Bird Brain
A Navigational Dance Project

Ducks and Geese Migration
Fall/Winter/Spring 2004

Classroom Resource Guide

"All over the world millions of birds set off on long, perilous migrations each year. Bird migration is a regular mass movement. Birds fly from winter homes to summer nesting areas in spring and the make the return trip in the fall. If you follow these vast movements of wildlife, you can witness some of the great spectacles of the natural world."

-- Carol Lerner,
On the Wing: American Birds in Migration.

Introduction

The Bird Brain Classroom Resource Guide has been developed by the Walker Art Center in conjunction with Jennifer Monson's Bird Brain Navigational Dance Project residency in April and May 2004. It is written for students in grade 3-6. For schools who are partners in this project in Minnesota, each section of the guide will be introduced by a classroom visit from Jennifer or a representative from the Bell Museum of Natural History, the Audubon Society, or the University of Minnesota Design Institute. For schools in Corpus Christi, Houston, Dallas and Cedar Rapids we will try to find equivalent organizations and institutions to participate in classroom visits. For classrooms that are not partners with this project, this guide can stand alone as an integrated resource that relates the study of the migration of ducks and geese along the Mississippi flyway with experiences in movement, writing, and art.

www.birdbraindance.org
A special web site had been created to provide information about the Bird Brain navigational dance project and to follow the dancers as they travel the migration route. There are classroom links on the site for your class to post data and share writing, videos, photos, artwork and observations with other classrooms along the route.

Goals
• to lead students to connect their own navigational skills to those of animals.
• to use movement, dance, writing, and art as tools to teach students about bird navigation and physiology.
• to help students become more aware of their environment and to become more educated stewards of the environment through both scientific and artistic exercises.
• to use the interconnectedness of migratory bird habitats as a metaphor for how our own communities are linked.

This guide has been developed as a collaboration between Jennifer Monson, artistic director of the Bird Brain Navigation Dance Project; Jane Greenberg, Teacher Resource Center, Bell Museum of Natural History, College of Natural Resources, University of Minnesota; and Susan Rotilie Associate Director, School Tours and Family Programs, Walker Art Center. Additional content has been contributed by Mary deLaittre, The Environmental Literacy Project; Joanne Toft, classroom teacher, Marcy Open School, Minneapolis, MN; materials from the Cornell Lab of Ornithology are used with permission. A complete listing is included in the "Sources and Resources" section.

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Projects

I. Sensory and Perception Explorations
This section explores how we as humans navigate and leads students to a deeper understanding of how they perceive their world through movement, sight and sound.

II. Bird watching
After constructing and installing bird feeders, students will learn how to observe and identify birds, collect data, and record it in both scientific and creative ways.

III. Avian Architecture, Flight, and Migration
Through two learning kits developed by the Bell Museum of Natural History, students will explore the hands-on science of bird anatomy, flight, and migration.

IV. Mapping and Way-Finding in Humans and Migratory Birds
Students will explore mapping as a way-finding and cognitive tool to explore how both humans and birds move through the world.

V. Movement workshop: Flocking Behavior in Ducks and Geese
Through individual and group movement exercises, students experience the sensation of flocking and other migratory bird behavior.

VI. Habitat: Field Observation and Response
During a visit to a habitat for migratory ducks and geese, students practice field observation, data collection and writing to reinforce the importance of these habitats and what they can do to preserve them. They will also experience moving and dancing outside in a natural environment.

For schools participating in the residency, this unit will culminate with participation in an outdoor performance with the Bird Brain Dance Company.

"At whatever moment you read these words, day or night, there are birds aloft in the skies of the Western Hemisphere, migrating. Bird migration is the one truly unifying natural phenomenon in the world, stitching the continents together in a way that even the great weather systems …fail to do. It is an enormously complex subject, perhaps the most compelling drama in all of natural history."

-- Scott Weidensaul
Living on the Wind: Across the Hemisphere with Migratory Birds

I. Sensory and Perception Explorations

Introduction for students:
This year we will be learning about birds, especially the ducks and geese that migrate along a flyway from the Gulf of Mexico to Canada that follows the Mississippi River. We will observe different kinds of birds, learn about how they can fly, why they flock together, and why and how they migrate. Through movement, writing, art and observation we will learn to express our experiences and knowledge of the phenomenon of migration.

