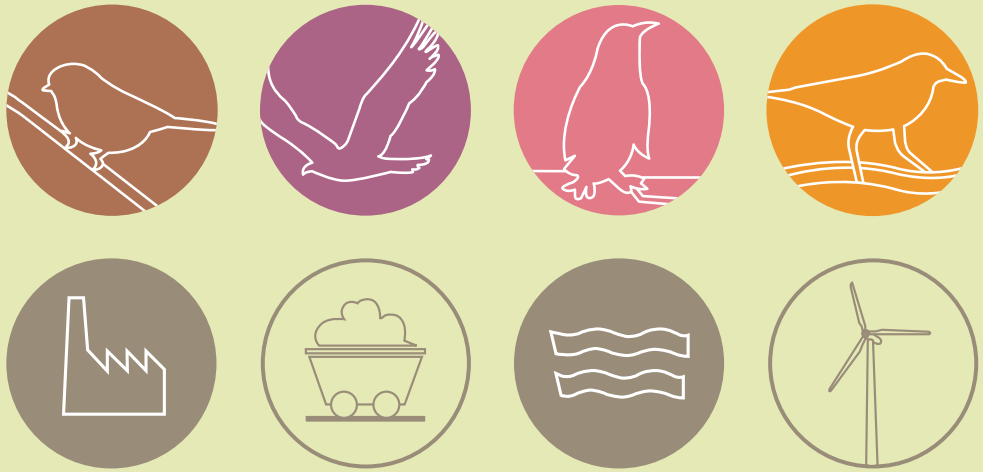

bird & energy

How Human Energy Infrastructure Affects the Lives of Birds

Team BEI

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Carnegie Mellon University, School of Design

Senior Project: Interactive Information Spaces for the Carnegie Museum of Natural History Experimental Gallery

Spring 2010

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In conjunction with
Carnegie Museum of Natural History

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1. Research

Understanding Problems, Discovering Opportunities

About Carnegie Museum of Natural History

Mission Statement

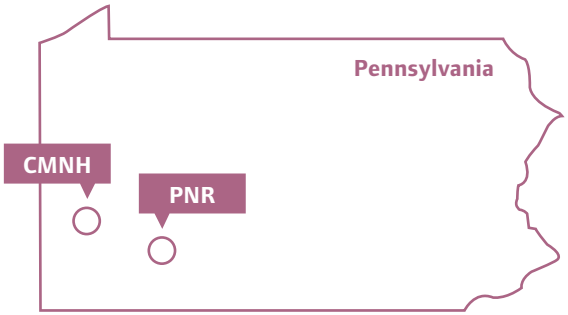
Carnegie Museum of Natural History (CMNH) conducts scientific inquiry, generates knowledge, and promotes stewardship of the Earth. Through public engagement, we share the joy of discovery about the processes that shape the diversity of our world and its inhabitants.

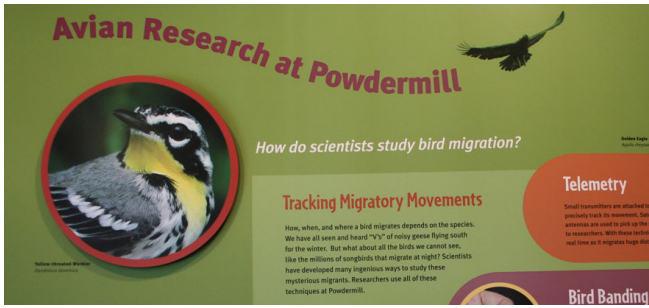
Established in 1895, CMNH has been served as a scientific research hub for studying the biological, cultural, and geological diversity on Earth and a place for disseminating the knowledge to the public through various exhibits and educational events.

Powdermill Nature Reserve

Powdermill Nature Reserve (PNR) extends CMNH's efforts to establish knowledge about our planet.

PNR is the biological research station located in Rector, PA. For over 50 years it has been an integral part of CMNH dedicated to research, education, and conservation. It provides students and families with a hands-on experience in a natural environment by hosting various public education programs. Most notably, PNR is known for its long history of bird banding along with other avian research. Researchers from around the world conduct diverse long and short-term scientific studies in herpetology, botany, invertebrate zoology, and ornithology.





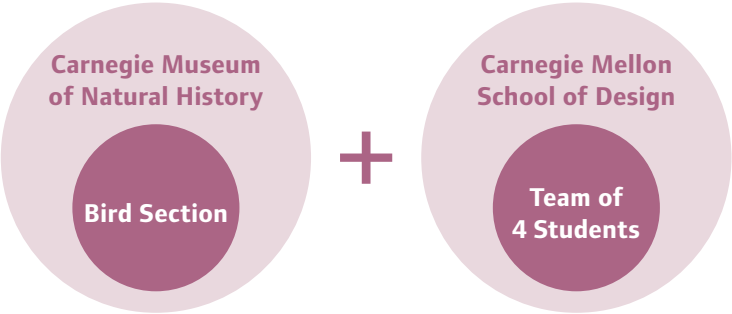
Project Overview

Reaching out to college students and sharing CMNH's wealth of knowledge about birds

CMNH has partnered with Carnegie Mellon School of Design to create an experimental exhibit design that showcases their research and collections of birds. Through this new exhibit, CMNH aims to share with the public the richness of knowledge they have established through studying birds. They are interested in creating an engaging experience that resonates particularly with college students. To this end, the museum challenged us to go beyond the traditional methods that exist in the current museum environment and to create a coherent, integrated system.

Needs for showcasing CMNH's avian research and bird collections

A semester long collaboration of industrial & communication designers

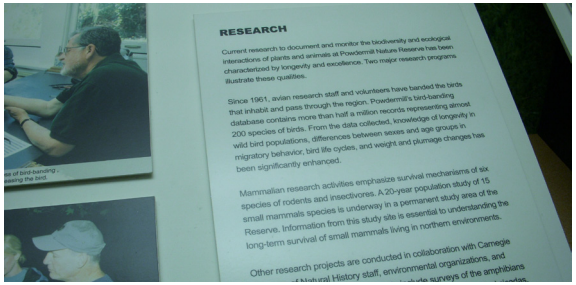


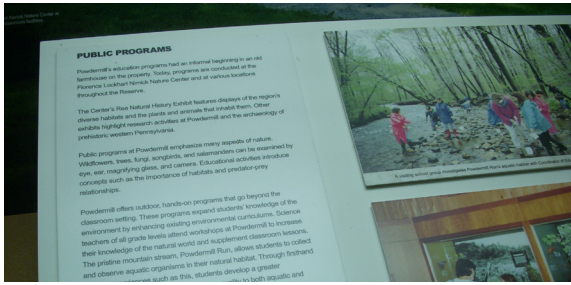
Problem Analysis

To better understand the current state of CMNH exhibits, we analyzed the problems in their promotion of PNR within the CMNH space and showcasing of their bird collections.

PNR Section in CMNH

CMNH has a dedicated space for promoting PNR. This space is located at a dimly-lit area on the first floor next to the dinosaur section. The content in the glass case and the video that introduces PNR look outdated. Also, the visitors may become distracted while watching the video by another video playing in an adjacent section of dinosaur hall. Overall, this space feels rather isolated and is not conducive to drawing or maintaining visitor attention.





Problem Analysis

Bird Hall

INFORMATIONAL

The important and interesting activities of the researchers behind the door is mystery to the public. The bird research at PNR is not communicated at all.

EXPERIENTIAL

The taxidermic birds behind the glass cases are not compelling or stimulating enough to engage the visitors. The information is spoon-fed to the viewers in a form of plain texts that do not their attract attention.

PHYSICAL

The hallway is small, narrow and cramp. It is hard to maneuver in when crowded especially on weekends. Because it is a hallway, people could see it more as a pass way than a destination where they stop and spend time.

INFORMATIONAL

The sheer quantity and beauty of information is locked away in the file cabinets.

Considerations

Audience: College Students

College students comprise a large portion of Pittsburgh's population. Located within walking distance from Carnegie Mellon and the University of Pittsburgh, CMNH has an opportunity to reach out to the student population. College students however, often associate the natural history museum with old knowledge that has little relevance to the present or the future. As a generation tending to rely on internet resources for gaining new information, students often consider a museum visit cumbersome and unnecessary. Therefore, we must create an exhibit which students can relate to their lives and provides them with a hands-on experience.

HAVE YOU VISITED CMNH?

"No, I have not…"

"Is that the one with the dinosaur?"

"Not in a long time."

"Maybe for an elementary school field trip?"

HAVE YOU SEEN THE BIRD SECTION?

"It's very creepy and weird corridor…"

"It's just birds and cases, that's about it."

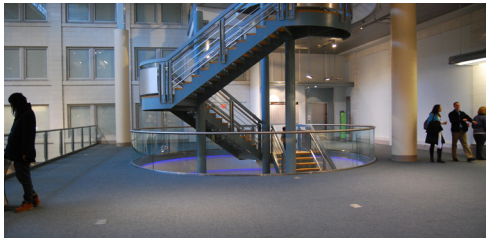
"I might have passes by but never stopped and looked."

"I didn't even know there's a bird exhibit."

We spoke with a few college students in the area to find out about their past experiences visiting CMNH and the bird section.

Space: Jurassic Overlook on the 2nd and 3rd Floors

CMNH has provided us with exhibit space that is located on the second and third floors of the museum. Currently, it does not serve any purpose besides an overlook of the dinosaur hall. It is adjacent to the bird hall and accessible from both the first and third floors by way of a spiral staircase.



2nd floor

3rd floor

Content

Our class visited CMNH and PNR early in the process to learn CMNH's bird department actually does. At the museum we saw their bird specimen and skeleton collection. At Powdermill, we toured the area and were introduced to some of the ongoing avian projects and their researchers.

Collection, Research, and Projects at CMNH and PNR

Bird Collection

CMNH has a long history of collecting and preserving a vast number of bird specimens. The first bird collected was an eagle killed in the battle of Gettysburg in 1850. Now the collection holds 160,000 skins, 16,000 skeletons, and 180 extinct birds from all over the North, Central, and South America. This collection is ranked roughly ninth in the US.

Bird Banding

PNR takes pride in its fifty year history of bird banding and is considered one of the most comprehensive studies of its kind. Since bird banding at PNR started in 1961, they have banded an average of about 10,000 birds annually and collected over half a million records representing almost 200 species. These activities provide data about population, migration behavior, and life cycle of banded birds.

Wind Experiment

PNR studies how different types of windows affect bird flight paths. These experiments aim to discover ways of reducing bird mortality caused by collision with windows.

Golden Eagle Project

Collaborating with Pittsburgh's National Aviary, PNR's researchers study the migration patterns and flight behavior of Golden Eagles in Western and Central Pennsylvania. With a transmitter attached to the back of Golden Eagles, researchers accurately track eagle paths and locations. These data may contribute to developing wind farms in a way that will not harm Golden Eagles.

Bioacoustics

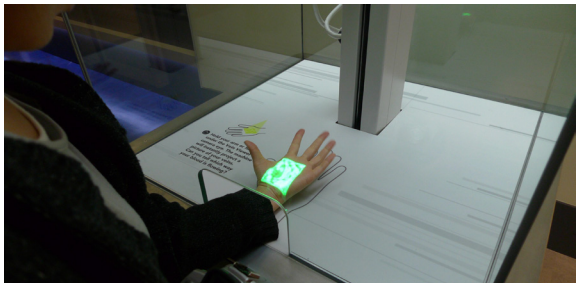
"Studying Bird Migration with our Ears." Long-distance migrations of birds can be good indicators of global warming and the health of ecosystem. PNR's bioacoustics lab monitors the flight calls of the birds passing during the night and collects sound data in its library, the largest flight call library in the North America.

We learned that CMNH's work is more than a simple study of birds—it helps us understand the relationship of humans and birds and strives to enhance the coexistence between the two on the planet.

Inspirations

Examples of Engaging Exhibits: What makes a successful exhibit design?

Museum of Science and Industry in Chicago
YOU! the experience



WHAT

As the exhibit topic is about how the human body functions in various aspects—emotions, sleep, foods, aging, etc., it has an inherent merit of being applicable to anyone's life.

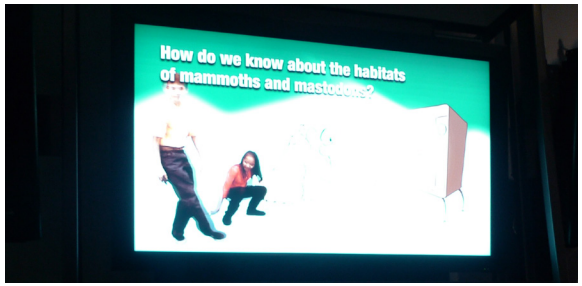
HOW

The sections are divided by topic with color coding which facilitates proper navigation.

The hands-on activities allow for exhibit content 'tailored' to each individual.

Field Museum in Chicago

Mammoths and Mastodons: Titans of the Ice Age



WHAT

The showcase of research on mammoths done by museum researchers is well integrated into the context of the exhibit.

Although the topic is on an extinct animal, it ends by tying it to the current issue of the preservation of elephants, the descendants of mammoths.

HOW

With an effective use of sound and lights, the exhibit creates an immersive atmosphere separating the exhibit space from the rest of the museum.

The video tells stories in a manner that relieves the burden of having to read the content.

Examples of Engaging Information Presentations

SUMMARY

WHAT

A successful exhibit delivers informative and educational content that visitors can easily relate to their lives.

HOW

A successful exhibit engages visitors through rich use of visuals and sound in an immersive environment. Storytelling is also a powerful format of delivering content.

Redefined Problems and Opportunities

Based on our research, we identified problems to address and opportunities consider.

PROBLEM #1

The content of the current exhibit has little relevance to college students and the extent of CMNH's collection, research, and projects is hidden behind the wall.

PROBLEM #2

The current bird hall does not attract visitors and other available space in the museum is not fully utilized.

OPPORTUNITY #1

CMNH's work can be highly relevant to everyone if we take into account our coexistence with the birds that we affect in good or bad ways as we share the natural resources with them.

OPPORTUNITY #2

The Jurassic Overlook suggested by CMNH for the new bird exhibit space is located in-between floors and overlooks the dinosaur hall which is the "hot spot" of the museum. This advantageous location will help draw more traffic to the new bird exhibit.

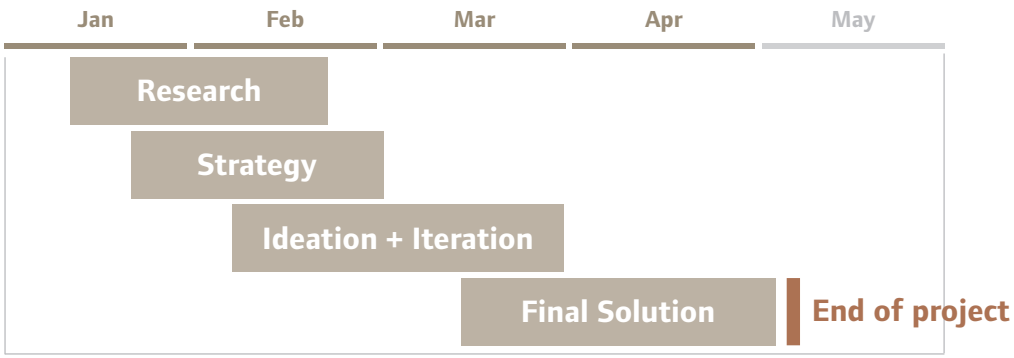
2. Strategy

Our Approach to Exploring the Content and its Presentation

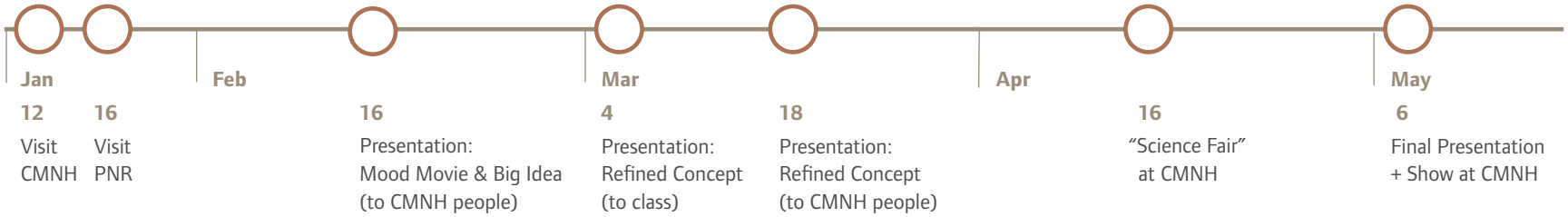
Project Timeline

Stages of Design

Our design process consisted of four big categories: research, strategy, ideation/iteration, and final solution. Research encompasses anything from museum visits to reading research papers. During the research phase we thought about our strategy, how we wanted to approach the problem. Then we moved into the ideation and iteration phase where we brainstormed ideas and went through an iterative process of refining the concept through feedback. As our ideas became more refined, we began finalizing our concept and building the final solution.



Visits and Presentations



Our Topic: Bird and Energy

Why Energy?

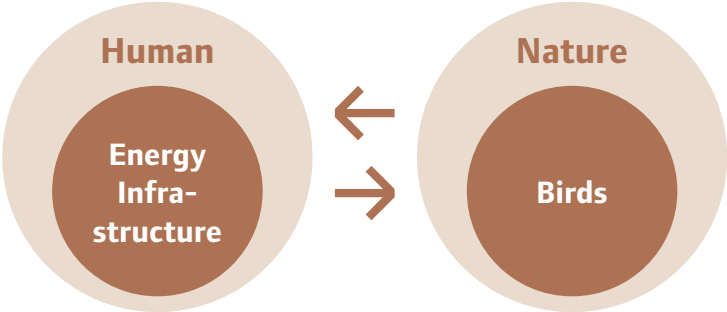
Energy is an increasingly pertinent topic of the global conversation. The ways in which humans gather and use energy have important ramifications Environmental issues such as global warming are becoming increasingly pressing issues. The State of the Union speech by the President Barack Obama is a good example demonstrating the relevance and importance of the subject matter. In his inaugural address the president spoke of the need to tackle global warming and switch to renewable sources of energy; "change" was needed to compensate for the negative human impact on the environment and climate change. But, how is this relevant to college students and birds?

