production Ideas

- Two dowel rods will be suspended from the ceiling by cords so that participants can easily grip and move them. The rods should be (dully) pointed to make matching them up difficult.

Design and Production Concerns

- Getting the height at the right level may be an issue, given that the rods need to be eye level and participants will have a wide range of heights.

Exhibit Components

- Text/activity instruction panel
- Pointed dowel rods (4)
- Adult eye height suspension cords (2)
- Child eye height suspension cords (2)

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Experience Goal

- Demonstrate how our omnivorous diet lead to our varied dental makeup, and how this diet provides an evolutionary advantage in allowing us the flexibility to find sustenance in a wide range of environments.

Audience	Reactions	Knowledge	Skills	Attitude	Behavior
COSI visitors	Participants will be intrigued by the giant teeth and skull models and want to look closer at them.	Participants will learn that they have different types of teeth and what the different purposes each of those teeth serve are.	Participants will have a better understanding of their teeth.	Participants will be amazed by the similarity of their different types of teeth with those of different animals.	

Why This Experience?

- The human dentition is highly varied due to our evolutionary history of omnivory. Canine teeth bite and tear meat, molars grind up plants, and incisors help to cut and hold food items, as well as hold onto non-food objects while they are being worked on. Through this experience, participants will be able to see how each of these teeth are specialized for these dietary tasks by comparing them with familiar animals or objects which are singularly specialized for the same tasks.

Proposed Visitor Experience:

- Participants will observe models of the different types of teeth, incisors, canines, and molars, next to a tool and skulls of animals with teeth that serve similar functions. They will compare these and see how they are adapted to help us to consume a traditionally omnivorous diet because they resemble both the teeth of herbivores and the teeth of carnivores. They will also learn about the other ways humans use their teeth through the comparison of the incisor with the tool.

Related Experience Theme(s)

- Thematic Concept A – Being Human

Design and Production Ideas

- Large models of a human incisor, canine and molar will be displayed next to a tool used for cleaning animal hide, a lion's skull, and a cow's skull respectively.

Design and Production Concerns

- The models will either need to be durable enough to withstand touching or kept inside a case.

Exhibit Components

- Text panel
- Incisor model
- Canine model
- Molar model
- Cow skull model
- Lion skull model
- Traditional knife or scraping tool for animal hide processing

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Experience Goal

- Explain how different temperature regulation mechanisms evolved and how they provide an evolutionary advantage.

Audience	Reactions	Knowledge	Skills	Attitude	Behavior
COSI visitors	Participants will want to tip the balance board to see what is revealed.	Participants will learn how mechanisms for maintaining homeostasis such as sweating and shivering evolved and about the adaptive benefits they give us.		Participants will be surprised to learn about the complex background of these common bodily processes.	Participants will feel less negatively about sweating.

Why This Experience?

- This experience shares some of the ways the human body has evolved to maintain homeostasis, or balance. By moving the board out of balance, participants can learn about what happens when the body gets out of balance from an extreme temperature in either direction. This tangible balance activity helps to convey what the process of maintaining homeostasis is all about.

Proposed Visitor Experience:

- Participants will tip the balance board in the middle of the display, revealing on one side information about adaptations for keeping cool such as sweating, and on the other side information about adaptations for staying warm such as shivering.

Related Experience Theme(s)

- Thematic Concept A – Being Human

Design and Production Ideas

- The display board will have two empty cutout windows into which the text to be read and a symbol indicating weather it is a hot or cold adaptation

will slide when the board is pushed down in the opposite direction of the text.

Design and Production Concerns

Exhibit Components

- Front text panel
- Balance board
- Rear text panel attached to the balance board for movement

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Experience Goal

- Describe the suite of features that modern humans possess that make it possible for us to be bipedal. Show these features help make us more efficient bipeds, as well as how they, and bipedalism in general, impact other areas of our biology and lives.