Animals use sight, sound, smell, and touch to navigate just like we do. By paying attention to our own senses and perceptual abilities (sight, hearing, smell, touch, and sense of direction) we can better understand the phenomenon of bird navigation.

Teacher Notes:
How do birds navigate?

• Vision

Birds have excellent vision and rely on visual landmarks for local and long-distance migration. When ducks, geese and many smaller birds move up or down the continent, they follow four broad routes or flyways. They follow great natural landmarks of North America. The Atlantic and Pacific coastlines, The Mississippi River valley, and the major mountain chains—The Sierras, Rockies, and the Appalachians—all lead in a north-south direction. These landmarks make it easier for birds to stay on course.

• Inner compasses: sun, stars and magnetic fields

Birds use the **sun** as a compass. They use the positions of the sun during the day to navigate. They also can use the setting sun as an indication of due west. Birds also have the capacity to see polarized light, which we humans can't see. This also gives them information about the season, timing and direction of migration.

Night flyers use celestial navigation, which means they find their way by knowing the patterns of the **stars** in the sky, and by knowing special stars like the North Star. In their first year of life, birds memorize the position of the constellations in relation to the North Star. These star patterns stay the same even though the Earth moves through space, making the constellations appear to move to different spots in the sky during the year. Star navigation changes as new constellations appear on the horizon as the birds travel north or south.

Birds have tiny grains of a mineral called magnetite just above their nostrils. This mineral may help them to navigate using the Earth's **magnetic field**, which tells the bird what direction is true north.

• Hearing and smell

Some birds supplement these navigational tools with their sense of hearing and smell. Birds can hear very small sounds called infrasounds that come from the wind moving through mountain passes, waves crashing along the coast, the rumble of earth quakes or volcanoes. Humans can't hear these sounds without special instruments.

- Each Other

  Birds who migrate in large flocks also depend on the more experienced members to lead the way. Some young birds such as geese, swans and many seabirds, migrate from their place of birth as part of a family group and so are introduced to the route by their parents.

Sources:
USGS: Northern Prairie Wildlife Research Center
http://www.npwrc.usgs.gov/resource/othrdata/migratio/routes.htm

University of Wisconsin-Madison
The Why Files: Science Behind the News
http://whyfiles.org/006migration/bird_strategy.html

Lerner, Carol. On the Wing: American Birds in Migration, Harper Collins, 2001.

Sensory and Perceptual Exploration Activity

This activity is best when it takes place outside but can happen anywhere. It can be adapted to each leader's personal style.

Materials needed: 1 compass for every 1-3 students; a map of the United States; a map of your state or metropolitan area

Part 1: Sense of Direction

• Ask the participants to stand up and close their eyes and to take a moment to feel their feet on the ground. Have them think about where they are at this moment.
• Then, with eyes still closed, ask everyone to face north. Allow the participants to take a moment to orient themselves. Once everyone has made their directional choice, ask them to open their eyes and see if there is a common sense of where north is.
• Demonstrate how to use a compass to confirm the actual North.
• Once everyone knows where north is, ask participants to close their eyes again and to face their home. Then ask them to face one or two more directions based on well known landmarks such as the ocean, a river, downtown, and a local mountain.
• Ask students to locate The Mississippi River on a map of the United States. Have them locate their own state on that map.
• Ask students to face the direction of the Mississippi River from where they are now. Confirm this by looking at a map of your state or city and using the compass.
• Use the scale on a map of your city to determine the distance from the Mississippi River to your school.

Discussion Questions:

• How did you know where north is? Is it an intuitive sense of a feeling? Is it based on landmarks or the sun, something you were taught or something you just know?
• Discuss how birds know the direction to fly when they are migrating. (see information in "Notes to Teacher.")
• Have you ever been lost? What do you do when you are lost?