1. College Students are the Next Generation

As our audience is college students, we want to focus on creating an exhibit that is educational and inspirational. College students are future leaders and problem-solvers. We believe it is important to facilitate their awareness of current issues and encourage them to think critically and become empowered to take action. The topic of energy is a good place to start since, as stated above, it is a current problem that is repeatedly discussed in many domains.

2. Revealing Cause-and-Effect relationships between Nature and Mankind

In our exhibit, we want to highlight case-and-effect relationships between nature and mankind. We believe relating human energy infrastructure to the habitat of birds is an effective way to show this relationship, not to mention the fact that it is also an interesting way of approaching the topic of birds. Using energy (a topic that is familiar to us) as a means to communicate human impact on birds will cause college students become interested in and contextualize the topic of birds.



Design Criteria

Design criteria serve as guidelines throughout the project and include all the categories that must be taken into consideration when working toward the final solution.

Before, During and After

One of the main objectives of our exhibit is to expand the experience beyond the exhibit itself. We want to establish a before and after experiences where users can either bring in or bring out knowledge before and after they have visited the museum.

Before

The "before" experience should set a tone for the audience, helping them think about what to expect from the exhibit. We see this taking the form of word-of-mouth or guerilla advertisements through which people who have already seen the exhibit play a crucial role. By having people who share their experiences with the exhibit, we believe we can spark curiosity for those who have not yet visited the museum.

During

Our overall vision for the actual experience in the museum is to build an exhibit that is entertaining and engaging. To reach this goal we are going to have interactive displays and stations that allow people to have tangible interactions and gain knowledge and understanding from those interactions.

After

Our goal for the exhibit not only to educate our audience, but to empower them to take action and contemplate the topic birds and energy after they have left. To help remind them of the content of our exhibit, we want to have a physical takeaway.

Before

Word-of-mouth
Guerilla advertisement
Spark curiosity

During

Environment
- Engaging
- Open space (scale)

Navigation
- Easy to find from the entrance
- Free and open
- Multiple vs. single path

Interaction
- Tangible and cognitive
- Individual and group learning
- Entertainment

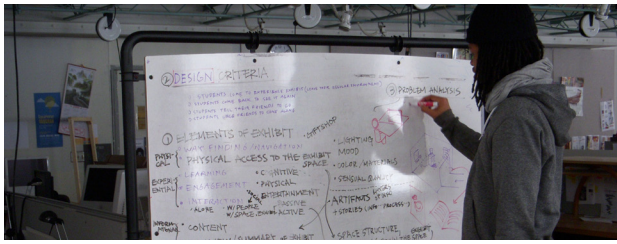
Content
- Show energy-related research (i.e. Golden Eagle project)
- Help understand information more easily (contextualize)

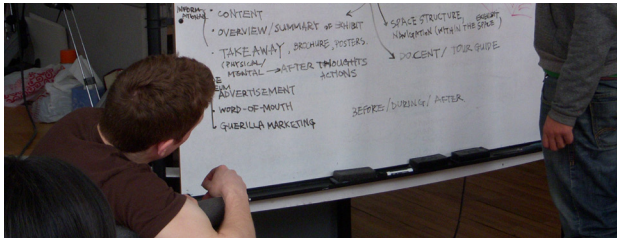
After

Physical Takeaways
- Things to be displayed and shared

Mental Takeaways
- Afterthoughts and after-actions

Brainstorming Ideas





Revised Design Criteria

As our ideas developed throughout the project and our priorities changed, we revised our design criteria.

Audience, Content, and Objective

We decided to go back to the basic elements that form an exhibit and realized this was a better way to frame our design criteria. The design criteria we presented before categorized the exhibit according to different stages of the exhibit (before, during and after) which we thought outlined an overall experience of the exhibit as opposed to specific elements we had to take into consideration. However, we still kept the idea of promoting the before and after experiences beyond the exhibit as we believe it plays a crucial role in creating a meaningful experience for the audience.

Audience

Audience plays a crucial role in any exhibits as they are what the exhibits are for. CMNH came to us with a specific audience in mind, and it is important that we focus on engaging our college aged audience.

Content

Content is also important as the goal of an exhibit is to communicate content in a way that can be understood and absorbed by our audience. Our topic deals with consequences of human energy infrastructure and environmental sustainability relating to birds and therefore, creating meaningful content is one of our main goals.

Goal

Having a clear goal drives us to create a successful exhibit. Our goal is to prime people to learn by providing interactive tools and delivering the content in a way that it provokes thoughts and action outside of the museum.

Audience

Primary: college students

Secondary: elementary students and teachers

Tertiary: families, parents, grandparents, young kids

Content

Provide information about birds, bird research, and energy

Present cause-and-effect relationships between elements

Have more than one subjects/ variables (birds, energy)

Create a framework that allows the subjects/variables to change

Stimulate Intellectual challenges

Goal

Prime people to learn by sparking their curiosity before they enter the museum

Use different ways to present information to help effective learning

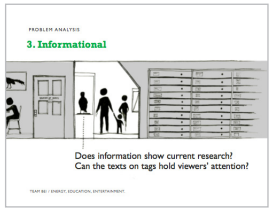
Provide tools for interaction (i.e. magnets) -> takeaways

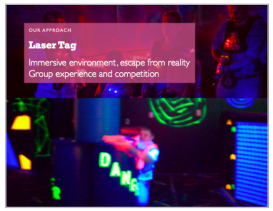
Provoke afterthoughts

Objectives

Based on the opportunity areas mentioned in earlier, we decided to narrow our focus by defining clear goals and objectives. Through multiple presentations and a great deal of feedback from our class and representatives of CMNH, we went through an iterative process to reach our final objective.

1st Presentation **2/16/2010**





During preliminary iterations we focused heavily on the entertainment aspect of the exhibit. As a result, we looked into different types of games as well as definitions of gaming to pull out keywords that would guide us through the process of narrowing down our focus. This research eventually continued throughout the entire project.

Energy, Education, Entertainment

Building an exhibit that is physically intuitive, experientially engaging, and informationally challenging.

What is a "Game"?

A game is a structured activity, usually undertaken for enjoyment and sometimes used as an educational tool. Games are distinct from work, which is usually carried out for remuneration, and from art, which is more concerned with the expression of ideas. [from Wikipedia]

Key Components of games

Key components of games are goals, rules, challenge, and interaction. Games generally involve mental and/or physical stimulation. Many games help develop practical skills, serve as a form of exercise, or otherwise perform an educational, simulational or psychological role. [from Wikipedia]

Example of Games

To ground our ideas around gaming and entertainment, we looked into three main gaming activities to see what we could learn from them. These three games were what we thought had the most relevant aspects to our exhibit.

Aspects of games we think are relevant

Goals, Scores, Levels, Rewards

Characters, Stories

Competitions, Collaborations

Laser Tag

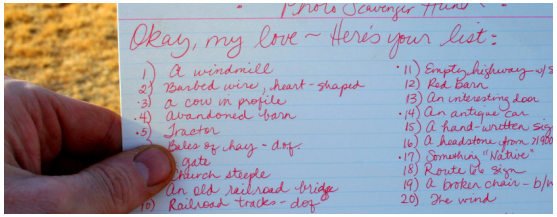
Immersive environment, escape from reality

Group experience and competition is hidden behind the wall

Scrabble

Intellectually simulating and challenging

Creative



Scavenger Hunt

Individual or group experience

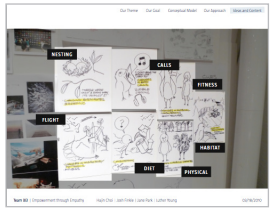
Involves multiple and different locations

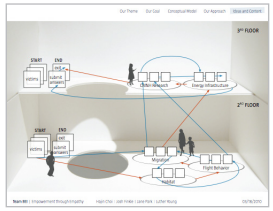
Collection of objects

Objectives

In our next iteration, we decided to focus more on the empathy; the ultimate goal should be to cause the audience to empathize with birds and researchers through meaningful activities and learning experiences. To achieve this we decided to create a setting both immersive and challenging enough to cause visitors to voluntarily engage in an independent problem solving activity.

2nd Presentation 3/18/2010





Our second presentation consisted of a myriad of sketches exploring different ways of engage the audience in order to create an immersive experience.
The ultimate goal of these sketches was to illustrate how people could gain meaningful information through interaction in order to empathize with birds and researchers.

Engage in independent problem solving through immersive experience

Empathize with the researchers and the birds

Solve Problems, Empathize, Become Empowered

Empowering college students to think critically, solve problems, and develop inquisitive minds.

3. Iteration

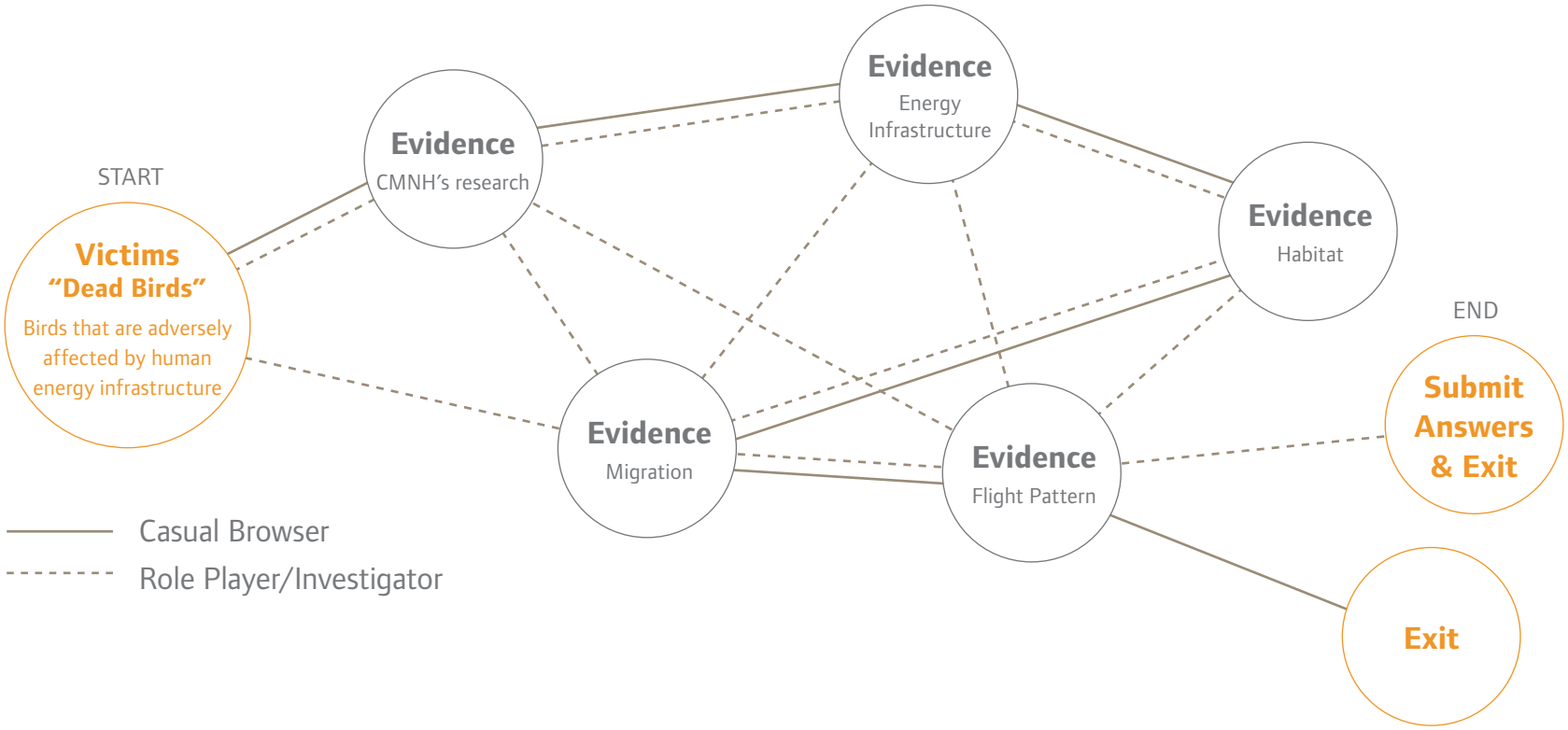
Building and Iterating Concepts and Forms

idea 1 | **Conceptual Model**

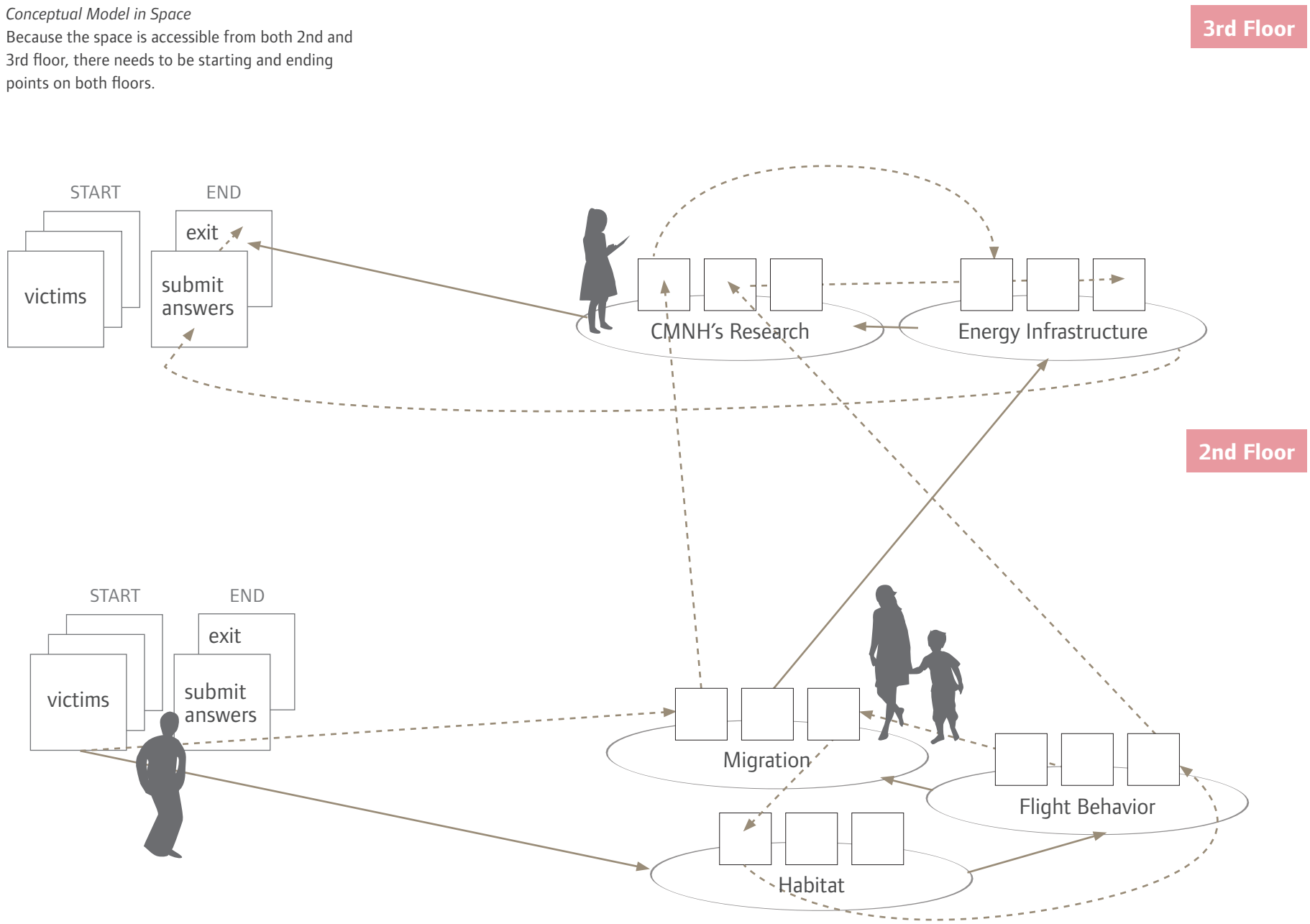
"Investigate What Happened to the Bird by Piecing Together the Evidence"

Initially, we pursued role-playing as a way of engaging visitors. The user is able choose his/her own path, moving around the stations where pieces of evidence are presented. Evidence includes information explaining the event that happened to the victims, such as CMNH's research, human energy infrastructure, and the characteristics of birds.

In order to accommodate casual browsers, we decided each station needed to be able to stand-alone and convey the content outside of role-playing context. After investigating the "clues," visitors would submit their answers at the exit, while casual browsers would skip this station.