Audience	Reactions	Knowledge	Skills	Attitude	Behavior
COSI visitors	Participants will want to try out the different activities.	Participants will learn that the transition from quadrupedalism to bipedalism in our ancestors required numerous physiological changes. They will learn what those changes were and the impacts they have had.	Participants is better equipped to understand and prevent or manage changes that will occur in their bodies due to bipedalism.	Participants will be surprised to learn that many of the basic elements of their body or common health concerns they have can be explained by human bipedalism.	Participants will make health decisions that account for their bipedal bodies.

Why This Experience?

- Bipedalism is one of the key features of humans, and this module demonstrates the breath and depth of the changes that occurred to make bipedalism possible. A variety of activities allow participants to explore these features through comparisons with our ancestors or other species and interactive challenges. The Formen Magnum activity allows participants to examine the placement of the foramen magnum as an indicator of bipedalism just as anthropologists do. By comparing at the placement of the spine in quadrupeds and hominin ancestors to its placement in humans they can see how the position of the spine changed in the bipedal transition. In Feet, participants will compare the grasping abilities of their hands and feet as well as the shapes of their hands and feet to the foot of the tree-dwelling hominin *Ardipithicus ramidus* to see how a life in the trees and a life on the ground lead to very different foot shapes. The Arthritis activity demonstrates one of the flaws of bipedalism by challenging participants to hold up the amount of weight that the average human pelvis and lower limbs must support 24/7 for several decades. The difficulty of this will show people just how much stress bipedalism places on the lower half of the body and lead them to think about how this pressure results in conditions such as arthritis. The Spine

activity, attempting to bend over while standing against the wall, helps to demonstrate what a center of gravity is and why it is so important for balance. This leads into a discussion of how the spine became reoriented during the bipedal transition to place the center of gravity more efficiently. In Childbirth, participants explore another of the flaws of bipedalism, the obstetric dilemma, wherein the pelvis must be as narrow as possible for efficient walking, but wide enough for baby's' heads to pass through. By attempting to pass the babies head through the different pelvises, participants will see how evolution has lead to a compromise between these two necessary traits in the actual human pelvis. The Limbs activity demonstrates the different demands put on the limbs of quadrupeds and the limbs of bipeds. By comparing the arms and legs of both, participants will see that while quadrupeds and bipeds have very similar legs, their arms look very different, a distinction related to the functions of each set of limbs.

Proposed Visitor Experience:

- This component will consist of six different activities, each exploring a different aspect of bipedal adaptation:
 - **Foramen Magnum**
 - Participants will place “spine” rods in different “skulls” to see how the positions of the foramen magnum are different in bipeds and quadrupeds.
 - **Feet**
 - Participants will compare the grasping abilities of their hands and feet by attempting to grasp a metal bar. They will also compare the shape of human hands and feet with the foot of the hominin ancestor *Ardipithecus ramidus* to see how our feet are no longer adapted to a life in the trees.
 - **Arthritis**
 - Participants will attempt to lift a heavy weight to see how much weight is balanced on their legs and how, over time, this leads to the development of arthritis.
 - **Spine**
 - Participants will stand against the panel and attempt to bend over and touch their toes to demonstrate the principle of the center of gravity, which has lead to the reshaping of our spines.
 - **Childbirth**
 - Participants will attempt to pass an infant skull through three different pelvises, each optimized for different demands to demonstrate how the shape of our pelvis is compromise between the demands of childbirth and the demands of walking on two legs.
 - **Limbs**

- Participants will compare the arm and leg bones of a deer and a human to see how quadrupedalism and bipedalism lead to differently shaped limbs.

Related Experience Theme(s)

- Thematic Concept A – Being Human

Design and Production Ideas

- The first panel will be an introduction to the topic with a short text.
- The foramen magnum panel will have the three skull models lined up from human to hominin ancestor to chimpanzee. A bin secured to the panel will hold the rods, which can be taken out to do the activity. The foramen magnum holes in the skulls will allow the spine rods to be easily placed into them.
- The feet panel will have a bar at the top for participants to attempt to grip with their hands and a bar at the bottom for them to attempt to grip with their feet. The hand/foot models will be life-size metal casts, much like those zoos often have at their chimpanzee or ape exhibits.
- The arthritis panel will have a vertical track with a 50 lbs. block weight on it that visitors can attempt to lift with the handles.
- The spine panel will have an outline of where guests should stand in order to do the activity.
- The childbirth panel will have the three pelvises lined up from optimal bipedal to optimal birth. The infant skulls will be attached to extending cords that allow them to rest against the panel but be pulled out to use for the activity.
- The limbs panel will have two sections: arms and legs. In both a model of a deer limb will be compared with a model of human limb. Participants will guess which is which and lift up a flap underneath each model to see the answer.