Point out that their solutions are very similar to animals. Animals look for familiar landmarks or make sounds to call their parents. They also can listen for familiar sounds such as coastal waves crashing or wind.

Part 2: Spatial Awareness with eyes and ears.

Sound

• Ask participants to close their eyes and listen to a sound that is VERY CLOSE to them. It could even be the sound of their own breath or their heartbeat or the sound of someone next to them. Take some time to identify and listen to this sound.
• Keeping their eyes closed, ask them to listen to a sound that is as FAR away as possible. Again, take time to listen to this sound.

• Then ask them to locate the far away sound in relation to the close sound. Can they estimate the distance between the two sounds with their eyes closed? Is it in miles or inches or yards? How do they calculate the distance? Is it something felt?
• Can they sense the direction of the far away sound with their eyes closed?
• Ask the students to open their eyes and identify the sounds they chose. It's amazing to see how different the sounds can be.

Sight
• Ask students to identify an object very close to them. Carefully observe its size and it's texture. How long has it been there? Where has it been before now? What do you know about it? What is unknown about it?
• Then ask them to choose a far away object and see if they can imagine the same kind of detail on the far away object as they have observed in the close object.
• Ask them to calculate the distance between the two objects.
• Ask students to become more acutely aware of things moving in their environment. For instance, can they see and hear the wind in the trees? Do they see if first and then hear it?
• Finally, ask the students to take a few minutes to let their eyes and ears move them through the space. Notice objects that attract their attention and sounds that dominate their hearing. Move a few steps toward each object or sound. Then move a few steps away from them.
• Add a rhythm or beat and have the entire class move together toward and away from the objects and sounds they have noticed.

Part 3: Spatial Awareness and Memory without sight
(Sometimes it is helpful to demonstrate this activity first.)
• Ask everyone to take a partner.
• The partners stand 10-20 feet apart from each other. One person is going to look at the space between the pair and then close their eyes and walk to their partner. The other person is going to make sure that their partner doesn't wander too far off course or trip and fall. Their job is to take care of their partner so that they feel safe moving with their eyes closed.
• Do this activity 3 times before switching partners. The first time take it at a normal pace. The second time run as fast as you can. The third time go as slowly as you can.

• Discussion Questions:
Does speed change your accuracy? What happens when you go fast? When you go slowly?

Part 4: Spatial awareness and direction with sound
(This is much better to do in a large outdoor space where the pairs can get some distance from each other and don't get confused by each other's sounds.)
• One partner is going to close their eyes and the other partner is going to make a sound in the environment such as brushing their hands across the grass, tapping on a tree trunk, crunching up leaves in their hand.

• The person with eyes closed moves toward the sound until they find it. • Have each partner locate three different sounds. Make sure each sound is made in a different direction. Use a variety of sounds.

• Discussion Questions:
Are some sounds more difficult to locate? Why might that be? Can you imagine navigating with only sound? Perhaps some birds do this. Some birds are able to hear infrasonic sounds (sounds that are below what humans can hear) and can possibly locate themselves by listening to the sound of the wind in the Rocky Mountains, The Atlantic Ocean waves, and volcanic sounds in the Caribbean.

• This activity can expand to include smelling and touching. One partner takes the other on a small sensory journey of sights, sounds, smell and textures. More experienced movers can use this sensory journey as a map and dance that experience back to their partner.

On the Internet
Go to www.birdbraindance.org

- Document this activity with video, photography or written texts and drawings.

- Introduce yourself and your class to the other schools that are also participating in this project.

Interim Activity : Bird Feeders

Student Introduction:
As part of our study of birds, we will put up and maintain bird feeders near our school throughout the year so we can practice observations of different kinds of birds.
You could just throw handfuls of seed out onto the lawn. Some of the seed will be eaten by birds, some of it will mold and spoil, some of it may sprout in your grass, other seed may be eaten by squirrels, chipmunks, or other animals. Birdfeeders keep the food dry and clean for the birds as well as keep it out of the reach of other animals.