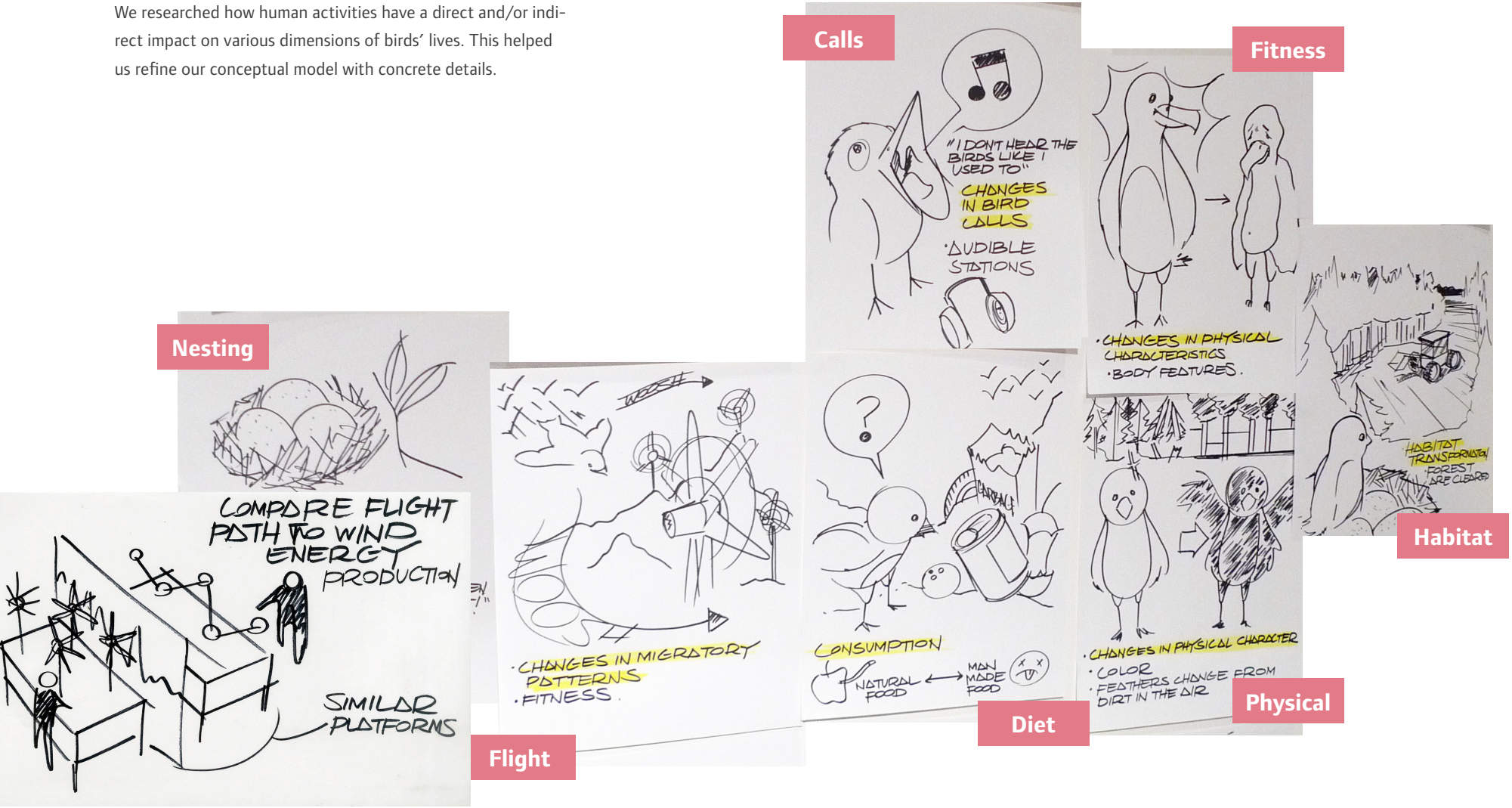
Conceptual Model in Space
Because the space is accessible from both 2nd and 3rd floor, there needs to be starting and ending points on both floors.



idea 1 | **Brainstorming Content**

"Investigate What Happened to the Bird by Piecing Together the Evidence"

We researched how human activities have a direct and/or indirect impact on various dimensions of birds' lives. This helped us refine our conceptual model with concrete details.



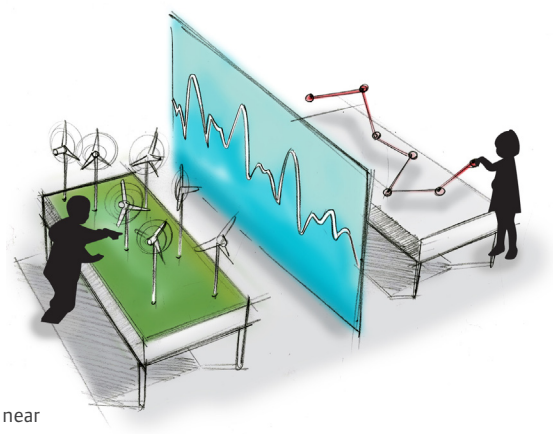
Content x Presentation Matrix

	Golden eagles				Hawk
	Birds			**Humans**	
	Habitat	Migration	Flight Behavior	Energy Infrastructure	CMNH Research
Graphics					
Installations					
Artifacts					
Sound					
Videos					

We created a matrix serving as a framework for the exhibit. The variables presented across the top rows can be applied to various kinds of birds, which allow the exhibit to be expanded as more content is developed. We can also use this to ensure thorough explorations of the different ways and media to convey the content shown in the left column.

idea 1 | **Brainstorming Forms**

"Investigate What Happened to the Bird by Piecing Together the Evidence"



Wind thermals are natural air streams that flow near mountains. This concept looked at ways to compare how birds use natural thermals and where wind turbines are installed to also use these natural streams.

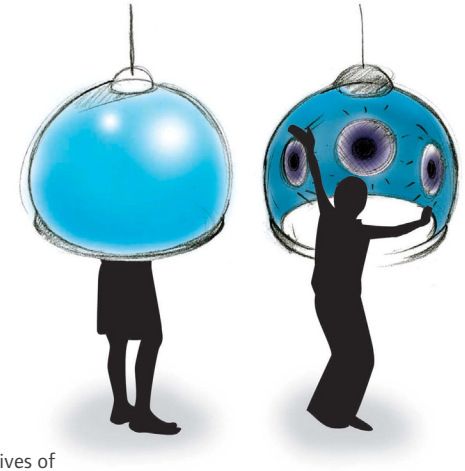
Birds create very unique living environments, but many times these are concealed. What if they were large and we were able to see the details of these unique spaces?

Flight Behavior, Energy Infrastructure X Installation

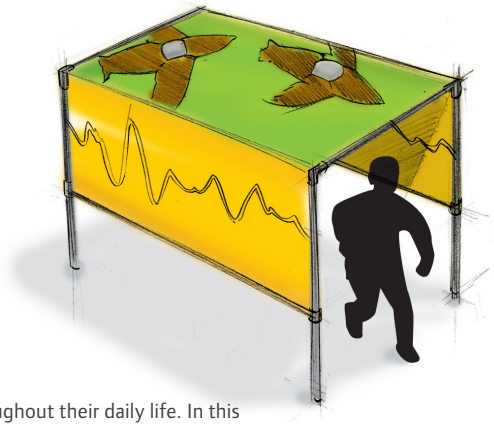
	Birds			**Humans**	
	Habitat	Migration	Flight Behavior	Energy Infrastructure	CMNH Research
Graphics					
Installations					
Artifacts					
Sound					
Videos					

Habitat X Artifact

	Birds			**Humans**	
	Habitat	Migration	Flight Behavior	Energy Infrastructure	CMNH Research
Graphics					
Installations					
Artifacts					
Sound					
Videos					



Sound is an important component of the lives of birds. By placing sound pods around the exhibit, we could allow people to hear unique bird calls in isolation.



Birds exert energy throughout their daily life. In this concept we were looking at ways to represent this data.

Migration, Flight Behavior X Sound

	Birds			Humans	
	Habitat	Migration	Flight Behavior	Energy Infrastructure	CMNH Research
Graphics					
Installations					
Artifacts					
Sound					
Videos					

Migration, CMNH Research X Graphic

	Birds			Humans	
	Habitat	Migration	Flight Behavior	Energy Infrastructure	CMNH Research
Graphics					
Installations					
Artifacts					
Sound					
Videos					

idea 1 | **Scenario**

"Investigate What Happened to the Bird by Piecing Together the Evidence"

We created a scenario to convey our concept with a story and acted it out during our second presentation. In this story, we have two role players (J: Josh, L: Luther) and two casual browsers (H: Hajin, N: Jane).

Before

J: What is that?

L: I think it's a dead bird.

J: It says "Discover how this bird died at CMNH."

L: Do you have some free time?

J: Ok, let's go to the museum.

Entering the Museum

J: There is the bird we saw on the poster.

L: Look, here's a note sheet.

J: It says "after sorting through the evidence, tell us how you think this bird died."

L: Let's go figure it out.

Evidence 1

L: Wow, there are a lot of windmills out in Colorado.

J: And they're right next to this mountain range.

L: What does that have to do with birds?

J: Maybe they hit them and die?

Evidence 2

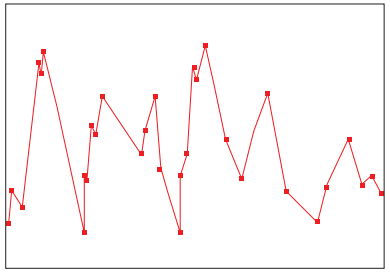
N: It looks like the researchers are putting solar powered GPS units on the backs of eagles.

H: Yeah, it says it is to track their flight patterns. Hmm, interesting.

J: Hey, these birds do fly next to the mountains on the thermals.

L: Maybe that bird died from colliding with the turbine.

J: But it didn't look like it hit something, there wasn't any blood and guts.



Evidence 3

L: Hey, you gotta come in here and check this out.

J: It shows the importance of fitness to the actions birds take.

L: Do you think a bird could die from not having enough energy?

J: Then there wouldn't be any blood and guts if it died.

Exiting the Museum

J: Ok time to submit our answer.

N: Oh, hey Luther and Josh. What are you guys doing?

L: We are submitting our answers.

H: Oh, what is it?

J: We think the eagle flew around the turbines and died from a lack of energy.

L: I hope we got it right, we have to wait another week to find out the answer

J: What are your answers?

N: Oh no, we were just walking around.

H: Yeah, we weren't really in the mood of role-playing today.

After

J: What is that? (looking at another exhibit advertisement)

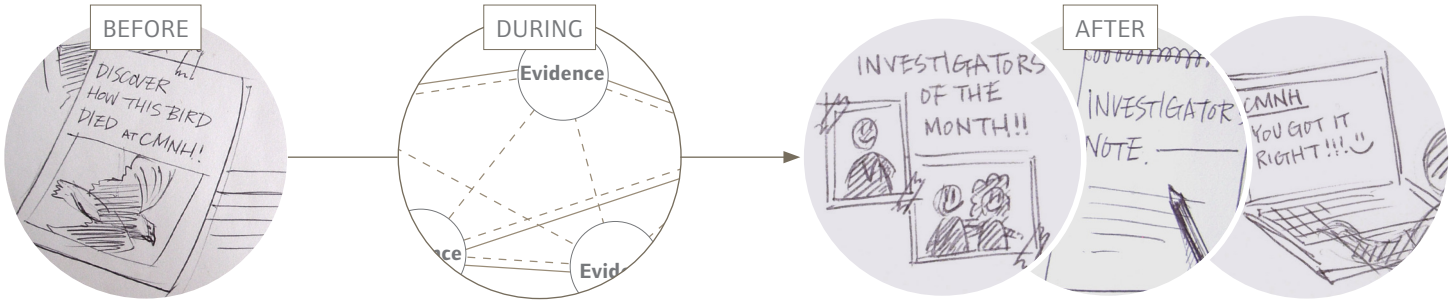
L: I think it's a dead bug...

Overall Experience

"Expanding the experience beyond the museum"

In order to draw visitors to the museum, we must spark their curiosity. One way to achieve this is by revealing only limited information about the exhibit when advertising it.

Rewarding visitors for taking part in the "investigation" and providing physical takeaways could make the exhibit more engaging and memorable.



REFLECTION ON idea 1

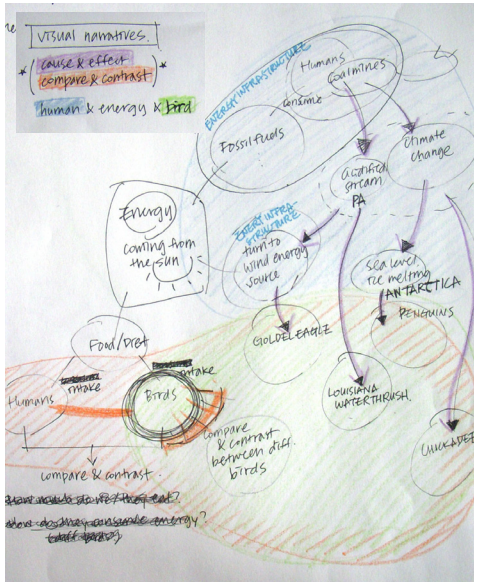
Presenting this idea to the class and to the museum staff allowed us to assess if our target audience, college students, would find it interesting and be willing to participate in role playing. One pice of feedback we received was a concern about the level of challenge the idea of "simulating investigation" presents to the college students. Some of our classmates expressed that it was rather puerile and would be more appropriate for kids. While the investigation idea seemed well received by the CMNH staff, they worried that visitors might associate the museum with a dead bird if we use it as a major component of exhibit and advertising materials.

idea 2 | **Conceptual Model**

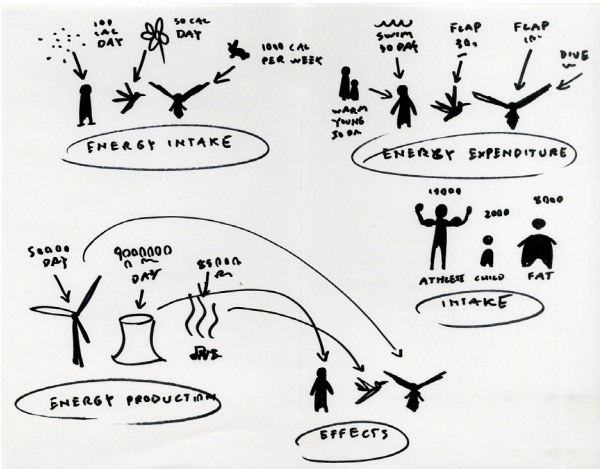
"Exploring Energy Relating to Birds and Humans"

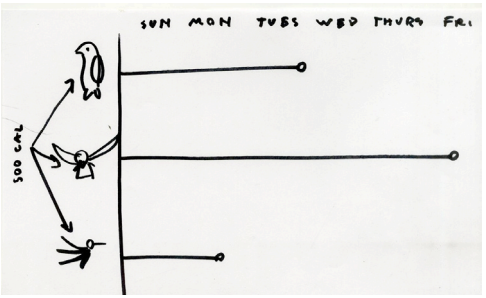
We also explored the idea of encompassing broader meanings of energy, including not only human energy infrastructure but also human and bird energy consumption and expenditure. We brainstormed ideas around this topic (e.g. human calorie consumption, hummingbird energy saving strategies, consequences of human coal mining on Louisiana Waterthrush, etc) and tried to group them into three categories as shown in the image below. We looked at the cause and effect between human energy infrastructure and birds as well as the comparisons of birds' physical characteristics relating to their consumption and expenditure of energy.

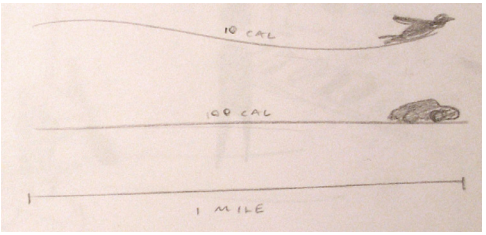
Introduction of birds at the beginning of exhibit

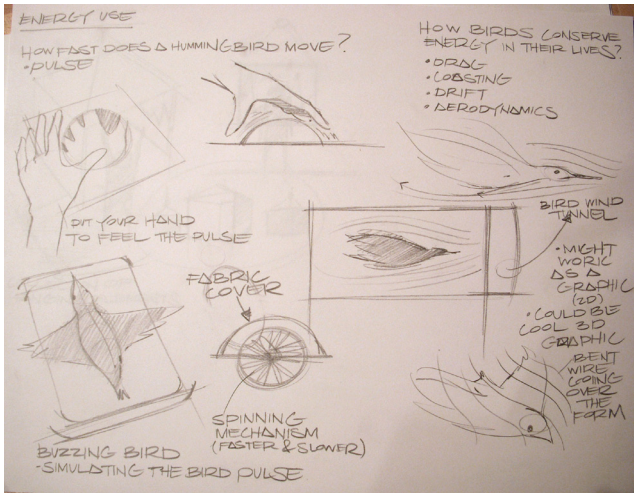


Brainstorming Content & Form









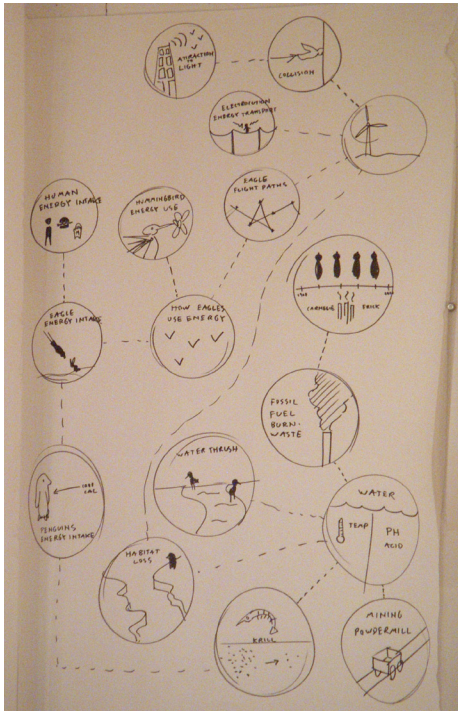
REFLECTION ON idea 2

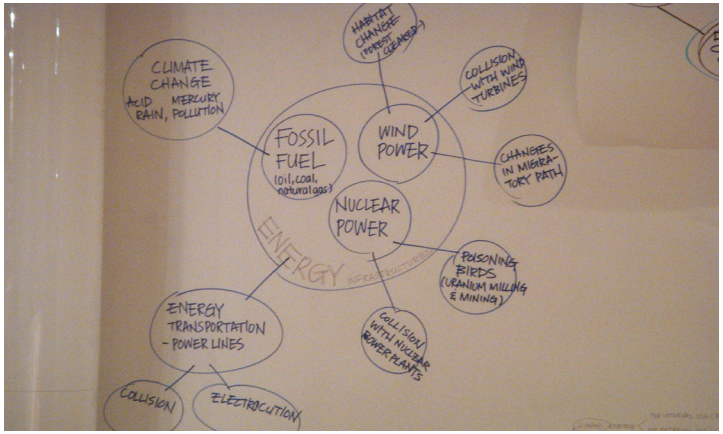
Before we went too far in developing this idea, we got feedback from a museum researcher who thought bird energetics (metabolism, migration, etc.) was a different topic dealing with a vast about of content. Therefore, it might be overwhelming to do both energetics and human energy infrastructure. He recommended we focus more on the impact that human energy infrastructure has on birds because it is a topic that had not been dealt with much. We also got feedback from faculty that this model didn't show the high-level picture and lacked cohesiveness.