Design and Production Concerns

- The metal bars for the Feet activity will need to be placed at heights that are accessible to all participants. The heavy weight for the arthritis activity poses a safety concern and must be set up in a way that it will not fall and participants cannot be injured trying to lift it.

Exhibit Components

- Text/activity instruction panels (7; arranged as a heptagon)
- “Skull” spheres: human (hole on bottom), hominin ancestor (hole at angle between back and bottom), chimpanzee (hole in back)
- “Spine” rods (3)

- Grasping bars (2)
- Human hand model
- Human foot model
- *Ardipithecus ramidus* foot model
- Weight block (50 lbs.) with handles
- Track for weight to lift on
- Pelvis models: optimal bipedal pelvis, optimal childbirth pelvis, standard human pelvis
- Infant skull model (3)
- Infant skull model suspension cord (3)
- Deer arm bone model
- Deer leg bone model
- Human arm bone model
- Human leg bone model

Content Advisors

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Images/Sketches/Photos *see Evolved Sketches and Evolved Rendering

Experience Goal

- Show that while evolution can lead to many beneficial adaptations, it can also lead to useless features.

Audience	Reactions	Knowledge	Skills	Attitude	Behavior
COSI visitors	Participants will be intrigued by the models on the life sized display.	Participants will learn that evolution does not always lead to useful adaptations, resulting in vestigial structures, and will see examples of those structures in the human body.	Participants can identify vestigial structures in the human body.	The participant feels surprised to learn that not everything in their body is as useful as they might have thought.	

Why This Experience?

- Because of the relatively slow pace at which natural selection operates and its inability to shape features not immediately impacted by the surrounding environment, features that once served a purpose in our evolutionary past may remain in our bodies even though they are no longer useful. These features are known as vestigial structures. This experience presents these structures in a way that draws viewers’ eyes to them, as well as shows what they physically look like and where they are within the body.

Proposed Visitor Experience:

- Participants will observe a display of the vestigial structures of the human body showing models of the structures and will read explanations of their evolutionary origins and about why they are no longer functional.

Related Experience Theme(s)

- Thematic Concept A – Being Human

Design and Production Ideas

- Models of the different vestigial structures will be secured to the silhouette backdrop in a sturdy but not highly visible manner.

Design and Production Concerns

Exhibit Components

- Text panel with silhouette of the human body in the center
- Model mounts
- Tailbone model
- Ear muscle model
- Eye model
- Appendix model
- Arrector pili model
- Teeth model
- Infant hand model

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Images/Sketches/Photos *see Evolved Sketches and Evolved Rendering

Experience Goal

- Explain the underlying genetic system that unites us all, as well as the ways in which just a few small changes to our DNA separate us from our ancestors and create so much variation among us.

Audience	Reactions	Knowledge	Skills	Attitude	Behavior
COSI visitors	Participants will be drawn to the interactive challenge.	Participants will learn how DNA is translated and coded, as well as how mutations can alter DNA and thus alter how the body looks and/or works.	Participants can translate DNA base pairs.	The participant will either feel happy that they have correctly translated the code or disappointed that they made a mistake.	

Why This Experience?

- This experience demonstrates not only the importance of DNA as the basic material on which evolution acts to shape our physiological appearance, but also how changes in DNA arise through mutation. As participants translate DNA just as the cell does and naturally make errors of their own, they will see how mutations occur in DNA through mistakes in the translation process.
- Additionally, this module can act as a transition between the previous thematic grouping and its own by examining the system through which human genes are shared and altered, leading to not just the similarities seen in the previous section, but the differences that will be seen next.