Teacher Notes:
Directions for building three simple bird feeders:

About, Inc.
http://birding.about.com/library/bleasyhouse.htm

Cornell Lab of Ornithology
http://birds.cornell.edu/pfw/AboutBirdsandFeeding/BirdFeeders.htm

II. Bird Watching

Student Introduction
The official name for the study of birds is Ornithology. Now that we have our bird feeders installed we will learn what ornithologists do. We will learn ways to observe birds, collect data, and use what we observe in both scientific and creative ways.

Teacher Notes:
Who are the bird watching experts?
Most states or regions have chapters of Audubon Societies or Ornithology groups. Many provide speaker's bureaus to talk on topics related to the study of birds. Invite a speaker to discuss with your students what ornithologists do.

How do I learn to identify birds?
Use a regional field guide to birds such as Birds of Minnesota, by Stan Tekiedo for reference to help identifying the birds you see at the feeders.

As your students continue bird observations throughout the year, post their observations, photographs, writings, etc. on the ducks and geese classroom link off the official Bird Brain web site.
www.birdbraindance.org
You may also visit the web site Journey North to join in a classroom-based study of migratory animals.
http://www.learner.org/jnorth/

Bird watching Actvities

• Go for a bird walk

A walk around the schoolyard is a convenient way to get kids started with observing birds and nature. Or try a local park, nature center or other natural area.

See what birds you find, talk about the habitat. For the first bird walk ask students to look for different kinds of birds and signs of birds. When you return have them write five facts they'd learned about birds.

Supplies that might be useful to the students on their walk include:
*binoculars
*notebook and pencil (for writing down observations)
*field guide to birds (and/or other animals or plants)
*hats and water bottles if it is hot and sunny
*cameras

• Collect Data

It is important that students collect data from their observations during a walk and from observing birds that visit the bird feeders you have installed around your school. Use the Bird Brain Data Collection Form included in this guide. This data will be used for activities later in this Guide.
This form can be submitted for inclusion on the Bird Brain dance web site. www.birdbrain.dance.org

• Write a Story

Have your students write a story about one day in the life of a bird. Encourage students to incorporate ideas from their bird observations. Suggest using illustrations or photographs they have taken during their observations to help them tell their story.

• Write a Poem

Have students create a poem or a haiku describing the features that make a bird a bird.
Make a list of adjectives that describe how birds move and use them to write a poem about bird navigation and movement.

• Read a book

Flute's Journey by Lynn Cherry, 1997, Gulliver Books, ages 4-8.
A wonderful story of the migratory journey of a Wood Thrush from its wintering grounds in Central America to its summer breeding grounds in northeastern U.S. 40 pp.

Washing the Willow Tree Loon, by Jacqueline Briggs Martin, illustrated by Nancy Carpenter, 1995, Simon & Schuster, New York, NY, ages 5-8. Illustrates the importance of conservation by following the rescue, cleaning, and release of one particular bird. 28 pp.

See the Bibliography in the Sources and Resources section for more book and video titles.

Bird Movement Activities

Student Introduction:
Now that you have observed birds and identified them in their habitat can you begin to notice their movement behaviors and patterns?
What movement to particular birds do when they feed?
How does a hummingbird feed? A hawk? A seagull? A sparrow?
Can you interpret this movement with your own body?
What are the flight patterns of some of the birds you observed?

Teacher Notes:
Do all birds fly the same way?
Here are some flight techniques used by different kinds of birds:

- Continuous flapping - used by heavy birds like ducks and geese that use their wings for swimming and travel long distances
- Flapping and Gliding – Where the birds gain height while flapping and then can glide for longer periods. Gliding is very efficient use of energy.
- Bounding - used by small to medium sized birds like warblers, finches and thrushes. They generally have small, broad wings. The drag created as the air passes over outstretched small, broad wing cancels out any lift the bird would obtain from gliding. These smaller birds therefore fold their wings and drop between periods of flapping. Surprisingly, the bird's bodies with wings closed generate significant lift and reduce drag
- Thermal soaring – A thermal is a current of air rising from a locally hot patch of ground. Thermals move in a spiral pattern. Birds can use the rising air to gain a flying height up to 1,650 feet. Birds convert the height advantage into distance gliding, wings outstretched to the base of another thermal and repeating the process. This is one of the most energy efficient ways to fly.