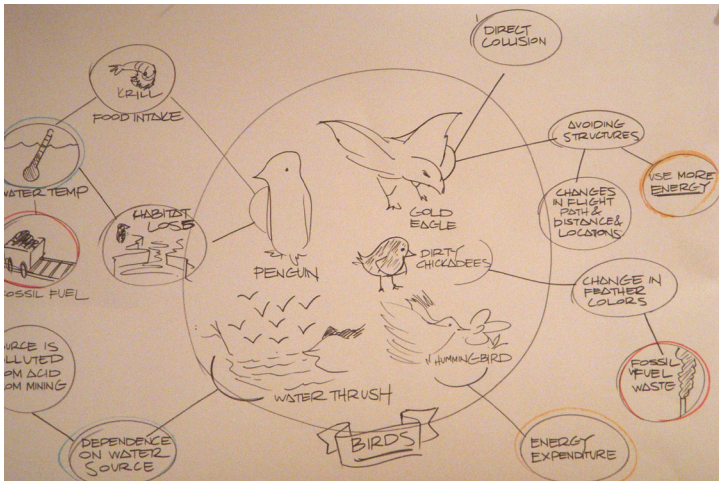
idea 3 | **Conceptual Model**

"Discover the Cause and Effect Between Birds and Human Energy Infrastructure"

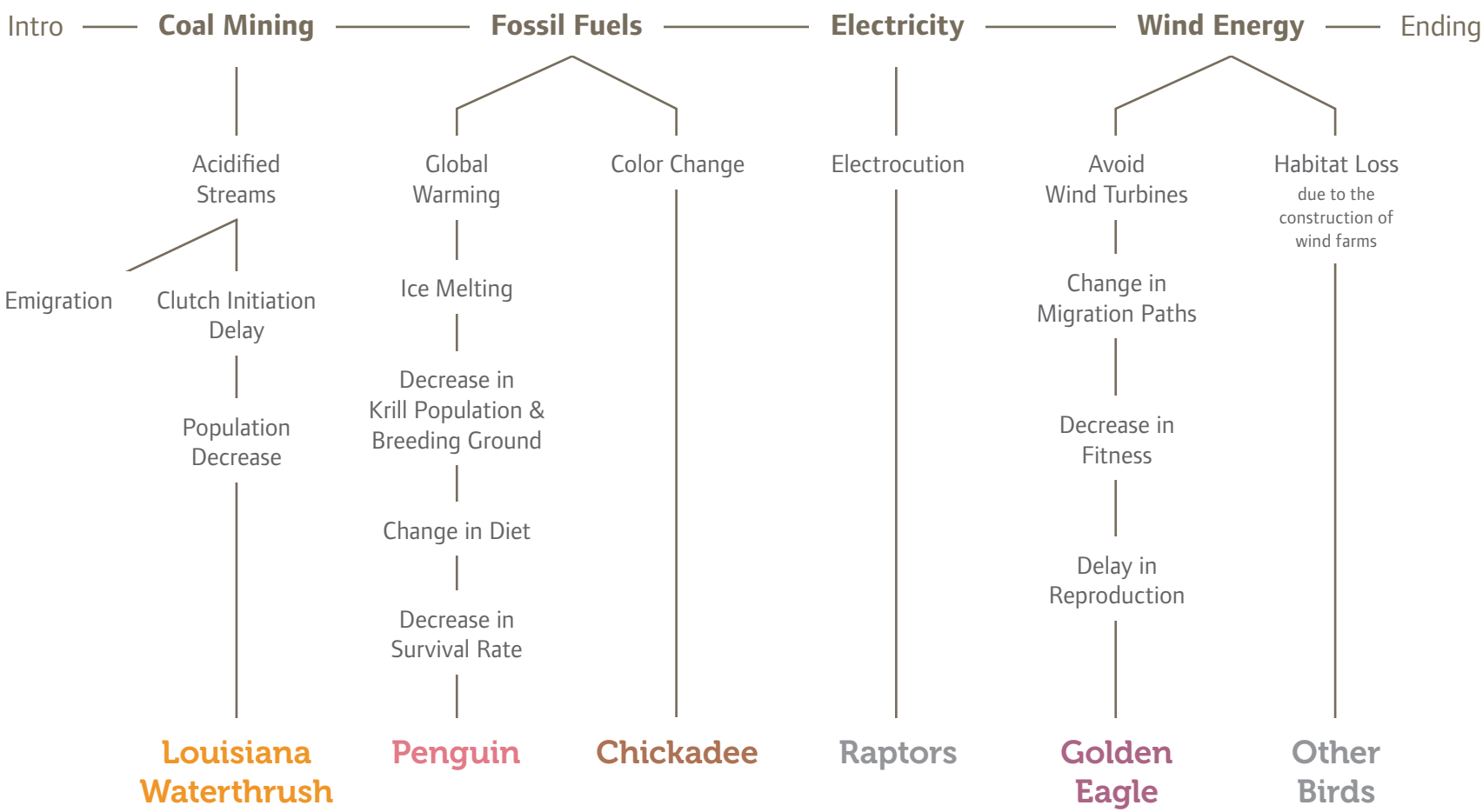
We decided to expand the range of ideas we wanted to show in the exhibit regarding the negative consequences of human energy-related activities on birds. Instead of focusing just on the death of birds as idea #1 did, we wanted to portray chains of cause-and-effects around the bird-energy issue.





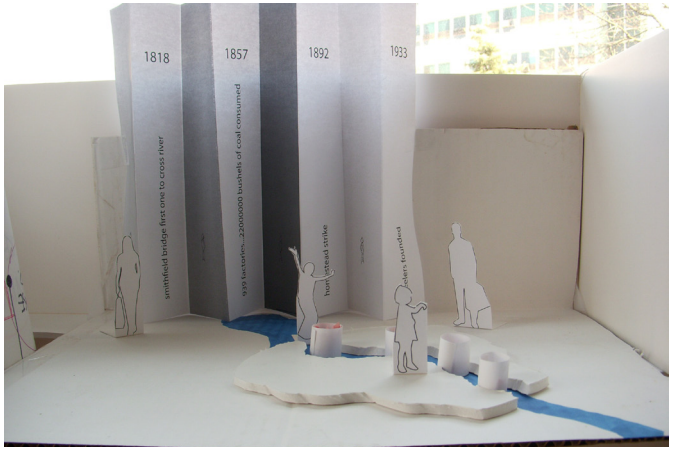


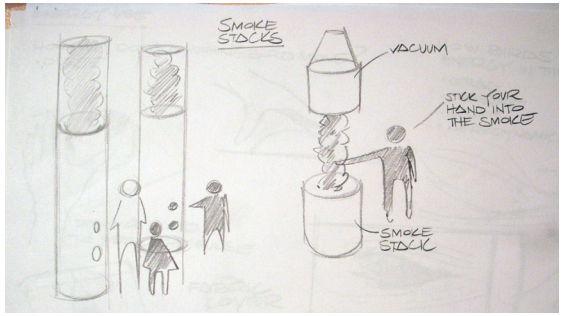
In this conceptual model, we built the connections between energy-related human activities and the consequences they have on birds. With the exception of penguins, the kinds of birds we chose were based on areas related to CMNH research. We believed the inclusion of penguins could present the issue of global warming, a pervasive, global energy-related issue that would complement other consequences happening at a local level presented by other birds.

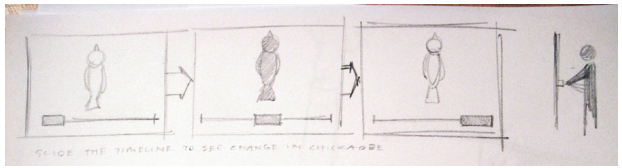


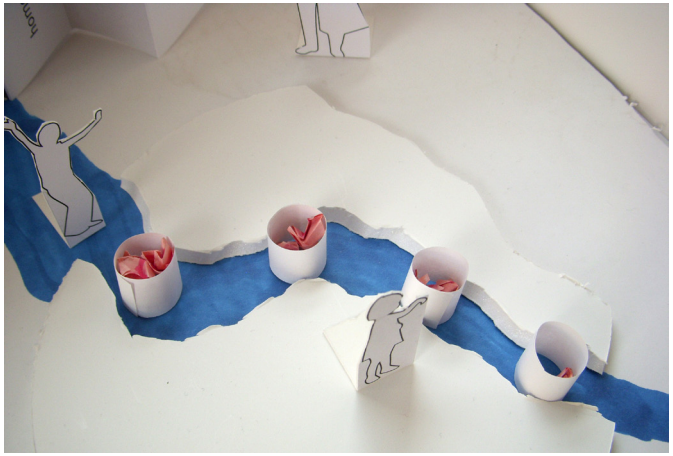
idea 3 | **Brainstorming Forms & Information Presentation**

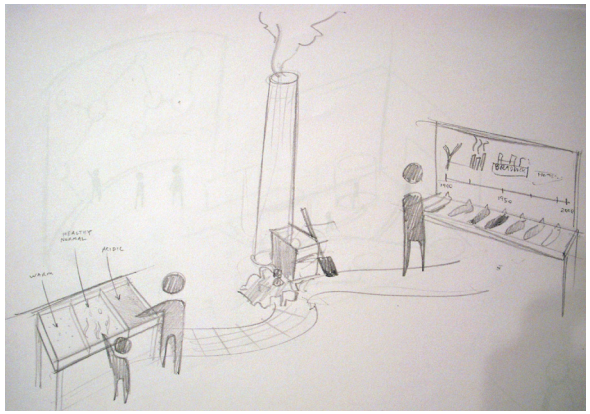
"Discover the Cause and Effect Between Birds and Human Energy Infrastructure"

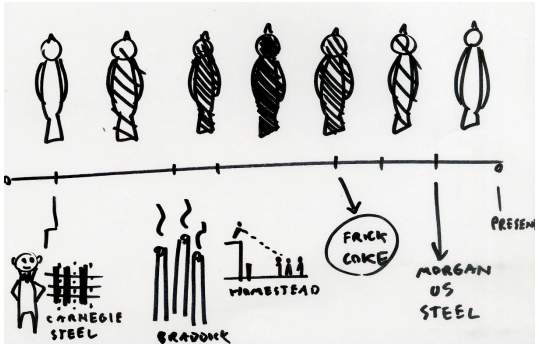


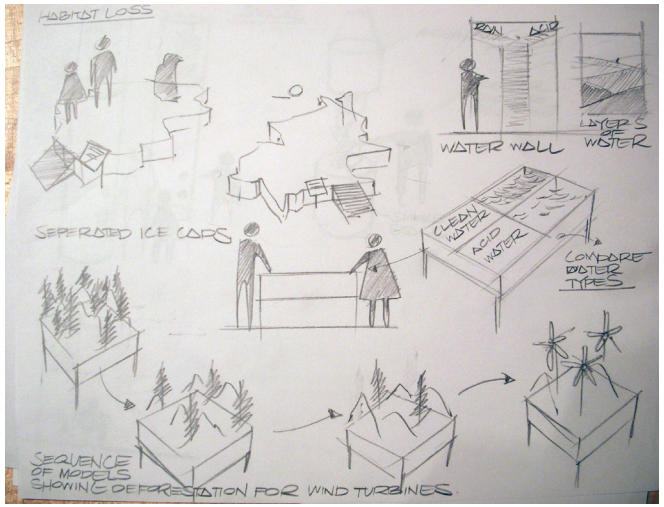


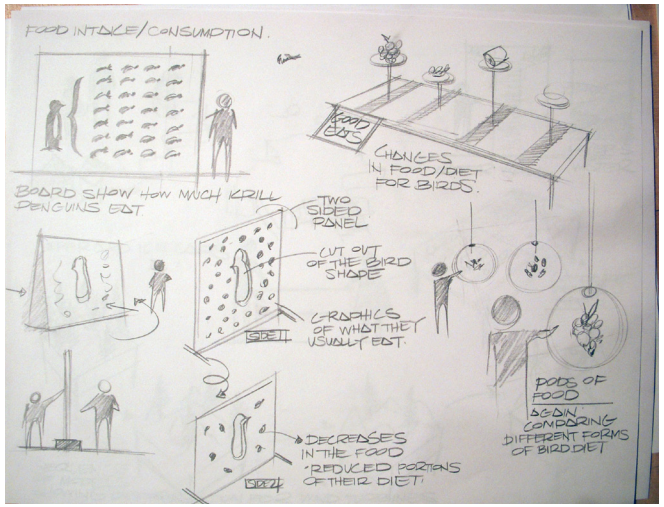


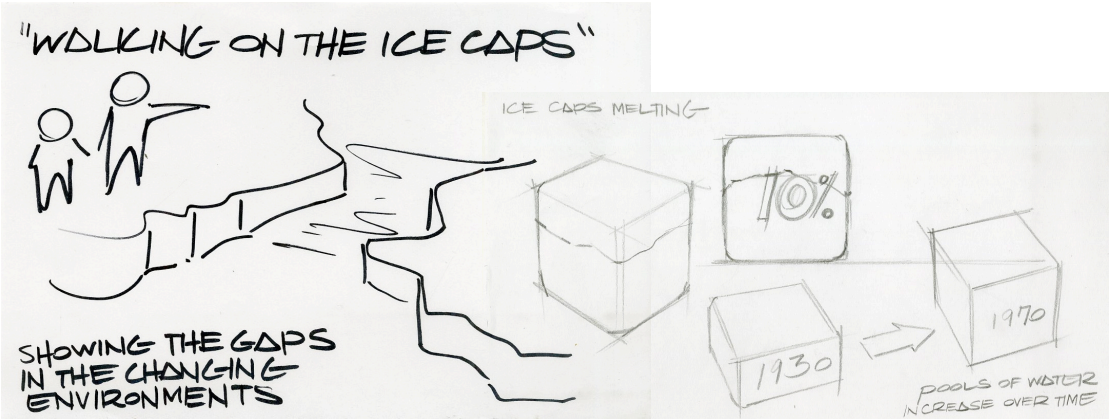


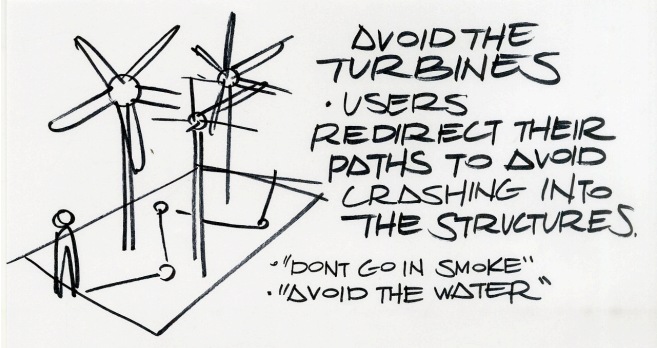


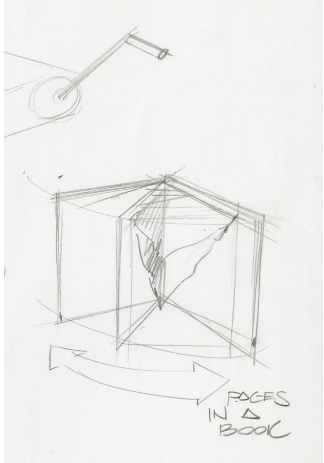


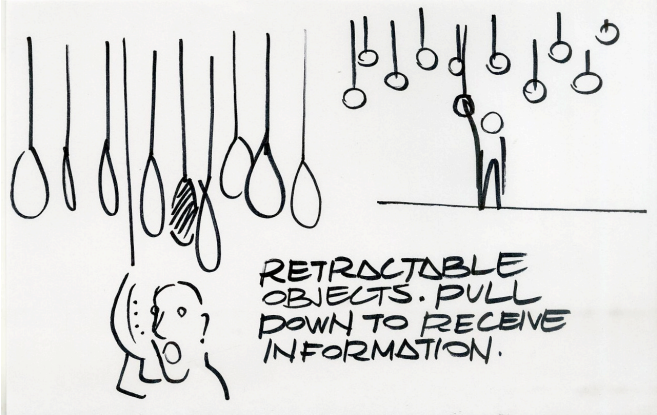

HABITAT LOSS
RAIN
WATER WALL
LAYERS OF WATER
SEPERATED ICE CAPS
CLEAN WATER
ACID WATER
COMPARE WATER TYPES
SEQUENCE OF MODELS SHOWING DEFORESTATION FOR WIND TURBINES.