Proposed Visitor Experience:

- Above a digital screen will be a line of DNA code and on the digital screen will be successive lines of that code translated by previous participants. The participant doing the activity will read the line of code at the bottom of the screen and translate it using the base pair buttons. Their translation will appear at the bottom of the screen, and when they have completed it they will compare it with the line of code from which they translated, as well as the original. Any mistakes they made will count as a mutation, and

they can see how frequent mutations were not only in their single translation, but also over the time since the original line was translated.

Related Experience Theme(s)

- Thematic Concept B – Human Variation

Design and Production Ideas

- The digital screen will have a simple display of successive lines of DNA code. Pressing the buttons for each base pair letter will select them and send them to the screen, where they will make up a new line of code. Once a line of code is full the activity is complete and will pause until the next participant begins the next line of code.

Design and Production Concerns

- The program needs to be simple to reset on a regular basis so that the code does not become overly jumbled. Basic technical troubleshooting will probably also need to be attended to.

Exhibit Components

- Text/activity instruction panel
- Digital screen
- Mantle for buttons
- Buttons (4)
- Wiring system
- DNA transcription computer program
- Computer

Content Advisors

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Images/Sketches/Photos *see Evolved Sketches and Evolved Rendering

Experience Goal

- Show how different environmental factors can shape how humans in different climates look, demonstrating Allen’s and Bergmann’s rules.

Audience	Reactions	Knowledge	Skills	Attitude	Behavior
COSI visitors	Participants will be drawn to the familiar scenes and animals and want to explore the experience.	Participants will learn that the demands of different climates lead to certain body size adaptations that help individuals best survive in that climate.	Participants can analyze trends in nature and draw conclusions from them.	Participants will think about how their own body shape or the body shapes of people they know are related to their ancestry.	

Why This Experience?

- Allen’s and Bergmann’s rules state that body size and shape are a factor of climate and reliant on surface area to volume ratios that help to maintain normal body temperature and function within that climate. They predict that in hotter, sunnier environments bodies will be tall and thin, while in colder, less sunny environments bodies will be shorter and stockier. This rule applies to all forms of life, from seals to rabbits to humans. Capitalizing on the universality of this rule, this experience asks guests to observe similarities in body size among animals in desert climates and animals in tundra climates to predict what the corresponding human body shape would be.

Proposed Visitor Experience:

- Participants will match animals to the climates they originate from by placing animal magnets on the climate backdrops. Then they will compare the body shapes and sizes of those animals and consider how humans in those environments might look based on the trends they see.

Related Experience Theme(s)

- Thematic Concept B – Human Variation

Design and Production Ideas

- The animal magnets will be cutouts of common desert or tundra animals that demonstrate the typical adaptations of their climates. The magnetic backdrops will be photographs of desert and tundra scenes.

Design and Production Concerns

Exhibit Components

- Text/activity instruction panel
- Tundra magnetic backdrop
- Desert magnetic backdrop
- Bins to hold animal magnets
- Animal magnets (12; 6 desert animals, 6 arctic animals)

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Experience Goal

- Demonstrate that skin color is the result of environmental factors that place different melanin-level requirements on individuals in different geographic locations.

Audience	Reactions	Knowledge	Skills	Attitude	Behavior
COSI visitors	Participants will be intrigued by the activity and want to try it out.	Participants will learn that skin color is a result of levels of melanin pigment in the skin and that the level of melanin corresponds to the amount of UV light a person needs to block out in different environments.	Participants can recognize that skin color is the result of climate-driven biological processes.	Participants will think about how their skin colors and the skin colors of people they know are related to their ancestry.	Participants will have an awareness of skin color as a scientific, rather than social phenomenon.

Why This Experience?

- Skin color is the result of melanin levels in the skin. Melanin is a pigment that blocks UV radiation. In warm climates where there is more direct sunlight, humans evolved more melanin-rich, darker skin that helped to block out harmful UV rays. However, as ancestral humans moved into more northern climates they faced the problem of Vitamin D deficiency, as they were not able to absorb enough UV rays. Thus evolution favored less pigmentation in the skin. This activity demonstrates how melanin works to block UV rays by blocking light in differing amounts based on the darkness of the lens, a scale that corresponds with the lightness and darkness of skin colors.