Activities

- Experiment moving your body to show different types of flight patterns.
  Use your arms and body to show the effects of flapping, gliding, bounding, and soaring movements.
  Make spirals in space and in your body and try doing a spiraling/ soaring dance.
- Choose three different moves you have observed in one bird. Try them out. Make them larger or smaller. Make up a solo dance by repeating the movements you see in the birds and arranging them in different orders to phrases.
- Try moving the phrases through space and interacting with other classmate's phrases.
- You can choreograph a 'Bird Movement' dance by making decisions about who moves where and when based on what you see the birds do. You can show this dance to your classmates and friends. You can take photos and videos of the dance and put it on the web site. When the Bird Brain dancers come through your town you can show us the dances that you have made! YEA!

III. Avian Architecture, Flight, and Migration

Teacher Notes:
This section is built around two learning kits that are available for rental from the Bell Museum of Natural History, College of Natural Resources, University of Minnesota. For more information go to
http://www.bellmuseum.org/learnkits.html

To order a learning kit, contact:
Bell Museum Learning Kit Program Office
Jane Greenberg, Program Coordinator
(612) 626-2299 voice
(612) 626-7704 fax
E-mail: green035@umn.edu

Other local institutions in your area may have similar kits available.

• Avian Architecture Learning Kit
What is a bird made of? Learn about bird anatomy with real bird parts. This kit includes study skins, wings, feathers, and several types of beaks and feet. Object descriptions, a student activity guide, multi-cultural books, and a guide to bird identification are also included.

• Migration and Flight Learning Kit
How far do ducks and geese fly when they migrate?
Calculate how far these and other birds migrate.
Construct a model of a bird wing.
Inside this kit you'll find a large migration map, plans for constructing a model wing, real bird study skins and wings, and familiar bird silhouettes. Supporting lessons, multi-cultural books, and activities are also included.

Interim Activities: How Birds Fly

Teacher notes:

How do birds fly?

- Birds have a **streamlined body shape**. Streamlined refers to a shape that can move through air easily because it hardly breaks the direction of airflow. Streamlined shapes have rounded edges, taper from front to back, and are horizontal rather than vertical.

- Birds have **wings that function as airfoils** to give them "lift" off the ground. This is the same idea behind airplane design.

> Try this:
> You can demonstrate "lift" with a strip of newspaper. Cut a piece of newspaper about 3 inches wide and 12 inches long. Hold the strip to your mouth and blow cross the top of it. The strip goes up—lifts—because you're moving air rapidly across its top side, and reducing air pressure. The slow air beneath the strip has a higher pressure and pushes the strip up.

- Birds have **lightweight skeletons** composed of many hollow bones.

- In addition to lower body weight, birds concentrate that weight towards its **center of gravity**, for example: Birds lack teeth, making their heads lighter, food is ground in the gizzard in the bird's core.

How do Ducks and Geese fly?

- Duck and geese are heavy birds with narrow pointed wings. Their strong breast muscles supply the power they need to move their wings and keep their bodies airborne. Except when landing, they flap their wings continually as they fly. Nonstop wing flapping takes a lot of energy, so these birds must pause along the migration route to rest and feed.

Sources:
Rupp, Rebecca. Everything you Never Learned about Birds, Storey Books, 1995. ISBN 0-88266-345-3

Kalman, Bobbie. How Birds Fly, Crabtree Publishing Company, 1998. ISBN - 086505-768-0

Journey North: Whooping Cranes
http://www.learner.org/jnorth/fall2003/crane/index.html

http://www.ornithopter.org/flapflight/

Art Activity: Flying Bird Mobiles

Use what you have learned about avian architecture and how birds can fly to make "flying" bird mobiles.

Materials:

heavy-weight cardboard (for body shape)
tag board –125# (for wings and beak)
wire or pipe cleaners
elastic cord
metal washers or other weights
colored tissue paper (for feathers)
large needles for punching holes
glue sticks
masking tape
scissors
X-acto knife (For cutting heavy cardboard. Teachers may want to do this step for students.)