FOOD INTAKE/CONSUMPTION.
FOOD CHAIN
CHANGES IN FOOD/DIET FOR BIRDS.
BOARD SHOW HOW MUCH KRILL PENGUINS EAT
TWO SIDED PANEL
CUT OUT OF THE BIRD SHAPE
GRAPHICS OF WHAT THEY USUALLY EAT.
SIDE 1
PODS OF FOOD
BEGIN COMPARING DIFFERENT FORMS OF BIRD DIET
DECREASES IN THE FOOD
REDUCED PORTIONS OF THEIR DIET
SIDE 2


"WALKING ON THE ICE CAPS"
SHOWING THE GAPS IN THE CHANGING ENVIRONMENTS
ICE CAPS MELTING
10%
1930
1970
POOLS OF WATER INCREASE OVER TIME

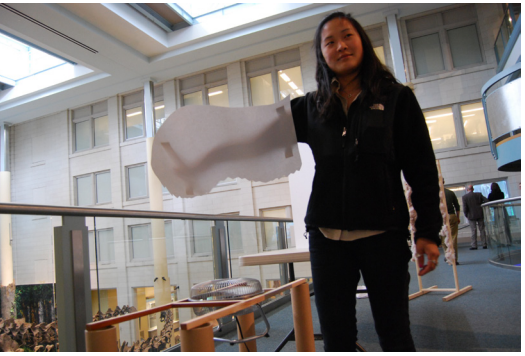

AVOID THE TURBINES
• USERS REDIRECT THEIR PATHS TO AVOID CRASHING INTO THE STRUCTURES.
• "DONT GO IN SMOKE"
• "AVOID THE WATER"


PAGES IN A BOOK


RETRACTABLE OBJECTS. PULL DOWN TO RECEIVE INFORMATION.

idea 3 | **Modeling the Idea & "Science Fair"**

At the fair we were able to showcase the visual and interactive designs that we had created over the semester. Attendees were impressed by the innovative techniques we used to explore the connections between birds and energy. Through our models and posters we created an interactive experience that grabbed the attention of many of the people that visited our station.



Through the use of color canceling panels would allow us to compare and contrast factors that affect the lives of penguins. As visitors move look through different panels they receive different levels of information.

By engaging the full body we want visitors to gain empathy for the experience of birds. In this example people would have the visitor pass through turn styles that simulate the way chickadees rub their bodies against trees.

The acidification of streams is changing the natural habitat of the Louisiana Waterthrush. In this station visitors would be ale to turn a crank and see what factors are changing over time in the stream

Golden Eagles use natural thermals to glide near mountain tops. Wind energy companies also look to use there natural currents to make money. In this example visitors would be able to feel flight with and without the natural thermals.

REFLECTION ON idea 3

1. The navigation us good.
2. Chickadee interaction needs more work.
3. Waterthrush model is not the best form of conveying information which is about comparison between acid and circumneutral water.
4. Golden Eagle model doesn't fully reflect what happens to them—the thermal affects the whole body not just wings.

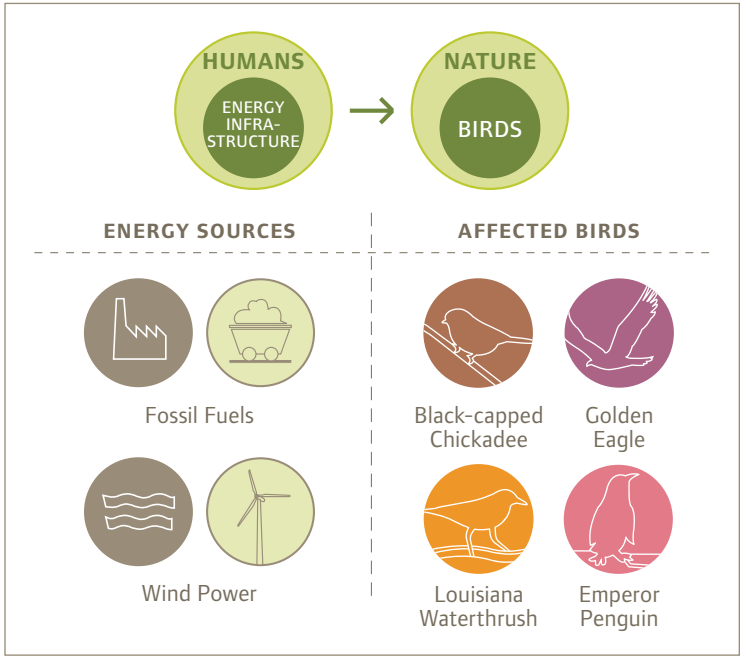
4. Solution

Bird and Energy: How Human Energy Infrastructure Affects the Lives of Birds

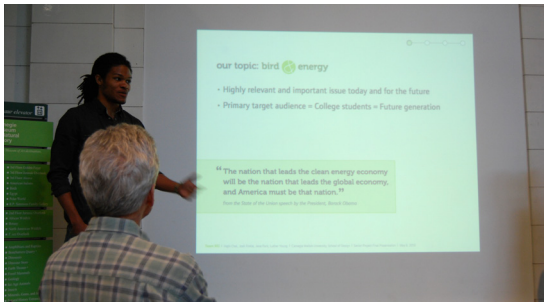
final design | **Concept**

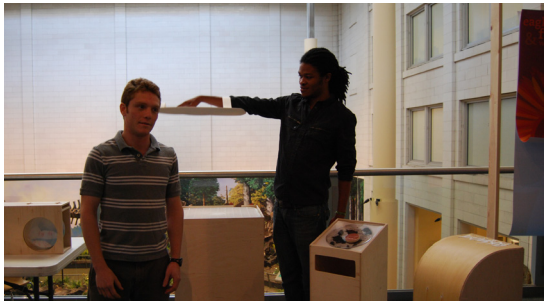
For our final design, we have decided to show relationships between humans, energy, and birds by focusing on four different birds, three of which relate directly to research activity at CMNH and Powdermill. Our space is divided up into four sections, four birds, four colors. Each bird is affected either directly of indirectly by human harvesting and consumption of energy. Each section has a main visual, tactile activity allowing the user to gain a comprehensive understanding of the information through tangible, memorable interaction. Each section is also has secondary information relating to CMNH research and collection. We hope visitors, especially college students, find our content interesting and relevant to their lives.

We have selected two main energy sources and four types of birds that we believed were best representative of the topic of birds and energy and the research being done at CMNH and Powdermill Nature Reserve.



Presentation at CMNH

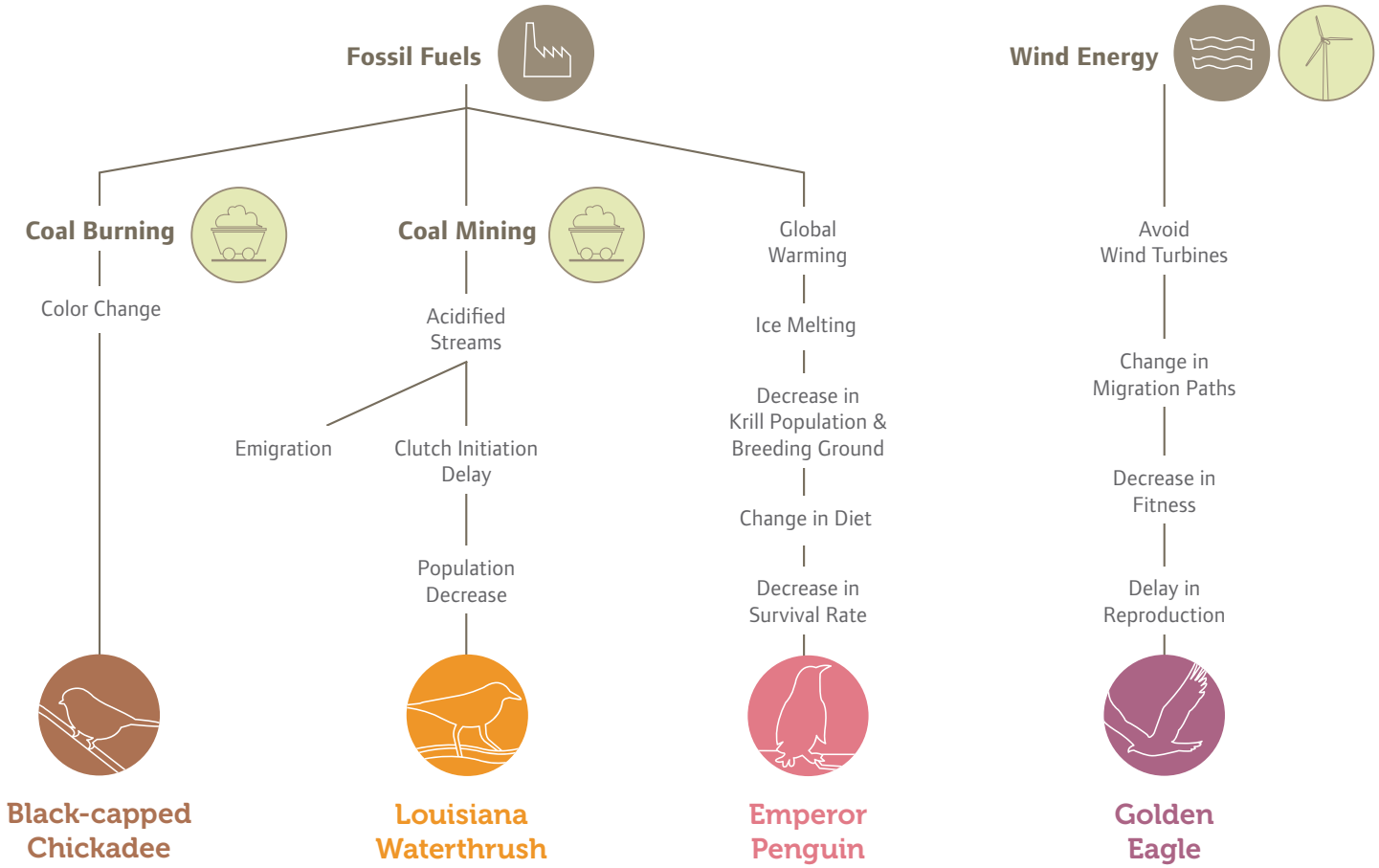




In May 6th, 2010, we gave a presentation of our final ideas to the personnels from CMNH and Powdermill Nature Reserve, walking them through our models and demonstrating our ideas.

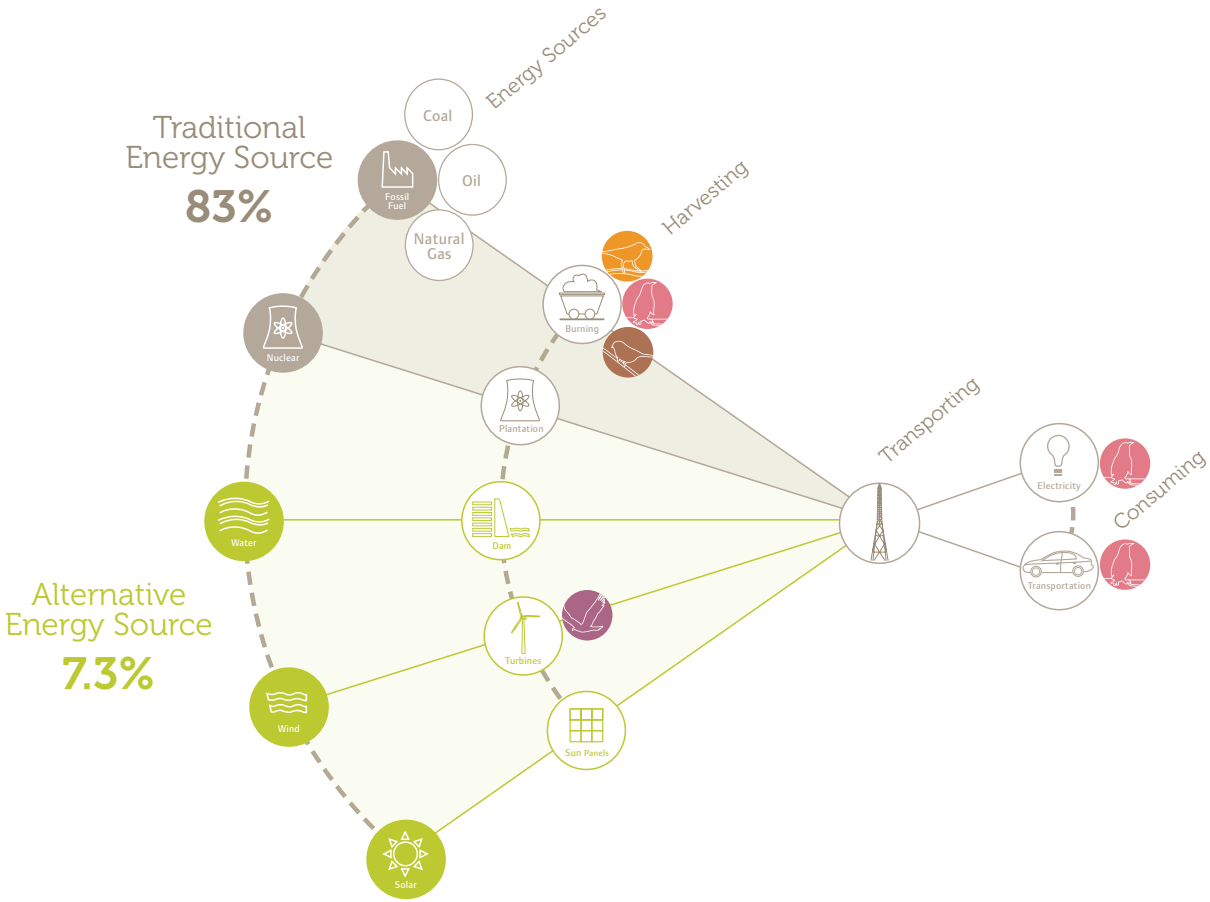
final design | **Conceptual Model**

The following conceptual model is a refinement of our old model (page 43). It highlights the specific energy sources and birds that we will be talking about in our exhibit and shows how they fit into the bigger picture.



Introduction to the Exhibit

Based on our conceptual model, we came up with the following diagram.



Birds & Human Energy Infrastructure

This diagram serves as an introduction to our exhibit, mapping out the overall picture of human energy infrastructure. It introduces different energy sources humans use and quickly illustrates the process of harvesting, transporting and consuming energy.

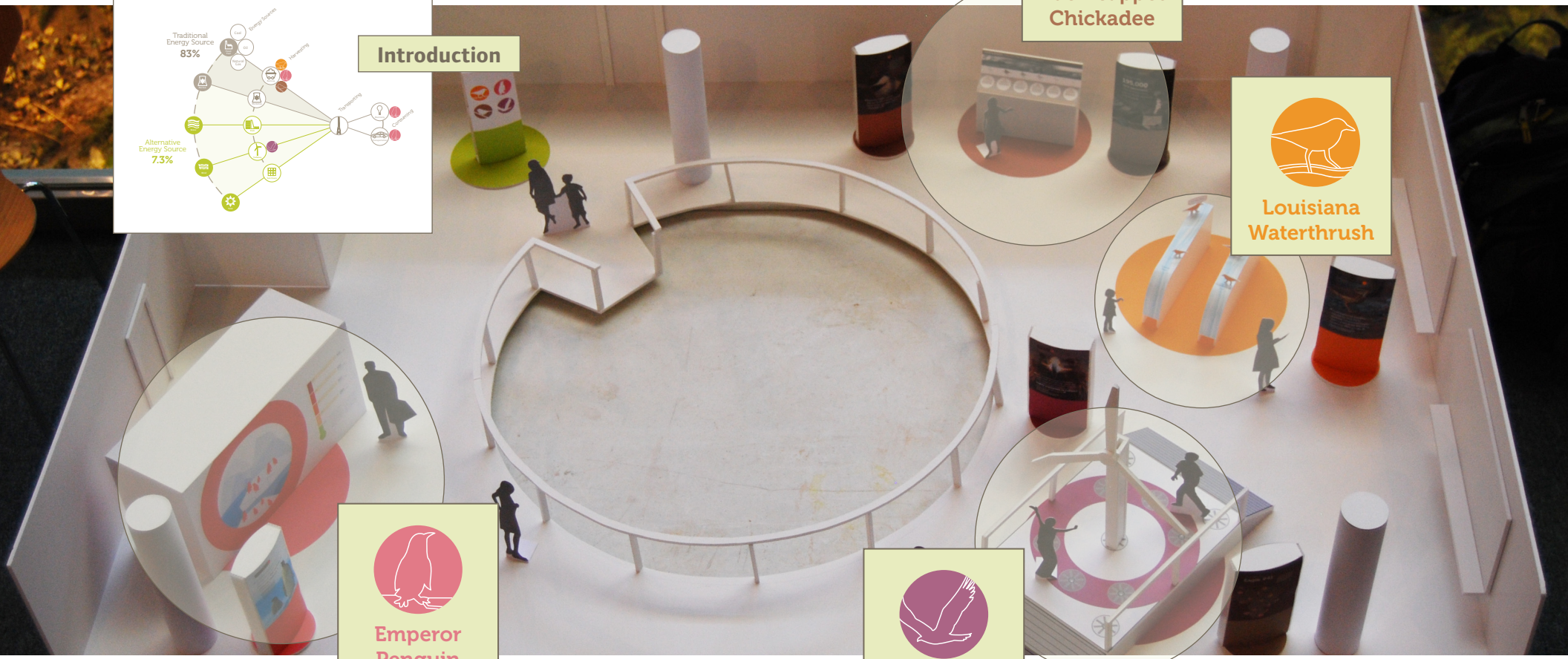
We plotted the four birds we will be talking about throughout our exhibit onto the diagram indicating the energy source and stage of the infrastructure that affects their lives, environments and behavior. As an example, chickadees are affected by the burning of coal because the polluted air and bark make their feathers dirtier and darker.

final design | **All Elements**

Scaled model of the space

Below is a scale model (1 inch = 1 foot) we built in order to demonstrate our ideas. We will be going through each individual elements more in depth.