Proposed Visitor Experience:

- Participants will move differently shaded dials in front of a lamp to see the differences in the amount of light that passes through onto a screen. This will demonstrate how melanin pigment in the skin works to block sunlight and show why people with warm-climate ancestry have darker skin than those whose ancestor’s evolved in colder climates with less sunlight.

Related Experience Theme(s)

- Thematic Concept B – Human Variation

Design and Production Ideas

- The component elements will be arranged in a row, with the screen on one end and the lamp on the other with the dials lined up from lightest to darkest in between. The dials will be pulled down into the beam of light by rotating on a beam. The lenses will block the light to varying degrees, making it appear brighter or dimmer on the screen.

Design and Production Concerns

- The light needs to be highly focused and bright, but it needs to be oriented in a way that it will not shine in visitors' eyes.

Exhibit Components

- Text/activity instruction panel
- Screen
- Lamp
- Rod
- Round lens dials with rotating mechanism and handles (4)
- Glass lenses (4; black, dark grey, light grey, clear)

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Experience Goal

- Explain how the humans have the most complex and relatively large brains of any animal without our brains actually being the largest, as well as how having a complex brain allows us to think, behave, and communicate the way we do.

Audience	Reactions	Knowledge	Skills	Attitude	Behavior
COSI visitors	Participants will be excited to try out the expanding brains.	Participants will learn the difference between brain size and surface area and the importance of that difference in determining intelligence.	Participants will better understand the concept of surface area.	Participants will be shocked at how big their brains actually are.	Participants will think about the brain sizes of these other animals when they see or interact with them in the future.

Why This Experience?

- Over the course of evolution, the space inside the skull for the brain did not expand as fast as the brain itself was growing in size and complexity. The solution to this was the development of ridges across the surface of the brain that served to create a greater surface area in the same amount of space. More intelligent animals have brains with larger surface areas. While there are animals such as elephants who have larger brains than humans, these are the result of these animals being larger; for their body size, humans have the largest brains of any animal. This experience demonstrates this surface area principle and, through comparison with other animals, illustrates how large the human brain truly is for its seemingly small size.

Proposed Visitor Experience:

- Participants will observe and compare the brain size of a rat, a cat, a chimpanzee, a human, and an elephant through models of their brains. They will then pull on handles of expanding models of the brains of each of the animals to stretch them out to their full surface area and compare them with both their original size and the expansion rates of the other animals' brains.

Related Experience Theme(s)

- Thematic Concept C – Human Thought and Communication

Design and Production Ideas

- The brain models will be displayed above the expanding brains for comparison.
- The expanding brains will consist of an expandable rubber wrapping around a Hoberman sphere. By pulling on the handle, the Hoberman sphere will expand, stretching the rubber covering. The sphere will rest at the size of the animal's brain and be able to be stretched out to the total surface area of the brain.

Design and Production Concerns

- The expanding brains need to be spaced out far enough that overlapping will not become an issue as it could damage them.

Exhibit Components

- Text/activity instruction panel
- 5 brain model platforms
- Rat brain model
- Cat brain model
- Chimpanzee brain model
- Human brain model
- Elephant brain model
- Expanding rat brain with handle
- Expanding cat brain with handle
- Expanding chimpanzee brain with handle
- Expanding human brain with handle
- Expanding elephant brain with handle

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Images/Sketches/Photos *see Evolved Sketches and Evolved Rendering

Experience Goal

- Demonstrate that language is important for social creatures such as us humans because it allows us to communicate more quickly and accurately, which helps when we are working together, and reveal some of the communication pre-cursors to complex language.

Audience	Reactions	Knowledge	Skills	Attitude	Behavior
COSI visitors	Participants will be excited to try the challenge if they have a family member or friend with them that they can do it with. Solo participants are likely to avoid this activity, as they will not feel that they can take part in it.	Participants will learn that language is essential for communication in a social system as complex as we humans have and that complex spoken language first developed from gestures and simple language.	Participants will be able to better communicate without complex language.	Participants will feel frustrated if they are not able to communicate the design plans or proud if they are able to communicate successfully.	Participants will place more value on the communication ability their language affords them.