Directions:

1. Cut a streamlined shape approximately 12 inches long from heavy cardboard for the head and body of the bird. You may use the template enclosed or draw your own streamlined shape. (Caution: Heavy cardboard is easiest cut with matt or X-acto knives. These are very sharp. It is recommended that teachers or other adults cut out body shapes for students.)

2. Punch two holes through the body as shown on the template.

tered about 1 to1-1/2" from edge. The bottom hole about 1/2" from the bottom edge.

These holes will function as the "center of gravity" for the finished birds. Notice that they are placed near the thickest part of the body.

3. Add patterns, colors and tail feathers the bird's body with "feathers " made of tissue paper.
Attach them with a very small amount of glue.

The designs can be based on a particular bird species or can be imaginary.

4. Fold a triangle of tag board to form a beak. Attach with glue to the front of body.

Birds have many different beak shapes. Select one that is more streamlined. This triangle should be hollow because birds' beaks are lighter than the rest of their body.

5. Draw a wing shape on tag board. Wings should be at least 12 inches long. (See template or design your own.)
Be sure to cut two wings.

6. Position the wings center to center with a 1/4" space between them. Attach with masking tape across the space. Leaving a space between the wings allows them to flap.

7. Use colored tissue paper to add feathers/patterns/designs to the wings. Only glue the tops so feathers will flutter when hung.

8. Attach wings with tape to top edge of body, centered over top "center of gravity" hole, with tape on the underside of the wings. Make sure wings still can flap.

9. Cut a length of wire approx. 16". Thread wire through the top hole on body. Center wire and bend it to form "v" to reach the wings. Tape in place.

This wire is like the strong breast bones and tendons, on birds. It strengthens and stabilizes the wings

10. Extend wire along underside of wings at the front. Wire should extend approximately halfway along wings. This is about the same distance that the bones extend in birds' wings. Tape in place.

11. Cut a length of elastic cord about 40 inches long. Fold it in half and tape cord together about 1 inch from the fold to form a loop for hanging the mobile and again about 1 inch from ends to help center it when attachment to the top of the wings. Separate the ends and tape each to the top of the wings at center point where they are attached to the body.

12. Use wire or string to hang weights from bottom "center of gravity" hole on body.

13. Hang bird from elastic cord. Gently pull and release weights to make bird "fly."

(Templates for the body and wings will be inserted here.)

IV. Mapping and Way Finding in Humans and Migratory Birds

Student Introduction

Birds are not the only creatures who move from place to place. Besides many species of animals that migrate, humans also travel every day. We may go short distances to familiar places such as school or to visit friends or we may take annual trips to more distant places when we go on vacations. Many of you have probably moved from one neighborhood, city, state, or country in your life. Have you paid attention to how you find your way when you "migrate"? Over the next few days, we will be looking at maps, making our own and even making maps for birds.

Teacher Notes

The activity in this section is based on:
Home Road Activity: Human Migration and Orientation*
* adapted from Environmental Literacy: Neighborhood Based Learning by Mary deLaittre

Content;
There is a disconnect between people and the environment they move through and interact with on a daily basis. Often people do not even "see" their surroundings. This activity is meant to connect the student to their own environment, encouraging them to see and give value to where and how they live, reflect on their relationship to the physical features of their environment and contemplate how they function within this environment,

Vocabulary:
Neighborhood - a specific place with particular distinguishing features, amenities, or boundaries; a community of common interests or associations, or an area within a 1/2 mile radius around your home school or other physical feature.
Landmark – A physical feature in the landscape that marks a local or serves to orient a person in the landscape.
Oriented- Becoming acquainted with the existing environmental conditions.
Physical Features – The tangible resources that express a neighborhood identity, influences its values, and shape its social and economic structure. The five physical features are:
Homes and gardens - The spaces where we rear our families, sustain our daily existences, display our identities and contribute to the overall neighborhood image. The home and garden can be found in many types of housing units, from the single-family house to the multi-family unit.
Community streets – Lanes that provide a functional and pleasant balance between use by automobiles, bicyclists, and pedestrians.
Neighborhood niches – The place where neighbors purchase their basic goods and services that support their daily activities.
Anchoring Institutions – the places where cultural, educational and social traditions of our communities are centered.