Introduction



final design | **Models**

Scaled models of individual stations

Black-Capped Chickadee

Relationship between **Pittsburgh history** and **Black-Capped Chickadee**

Louisiana Waterthrush

Relationship between **acidified water stream** and **Louisiana Waterthrush**

Golden Eagle

Relationship between **wind turbine** and **Golden Eagle**

Emperor Penguins

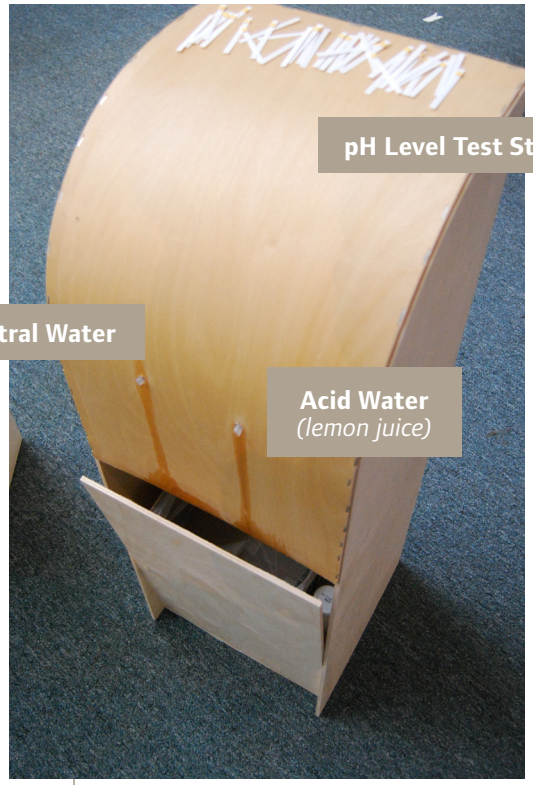
Relationship between **Global Warming** and **Emperor Penguin**

final design | **Main Stations**

Each station has a main component that is interactive. These interactive installations allow the visitors to learn about the cause-and-effect relationship between a bird and an energy infrastructure.

BLACK-CAPPED CHICKADEE

Over time, chickadees in Pittsburgh became darker in color and then lighter again as a result of rubbing their breasts against an environment polluted by burning coal sediment. Just as the chickadees rubbed their bodies on dirt to survive, the user must rub away dirt in order to read the historical event that occurred during the dirty years in Pittsburgh.



LOUISIANA WATERTHRUSH

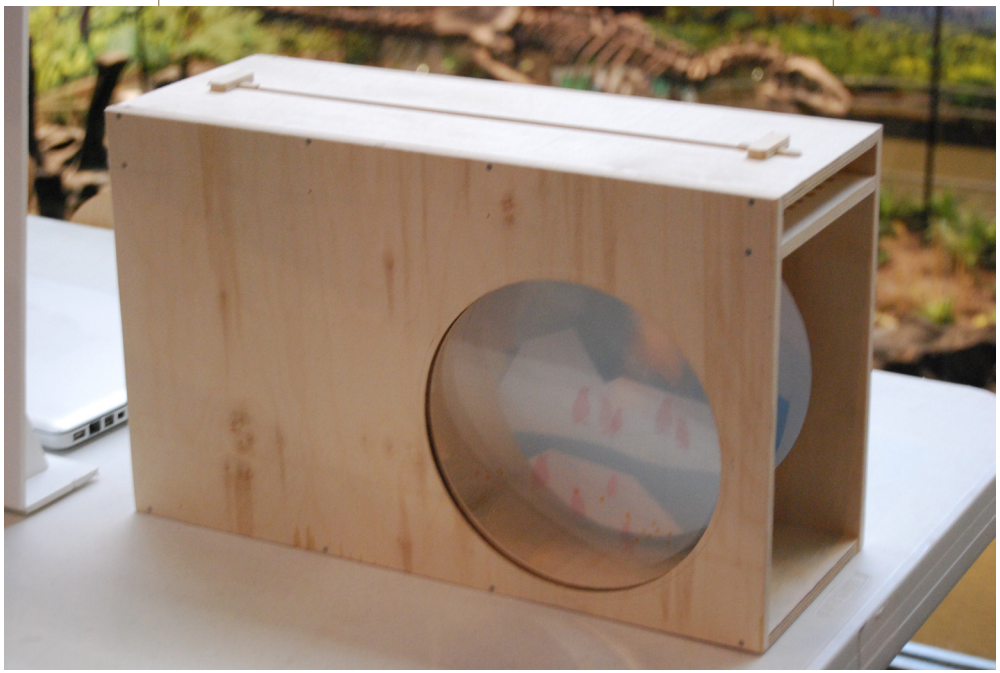
Researchers at the Powdermill nature reserve have collected data of waterthrush populations on two different steams. One of the streams has an increased level of acidity as a result of coal mining in the area. Based on visual clues in the two stream structures of our exhibit (such as returning birds, new birds, amount of birds, size of birds) the visitors can make assumptions about which stream is acidified and verify his/her assumption by testing the water at the end. Visually, acidified water looks the same or clearer than neutral water and the visitors are meant to realize this.

GOLDEN EAGLE

Powdermill researches have found that some Golden Eagles fly around turbines during migration and in doing so, must flap their wings instead of riding thermals or updrafts located next to the Appalachian mountain range. This has major implication on fitness levels, flight time, mating, etc. In this station the visitors are meant to simulate the act of avoiding a turbine and understand the difference between holding his/her arms up and having them held up by thermals.

EMPEROR PENGUIN

Their is a long chain of indirect events that eventually affect penguins: fossil fuel burning, global warming, ice melting, krill population decrease, decrease in food availability for penguins. This station allows the user to see the many layers of this string of events occurring in this order.



final design | **Subinformation Panels**

The subinformation panels serve as additional materials to help the audience understand the meaning of the interactions they experienced at the main stations (models on pages 56-57). These panels consist of general information about the particular birds, how they are related to corresponding energy infrastructure and related research going on at Powdermill Nature Reserve and CMNH.

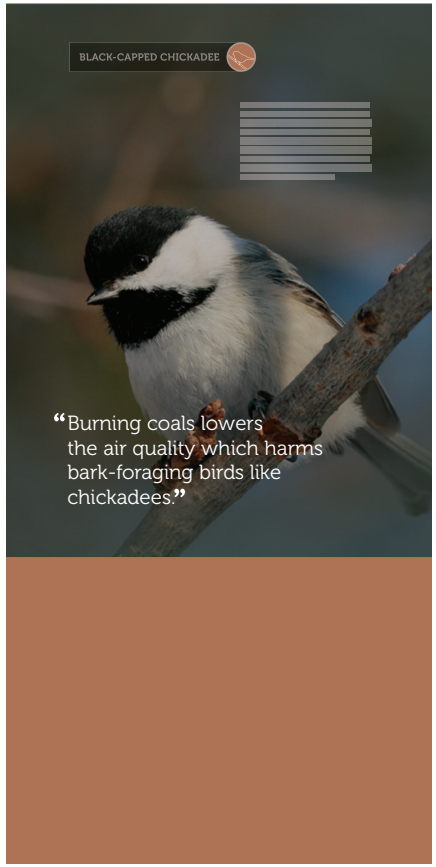
Research Panel 1

Front **CMNH Collection**

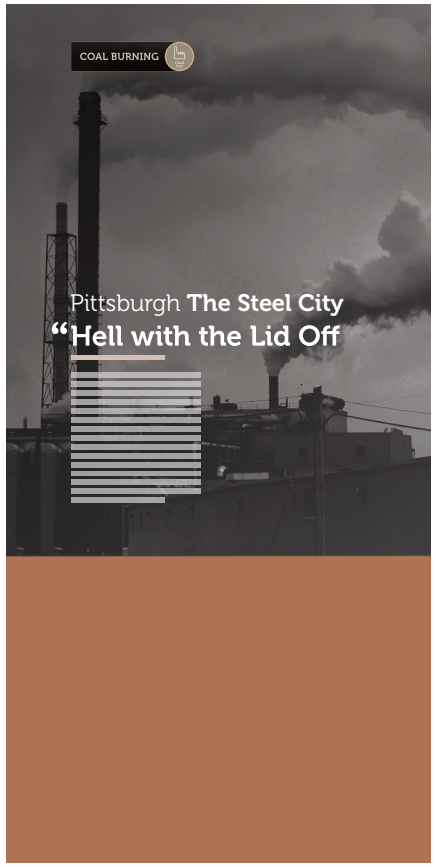
These panels highlight findings derived from the CMNH specimen collection. They show how polluted air in the Pittsburgh area (caused by burning fossil fuel) resulted in a change of colors of local chickadees during a specific time period.

Bird & Energy Panel 1

Front **Black-Capped Chickadee**



Back **Coal Burning**



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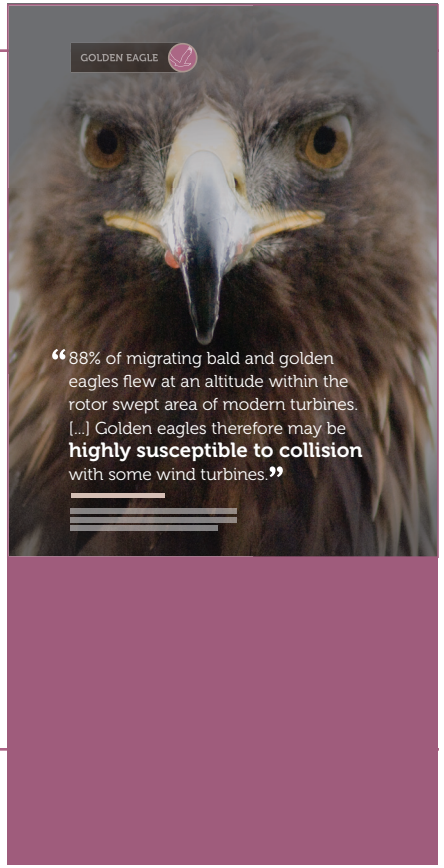
http://www.flickr.com/photos/qmnonic/2306775957/
http://www.flickr.com/photos/21561428@N03/4399841680/

final design | **Subinformation Panels**

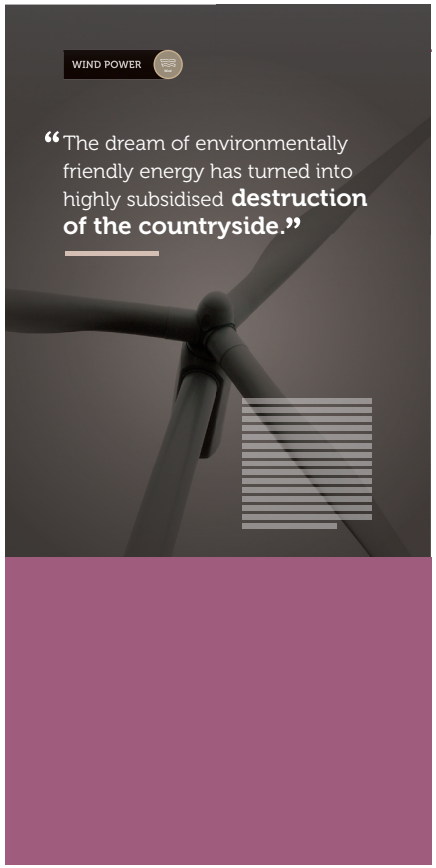
Bird & Energy Panel 2

These panels focuses on the Golden Eagle project conducted by Powdermill Nature Reserve and the National Aviary in Pittsburgh. By tracking Golden Eagle migratory paths, this project highlights the conflict between wildlife and humans as they both use wind as a resource. The harvesting of wind energy involves building wind turbines; together with the interactive component (page 59) this station allows visitors to experience how Golden Eagles are affected by these turbines. The placement of the turbines might interfere with migratory paths and hinder them from using updrafts, a way for them to save energy by spreading out their wings and allowing themselves to be carried by the draft of air.

Front **Golden Eagle**

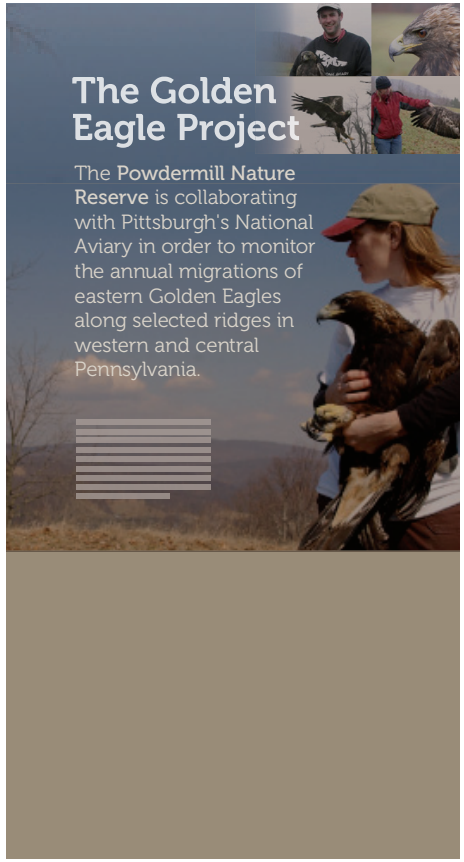


Back **Wind Power**

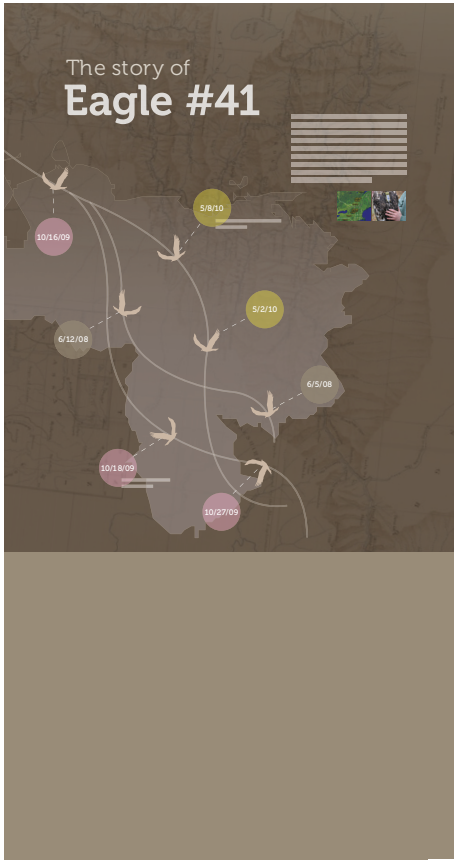


Research Panel 2

Front **Golden Eagle Project**



Back **Golden Eagle Project**



Photographs via *Creative Commons*

http://www.flickr.com/photos/petideux-mont/3048947095/

http://www.flickr.com/photos/blackplas-tic/3430965745/

Photographs for the Golden Eagle Project

Powdermill Nature Reserve Website
http://www.powdermill.org/avian.htm

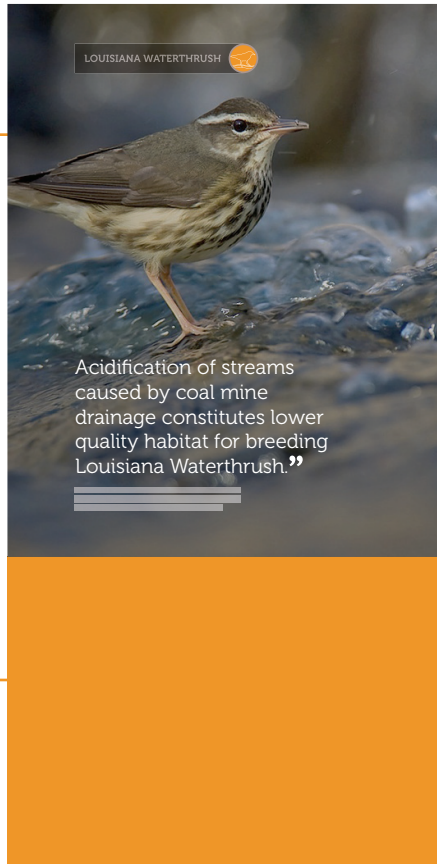
National Aviary in Pittsburgh Website
http://www.aviary.org/cons/story_eagle41.php

final design | **Subinformation Panels**

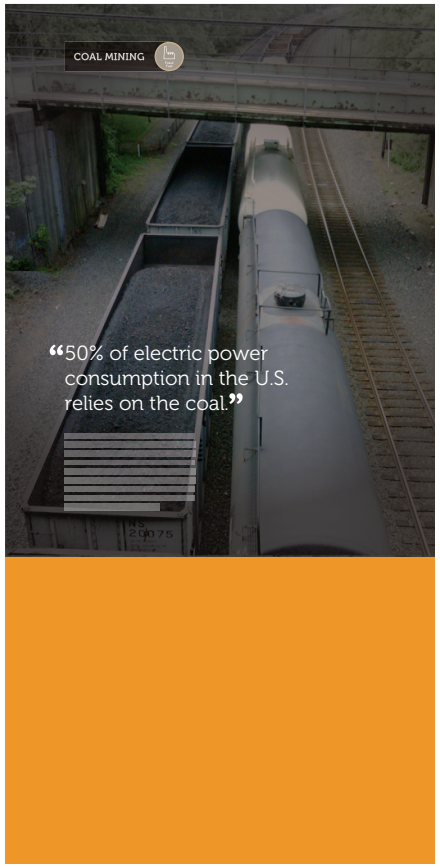
Bird & Energy Panel 3

The content for these panels is based on a research done by Powdermill Nature Reserve. The research looks into how acidified water (caused by coal mining) could affect the breeding density of Louisiana Waterthrush. The two interactive installations going along with these panels (page 58) allow visitors to compare two streams and learn that as the water becomes more acidic the quality of the bird's breeding grounds decreases. Conversely, as the water becomes more neutral, more Louisiana Waterthrush breed.