Why This Experience?

- This experience demonstrates the importance of complex language to human communication in society. By attempting to communicate through only gesture and simple sounds, participants see just how difficult it is to communicate something as simple as a block design without the use of words. The methods of communicating they will likely resort too, including gesture and different tonal sounds, will show some of the ways human ancestors communicated without a full language system. These early communication methods conferred an evolutionary advantage and lead to the development of the brain capacity for ever more complex language.

Proposed Visitor Experience:

- Participants must find a partner for this activity. One participant, the builder, will construct a design out of blocks as the other participant, the communicator, gives them instructs on what to do without the use of

words. The activity station itself will be divided into two sides; on one side the communicator will look through a selection of block designs and secretly choose one. They may use gestures or noises to explain what to do, but cannot use any actual words to communicate with the builder. On the other side, the builder will attempt to construct the design based on what the communicator is instructing them to do.

Related Experience Theme(s)

- Thematic Concept C – Human Thought and Communication

Design and Production Ideas

- The table will be divided into two opposite sides. On the communicator side a book will be set up with templates for block towers. The pages will be made of thin wood or plastic and can be flipped through, providing several different building options. On the listener side, a tray will hold a variety of blocks and there will be an empty space to build on. Each side will have different instruction panels, but the same text on the evolutionary background and implications of the topic. There will be a stool on each end for seating while the activity is completed.

Design and Production Concerns

- The divider in the middle of the table needs to be high enough that the communicator cannot see over it, but low enough that the listener can see any gestures the communicator is using.

Exhibit Components

- Text panels (2)
- Instruction panels (2)
- Table with an inset tray on one side for the blocks and a design book on the other, divided by a short wall to prevent seeing the workspace on the other side of the table
- Design book with a series of block designs
- 2 stools
- Assorted wooden blocks

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Images/Sketches/Photos *see below

Experience Goal

- Demonstrate how art is one of the unique features of humanity that sets us apart from other organisms and explain how it relates to higher thought.

Audience	Reactions	Knowledge	Skills	Attitude	Behavior
COSI visitors	The participant will be wowed by the aesthetic appeal of the experience.	Participants will learn that they creation of art for aesthetic purposes is a uniquely human trait and that it demonstrates our complex brain functions.	Participants will learn how to analyze meaning in art.	Participants feel more appreciative of the artwork with a knowledge of its context and biological meaning.	Participants will think more about the larger biological meaning behind other pieces of art they observe.

Why This Experience?

- This experience explores the power and meaning of art for humanity. Participants will be encouraged to think about what cave art represents and why it was created. Through this question they will think about the many different reasons humans create art, and through their own observation of the art itself, think about the ways in which humans appreciate art. The label will provide context on the history of art creation and its significance for human brain development.

Proposed Visitor Experience:

- Participants will watch a moving projection of cave art overhead and be encouraged to think about a common question asked about cave art – what was its purpose?

Related Experience Theme(s)

- Thematic Concept C – Human Thought and Communication

Design and Production Ideas

- A large white screen will cover the ceiling or a portion of it and moving cave art images will be projected onto it. Seating underneath will allow guests to spend a longer time looking at it.
- The projection will be a key element in the lighting design of the exhibition space.

Design and Production Concerns

Exhibit Components

- Text panel
- Seating area
- White screen
- Projector
- Cave art images to project

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Images/Sketches/Photos *see below

Experience Goal

- Show how our ability to use tools is an evolutionary advantage because it helps us to solve problems and obtain things more efficiently, as well as demonstrate how tools have changed over time.

Audience	Reactions	Knowledge	Skills	Attitude	Behavior
COSI visitors	Participants will be excited to try out the activities.	Participants will learn that there are many types of tools and that tools offer an evolutionary advantage. They will also learn about the neurological milestones that allowed for and arose from early hominin tool use.	Participants will be able to recognize the different types of tools they use everyday as such.	The participant is surprised to learn that tools can be many more things than just a hammer or wrench.	

Why This Experience?