Public gardens – Open space where people of different ages, ethnic origins and economic circumstances gather together and connect to the natural environment.

Discussion Guide:
• Encourage students who have recently arrived to the United States to incorporate their previous home into the "Home Road" drawing and conversation.
• Discuss with students where they live and what their daily routine is.
• Compare how a mode of transportation (walking, bicycle, bus and car) and speed effects what they see and how far they travel each day.
• Contemplate home and school locations to proximity of goods and services.
• Talk about how landmarks orient students along their route.
• Encourage students to think about the value of daily social interactions and how much time they spend with people.

Home Road Activity: Human Migration and Orientation

Materials:
- paper, pencils, color pencils, crayons, marker
- large street map of city, suburb or town

Exercise:
A. Draw a map of your daily path or routine, illustrating the physical features, both built and natural, that define your "Home Road." Once the drawing is complete, pin or tape it up and verbally describe your "home Road" to the class. Post it on the Bird Brain web site.

B. Once the entire class has presented, locate your map on a large street map and draw in your "Home Road' route.

C: Discuss:
What is a cognitive map? The word cognition comes from the word "to know." It has to do with things you know from either memory or past learning. A cognitive map is a map based on your memory of a place rather than an official street map. Things like relative distance and size and keys for labeling sites are impacted more by the strength of your memory or importance to you personally than by actual measurements. We carry "cognitive maps" around in our heads when we walk or drive through familiar places. We don't need to look at a map to find our way, we just know.
Humans have used maps for thousands of years. See the section below for cultural maps, especially those made Eskimo and Marshall Island peoples.

Additional mapping activities:

• Make an artistic "cognitive" map of your neighborhood. Identify landmarks, places where you like to visit, places that are pleasant or fun (a friend's house), and places that provide necessities for you (drinking fountains, gas stations, benches for rest) by drawing images of symbols to represent them on your map.

• Map a route you have traveled that takes you far from your home such as a vacation trip, or journey to relatives in another city, or when you moved from one city or country to another. Identify places on your map where you remember stopping to eat, rest, get fuel, etc. with drawing or symbols.

Mapping Bird Migration

How do birds know the route to travel when they migrate? What physical features would be important to them along their journey?

• Examine a map of the Mississippi River Flyway route (enclosed) that migratory ducks and geese follow. Divide it up by state and using a map of that state, identify natural landmarks, bodies of water or wetlands along that route.

• Look at a map of your county or town. Find areas that could be stopover sites for migratory birds such as wetlands, lakes, rivers, etc.

• Make a "map" for birds migrating through your area that shows them where good stopover sites are located.

Optional ideas for cultural connections with maps and navigating:

• Look at maps made by Aztec, Plains Indians, and Eskimo cultures for examples of how symbols can be used to describe places, events, and travel routes.

• People in Australia sing "Songlines" that describe long journeys across the desert and tell those listening where they might find, food, shelter, water, good and bad spirits.

• What would it be like to be a Polynesian on a boat in the middle of the Pacific navigating with the wind ripples on the water, the stars, and the clouds? How do you think they navigate?

• Did you know that bees who find good flowers with lots of pollen come back to the hive and do a 'dance map' that tells the other bees where the other flowers are? Could you do a dance that would tell people where you lived?

Sources:
Turnbull, David. Maps are Territories: Science is an Atlas: A Portfolio of Exhibits , U of Chicago Press, 1994 ISBN 0226817059

Holmes, Nigel. Pictorial Maps, Watson-Guptill, 1991 ASIN 0823040135

Warhus, Mark. Another America: Native American Maps and the History of our Land, Griffin Trade paperback, 1998 ASIN 0312187025

Movement Activity: Using a Dance to Make a Map

Instructions for dancers:
In this exercise you can make up any kind of dance that you would like. Perhaps you've been observing bird behaviors and now have enough information to make a small dance based on the movement of the birds you have been watching. Perhaps you can make a dance that feels like the 'map' of going to a favorite place, or of returning home.
You can improvise this dance. That means you can dance it just this one time for your classmates.