Front **Louisiana Waterthrush**



Back **Coal Mining**



Photographs via *Creative Commons*

http://www.flickr.com/photos/thirdbirdfromthesun/3796976266/

http://www.flickr.com/photos/solyoung/3583871868/

Bird & Energy Panel 4

Front **Emperor Penguins**

Back **Emperor Penguins**

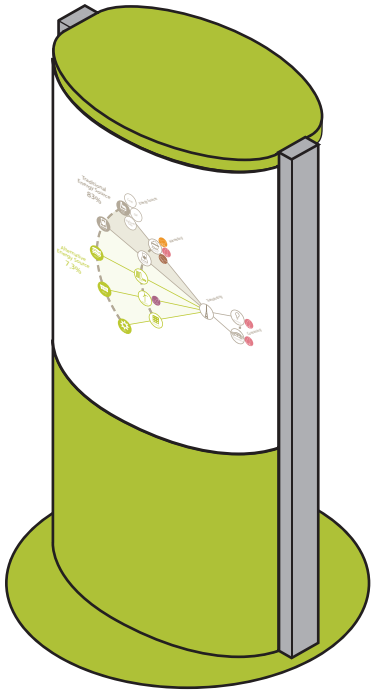
These panels illustrate how human generation and consumption of energy results in a chain of indirect impacts on the environment and animals. One example is global warming. The content here focuses on the affect of global warming on penguins by showing the decrease in their breeding grounds, food (krill) and population as the atmospheric temperature increases.

Photographs via *Creative Commons*
http://www.flickr.com/photos/ianduffy/4132898098/
http://www.flickr.com/photos/mikaelmiettinen/3382635889/

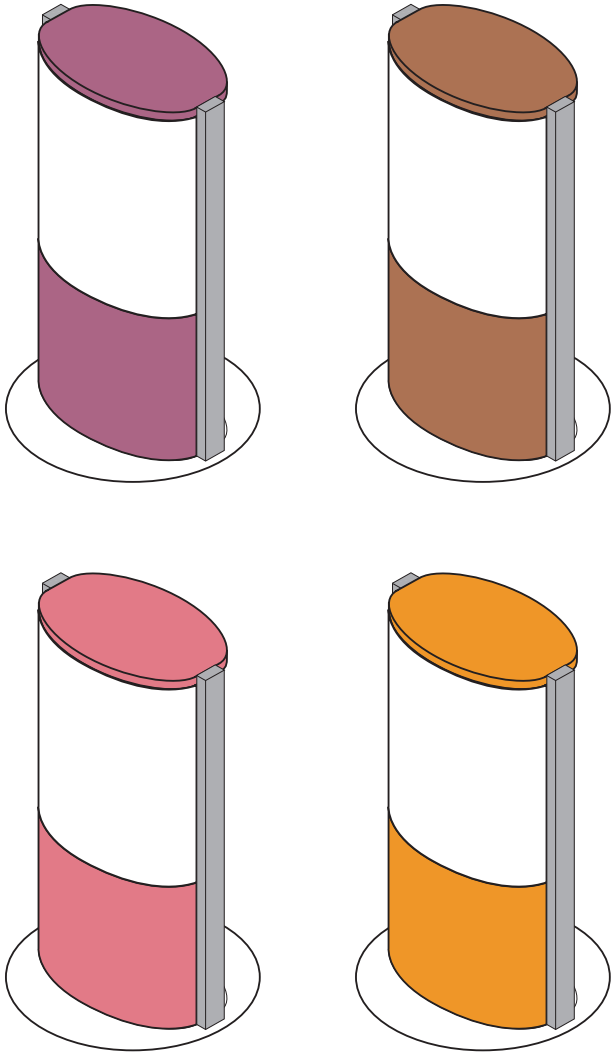
panels | **Specifications**

Production and Implementation

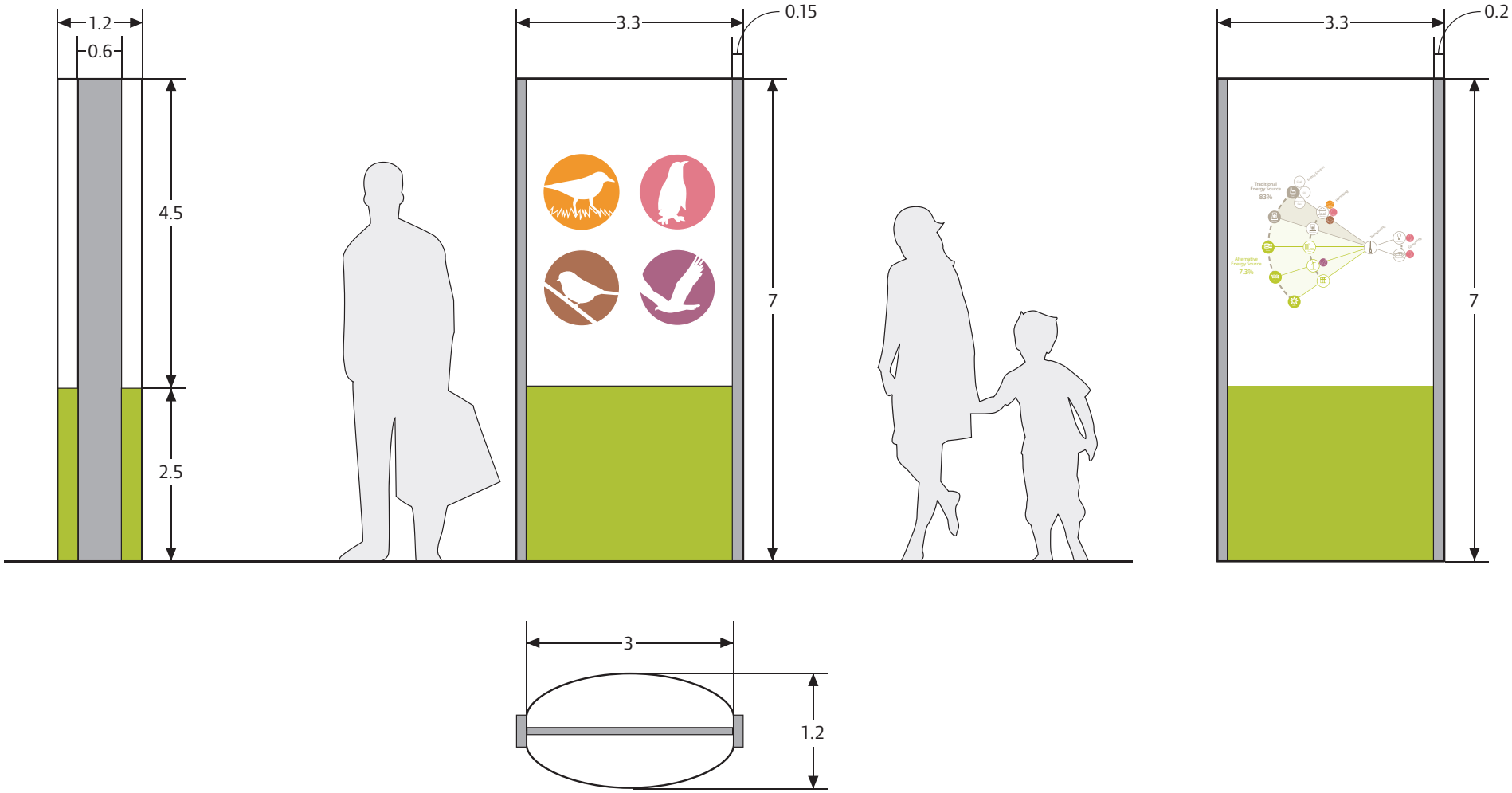
Introduction Panel



Bird & Energy Panels



dimensions in ft

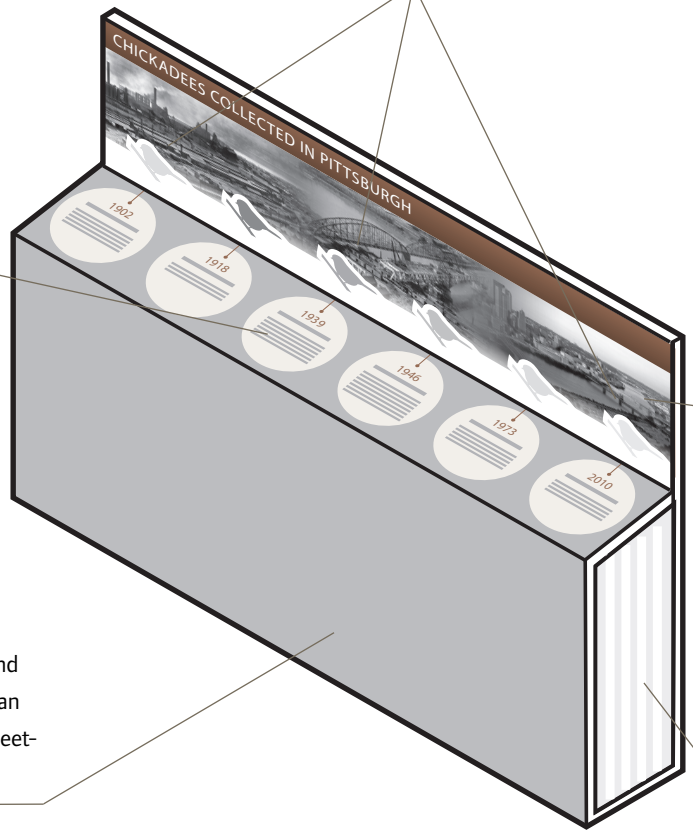


model 1 | **Specifications**

Production and Implementation

Event viewing sections can be made much like the scale model on page 56: acrylic or glass panels with the printed text underneath and magnetic filings sandwiched in between. Filings can be made by pressing a steel pipe against the belt sander (dust collector disengaged) and collecting the dust/sparks underneath.

These three birds will be actual specimens from the CMNH collection (two clean chickadees and one dirty one).

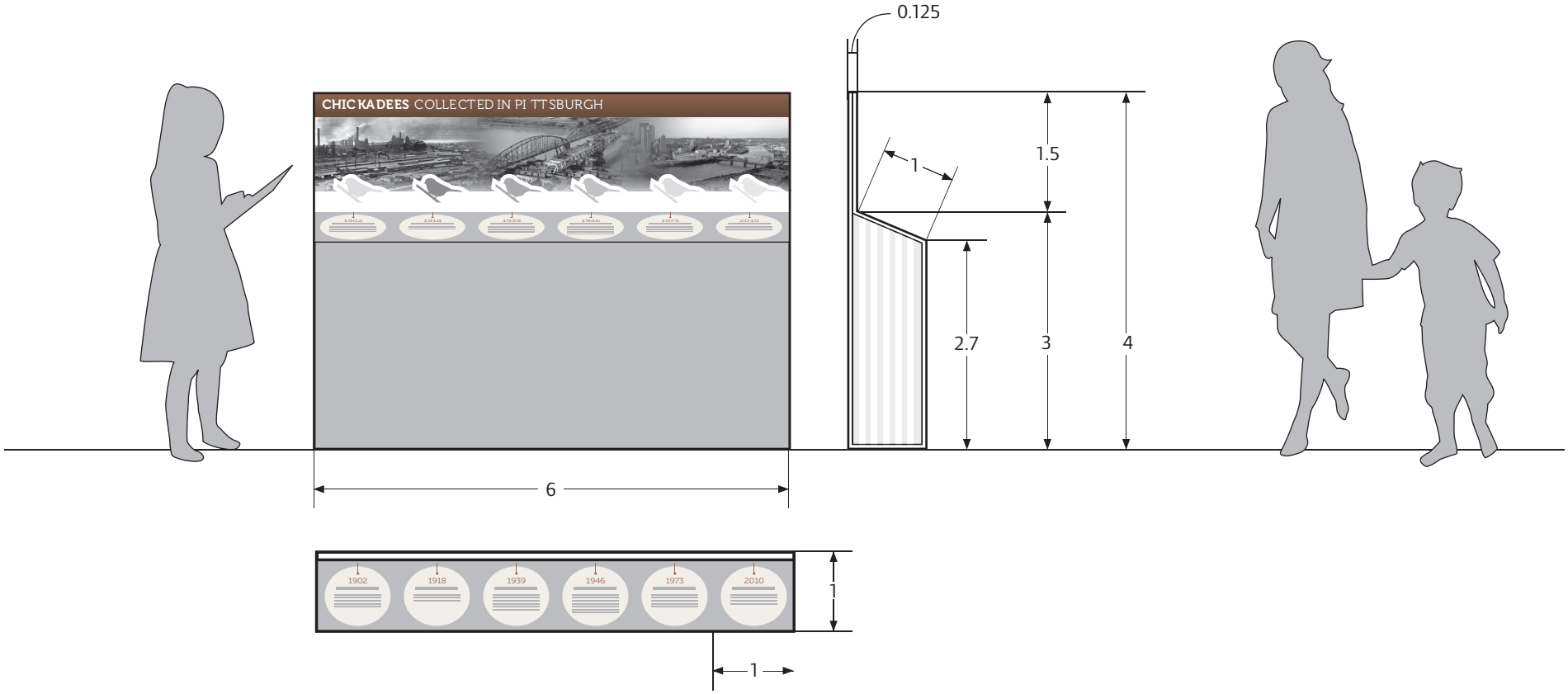


Printed images

Exterior pieces should be smooth and grey. They are similar to walls and can be made out of similar materials: sheetrock painted grey.

Side components are not load bearing and can therefore be made out of a flexible vinyl material. They are translucent to make the structure appear less solid/massive and allow the user to see the structural material inside.

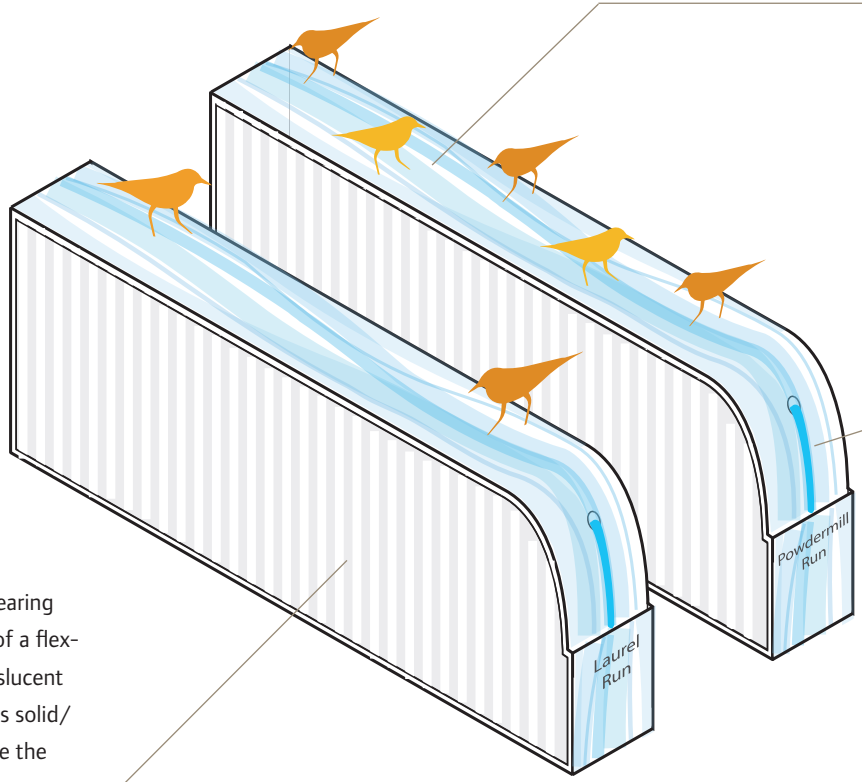
dimensions in ft



model 2 | **Specifications**

Production and Implementation

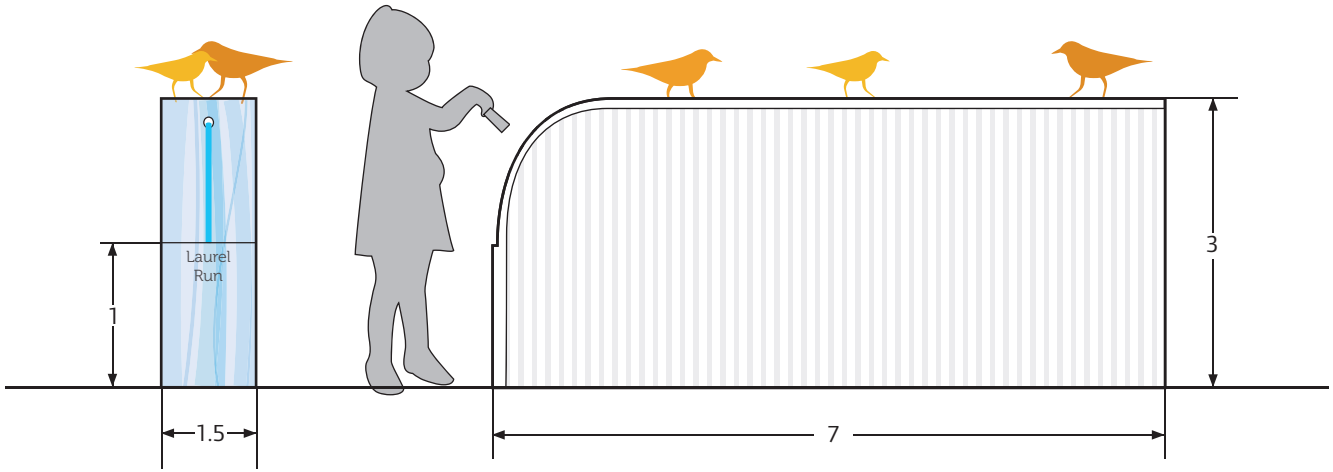
Colorful graphics can be painted on much like traditional museum lettering on a wall.

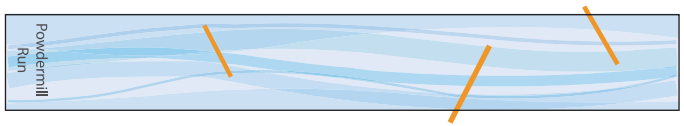


Dripping water can be made much like the model on page 56: Reservoirs or water with pin sized holes dripping form one container to another. PH test strips should be in the shape of the waterthrush logo.