- This experience demonstrates the importance of tool use to humans by exploring how tools have changed, diversified, and become more complex over time. Through these three activities, participants will see the breadth of tools that have been and are used by humans, illustrating the broad definition of a “tool.” Additionally, they will recognize how tools offer an advantage to the user, demonstrating the evolutionary advantage the ability to use tools has given humans.

Proposed Visitor Experience:

- Through three tasks, participants will see how tools have helped humans to complete ever more complex tasks throughout history. In the first task, participants will attempt to retrieve a higher number of magnetic termites from the termite mound, first with their hand and second with the magnetic “stick” tool. The termites will cling to the magnetic “stick” as real termites do to real sticks, demonstrating how tools make this task of collecting food

easier. In the second task, participants will attempt to push a heavy box first by itself, and then with wheels. It will roll easier with the wheels, showing the effectiveness of the wheel as a tool. In the third task, visitors will be given a complex equation and the choice of a chalkboard and chalk or a calculator to do it with. The calculator will make the task much quicker and likely more accurate, showing the importance of computers as tools in the modern world.

Related Experience Theme(s)

- Thematic Concept C – Human Thought and Communication

Design and Production Ideas

- The termite mounds will look somewhat similar to baking soda volcanoes, with a cylindrical opening in the middle of a conical stand stylized to look like the outside of a termite mound. The inside will be magnetically lined so that the magnetic termites will stick to it. The termites can be removed with the hand or with the magnetic stick by reaching into the opening.
- The boxes will be identical with the exception of the wheels on the second of them. They will be able to be pushed along a short track.
- The calculator and chalkboard will be secured to the stand and can be used in place.

Design and Production Concerns

- The termite mound opening needs to be big enough for guests' hands to fit into without getting stuck.
- The magnetic termites will need to be large enough that they are not hazardous to younger guests.
- The boxes need to be restricted to their tracks so that they are not moved from the component station.

Exhibit Components

- Text/activity instruction panel
- Activity station
- Termite mounds (2)
- Magnetic termites (20)
- Magnetic "stick"
- Box with handle
- Box with wheels and handle
- Tracks for boxes to move on (2)
- Calculator
- Chalkboard
- Chalk

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Images/Sketches/Photos *see Evolved Sketches and Evolved Rendering

Experience Goal

- Demonstrate how the process of evolution is ongoing and explore some of the ways in which it continues to shape the human species.

Audience	Reactions	Knowledge	Skills	Attitude	Behavior
COSI visitors	Participants may be surprised to learn that evolution is still affecting humans. They will be interested to see how the processes they have been learning about are still at work.	Participants will learn that evolution is an ongoing process of which they are a part. They will learn some of the ways evolution is at work today.	Participants can make decisions about their diet, environmental impact, etc. based on their potential evolutionary impact.	Participants will be more aware of the weight of the seemingly simple decisions they make everyday in regards to their food, environment, etc.	Participants will be able to make decisions with an awareness of their impact on future generations of humanity.

Why This Experience?

- This component wraps up the exhibition by conveying the important message that evolution is an ongoing process and that it is not limited to the features they have just explored in the exhibition. This idea was chosen as a conclusion not only to emphasize how fundamental it is to evolution as a concept, but also to give visitors with something to continue to think about when they leave the exhibition. Presenting visitors with images that represent the factors influencing current human evolution gives them an indication of what they are, and the flaps offer a quick, simple way to get more in depth information on how they work.

Proposed Visitor Experience:

- Participants will lift up different flaps to see how factors in the world today such as food, diseases, globalization, and more continue to shape how the human lineage evolves.

Related Experience Theme(s)

- Thematic Concept A – Being Human
- Thematic Concept B – Human Variation
- Thematic Concept C – Human Thought and Communication

Design and Production Ideas

- The component will consist of a text panel and four round flaps with the words food, disease, globalization, and a question mark on them. On the reverse side of the flaps will be an image that represents the evolutionary factor and on the main panel text will be revealed explaining that factor.

Design and Production Concerns

Exhibit Components

- Text panel
- Flaps (4)
- Rings for flaps (4)

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