Side components are not load bearing and can therefore be made out of a flexible vinyl material. They are translucent to make the structure appear less solid/ massive and allow the user to see the structural material inside.

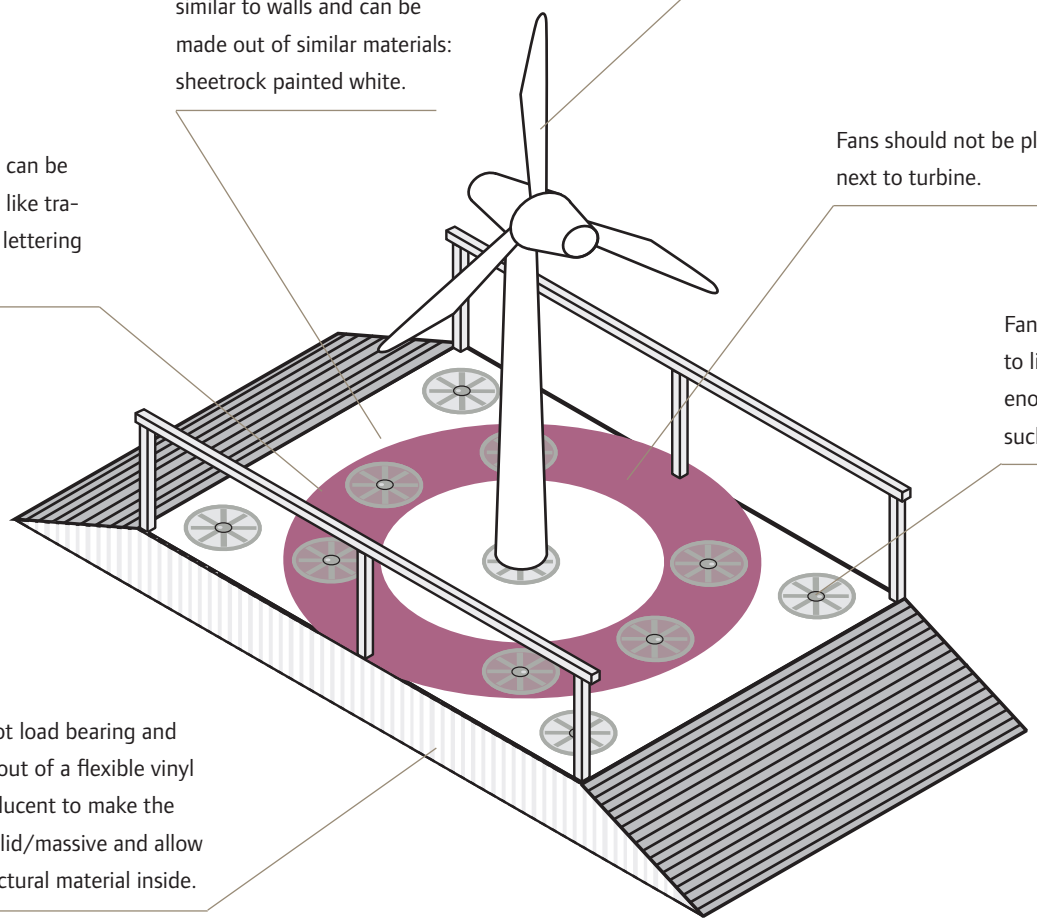
dimensions in ft



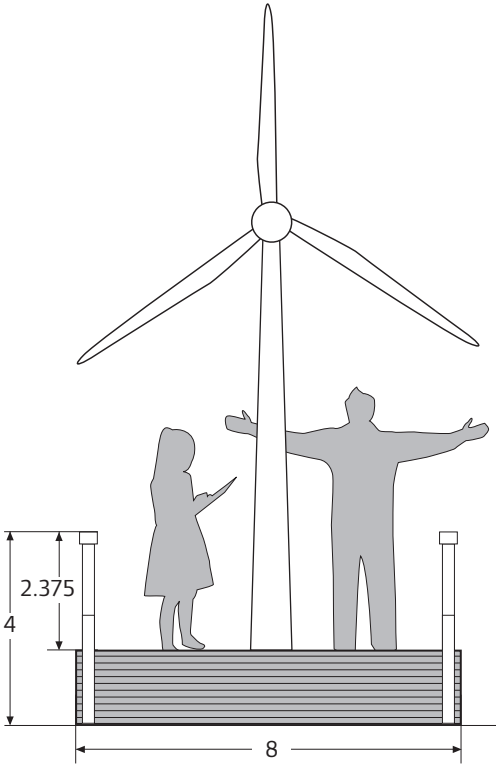


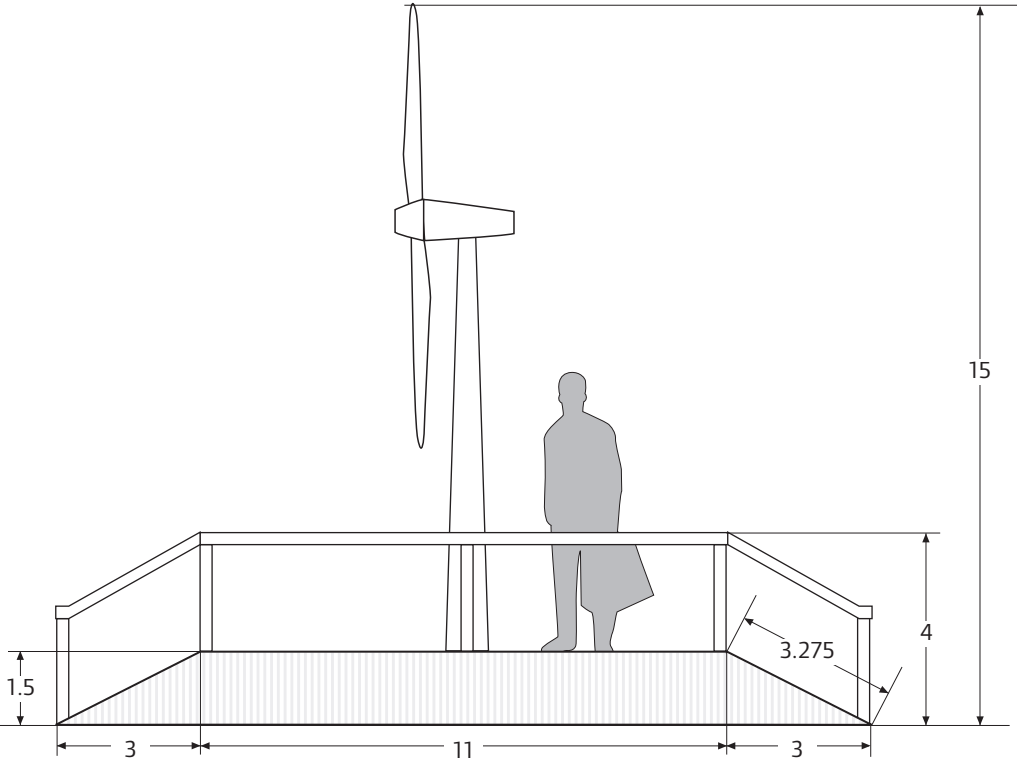
model 3 | **Specifications**

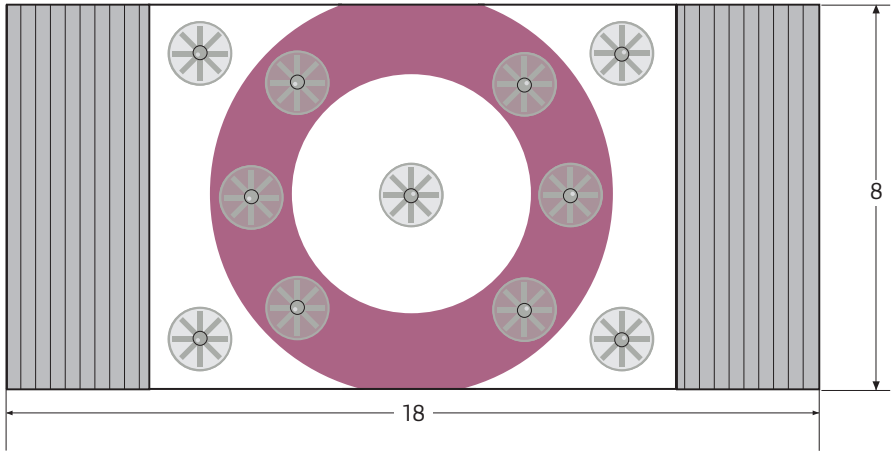
Production and Implementation



dimensions in ft

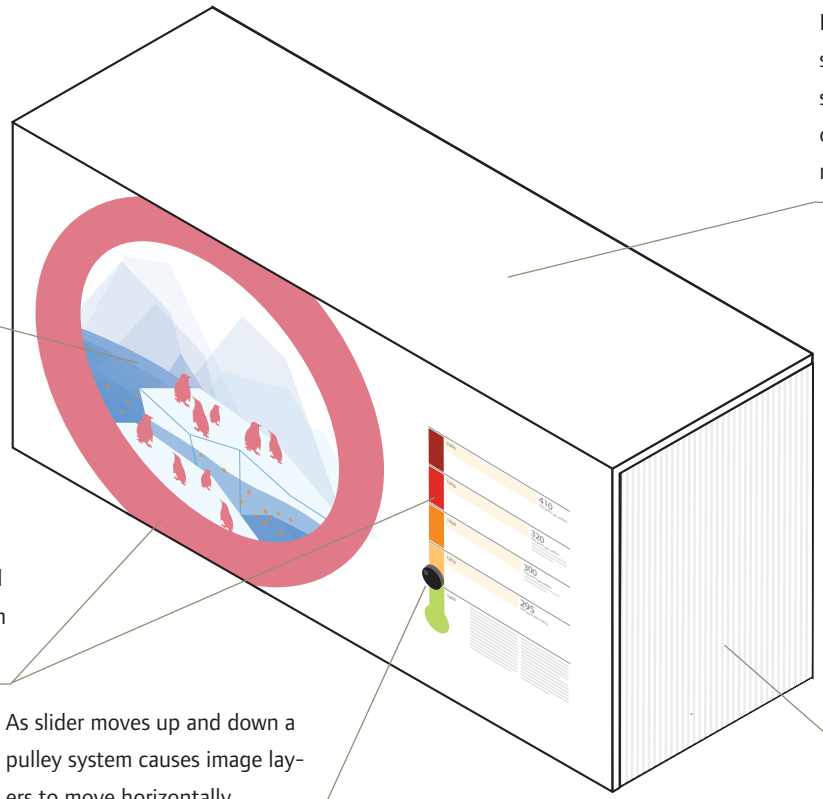






model 4 | **Specifications**

Production and Implementation



Exterior pieces should be smooth and white. They are similar to walls and can be made out of similar materials: sheet-rock painted white.

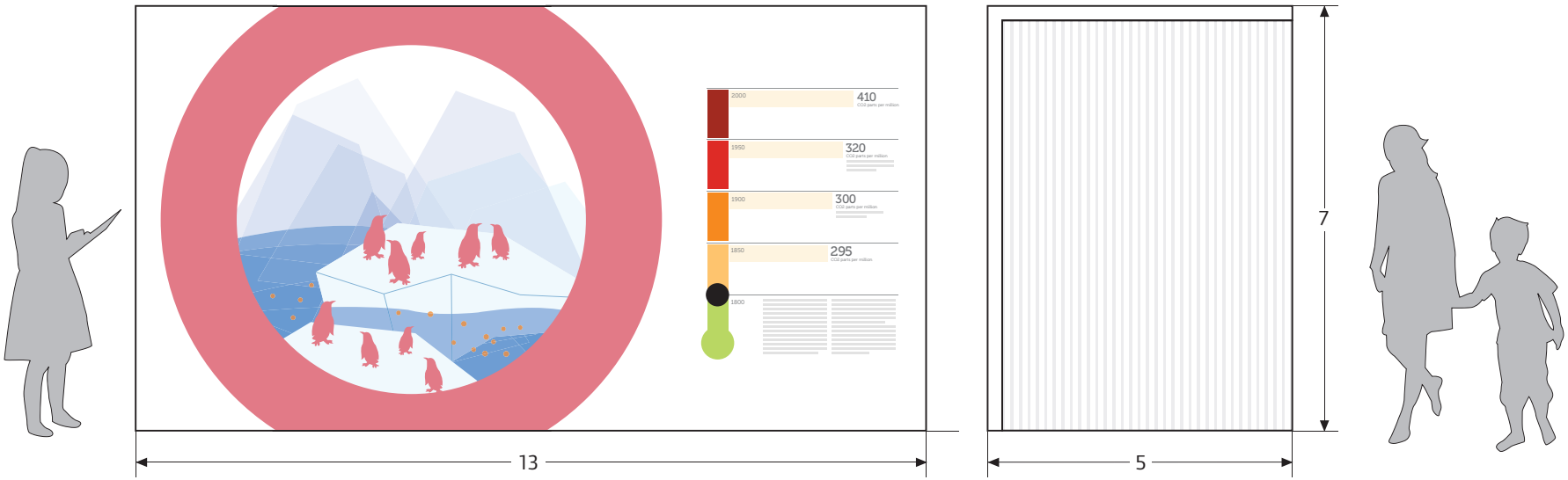
There are 12 images printed or painted on a sturdy transparent material that move with a pulley system.

Colorful graphics can be painted on much like traditional museum lettering on a wall.

As slider moves up and down a pulley system causes image layers to move horizontally.

Side components are not load bearing and can therefore be made out of a flexible vinyl material. They are translucent to make the structure appear less solid/massive and allow the user to see the structural material inside.

dimensions in ft



5. Reflection

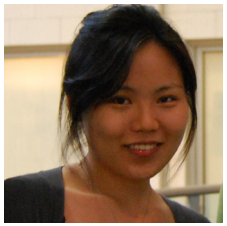
What we thought about the experience

HAJIN SAYS..

This project was a culmination of everything we have learned in the past four years as design students. Over the course of semester we experienced a thorough design process that involved understanding the topic, coming up with a concept and forms that convey our ideas, and creating a cohesive system that ties every piece together.

It was nice that this project gave us complete freedom to set a direction and to pursue whatever idea we believed would appeal to our audience. This open-endedness, however, also presented us with a lot of challenges. Because we were exploring such a broad space with limitless possibilities, our team spent a big portion of the semester just getting the high level picture drawn and the content nailed down. I wish we would have gotten to that point earlier, which would then allow us more time to better think through the concept to further develop the idea.

For the museum as well, this project seemed to challenge them to make a shift in their thinking about what they could do with the topic of birds. It felt rewarding to know that our class did our part in contributing to that shift. Once our ideas have been implemented after the summer, I hope they will help enhance college students' perception of CMNH in terms of its importance and relevance and I hope CMNH will draw more visitors from the community.



JOSH SAYS..

Our first visit to the bird department and Powdermill seems like such a long time ago; yet now I feel we could use a little more time to execute our concept. Our journey as team BEI has certainly been an educational and worthwhile experience. We chose energy as our theme because we thought it could highlight CMNH research and it is a topic of concern and interest to our generation. I think this was a good decision.

One of the most memorable moments in our process was our second presentation when we acted out a skit. Our concept then was a mock investigation (a game) with clues and a notebook, causing the user to empathize with the researchers and cast them as heroes. The feedback we received praised our goals and fun factor, but criticized our tone. I had not realized that our tone was quite puerile and may not appeal to college students or adults. Our concept has changed a lot since then and that is what I find valuable: constant revaluation and transformation of our ideas. We spent most of our time ideating and evaluating our theme, navigation, tone, etc. I am glad we did not short-change this phase, but now I wish we had more time to make refined drawings, models, etc.

Our group had a great division of work. Luther and I sketched and made models while Hajin and Jane worked on type, graphics, movie, etc. We spent a great deal of time as a group discussing our concept. This was different from other school projects, even group projects, in which the majority of the time is spent making rather than conversing.

I've learned about relationships between researchers and birds and energy and I hope our exhibit will provide the user with a similar experience.

JANE SAYS..

I remember how excited I was when I heard that we will be designing an exhibit about birds, yet had no idea where to start from. Birds are interesting in many ways and there were so many things we could talk about—like most design problems, the topic seemed very broad and unlimiting.

Working as a group is great in the sense that you can work together to find a scope and narrow down your focus. Frankly, energy was not the first thing that came into my mind when thinking about birds, but through group discussions and conversations I quickly realized how there could be interesting challenges and opportunities for this topic.

Paving our way through the project with the topic of energy (while other groups focused more on behaviors and evolutions of birds) was not always easy for us, and I believe our group benefited the most from the feedback from peers, faculty and researchers at CMNH. We were struggling with the limited amounts of research that "we" could do, and realized how much knowledge researchers at CMNH had and how we could reach out to them for help and resources. And this was exactly what the project was about—researchers were out there conducting studies so that people like us could go and ask questions and get them answered. As much as we tried to help college students empathize with researchers through our exhibit, we were able to empathize with them along the process.

I feel grateful to have worked with such amazing and talented peers, it was certainly a great project to end my design undergraduate with!

LUTHER SAYS..

The Interactive Information Spaces has been an amazing culmination to my undergraduate student experience. Working along side my design peers, who each have unique skills and interest, has been a very rewarding experience. By bridging the worlds of product, interaction and communication we have developed a exhibition that reflects the dynamic qualities of our group. We each have brought a unique take on the design process and I'm very excited to have worked with such great designers.

Team BEI
Hajin Choi
Josh Finkle
Jane Park
Luther Young

Carnegie Mellon University
School of Design, Senior Project

Advisors
Mark Baskinger
Stacie Rohrbach

In conjunction with
Carnegie Museum of Natural History