Instructions for classmates:
Your job is to be able to draw an artistic map while the dancer is dancing. Generally maps show the point of origin, the distance traveled, the destination and any landmarks or events that occurred along the way.
You may see an image in the person who is dancing. For example, the dance may remind you of an animal or creature. You may include an image of it or a symbol for in your map. Sometimes the map is just a line of energy that refers to the movement. It is up to you to let your imagination draw the map of what you see and feel as you watch the dance.

The dancer can also draw a map of their dance when they are finished. It is fun to compare the differences and similarities between what the dancer feels while dancing and what the watcher sees.

Using a Map to make a Dance

Look at one of the maps that you or your classmates made and imagine that it is like a very unusual hiking trail map. Use it to create a new dance.
Your movements should follow in some way the directions or motions suggested by the dance map, but you can use it any way you wish. Like hikers with a trail map, you can decide to begin your route at any point- the beginning, middle, or end. You can follow the route backward, or forwards. Even if you are in the same space or using the same dance map, your dance will feel and look different from the others.
You can also use the map you made of your trip from home to school to make a dance. Can you express in your movement the different feelings of walking, riding in a car, waiting in traffic, seeing people's gardens?

V. Movement workshop: Flocking Behavior in Ducks and Geese

Student Introduction:

Have you ever felt like you were part of a flock? Did you like the feeling? Many types of animals move in groups – flocks of birds, herds of horses, schools of fish. Why do you think they do? For birds that migrate — especially ducks and geese—being in a flock is important for many reasons. Along with learning those reasons, we will also experience what it might feel like to move in a flock of migrating ducks or geese.

Go to http://www.dnr.state.wi.us/org/caer/ce/eek/critter/bird/goose.htm to see Canadian Geese flying in formation.

Teacher Notes

Why do birds flock?

- Aerodynamic efficiency

  Scientists think that it is likely that there is some aerodynamic advantage for waterfowl that fly in flocks with fixed distances and angles between individuals. The V formation may be the best example of this. You can see the birds taking turns being the leader. The leader is flying without any benefit so when he or she gets tired it can trade places with another bird. Helping them go farther before they need to take a rest. Birds may be able to take advantage of the vortices coming off the flapping wings of the bird ahead of them to reduce their own drag.

  Vocabulary:

  aerodynamics - The properties and interactions that effect how an object moves through gases or air in the atmosphere.

  vortex - A spiral motion within a limited area, especially a whirling mass of air or water that sucks everything near it toward its center.

  drag - The force that slows an object down as it moves through a medium such as air or water.

- Route Finding

  Since finding the way over very long distances is such a challenging navigational task for a bird, it may be helpful to fly with a bunch of friends. Some of the older migrants will have more experience and in the case of ducks and geese they are teaching the juveniles the right way to go.

  Some researchers suggest that by pooling their brain power birds may reduce their chances of getting off course and losing their way. The number of birds heading in the correct direction would compensate for the poor orientation of certain individual birds. Researchers have found that larger flocks orient better. This suggests that flocking promotes better migratory orientation and navigation.

• Detecting Predators
When many eyes are together each bird needs to spend less time scanning for predators then they would if they were alone. This gives them more time on stopovers to eat and build up fat.

• Foraging
Also many eyes may be able to find food sources more frequently and quickly.

Sources:
Paul Kerlinger, How Birds Migrate
Scott Weidensaul, Living on the Wind – Across the Hemisphere with Migratory Birds

How do ducks and geese flock?

• It's a family trait.
For waterfowl more than other birds, migration is largely a learned behavior passed down from parent to offspring and modified by the social bonding of the flock. Ducks and geese can navigate the way that other birds do – using solar and celestial compasses, an awareness of magnetic fields, etc. But the entire time-distance program that other birds have is superseded by the learning process within family groups. These animals have a tradition of migrating passed from generation to generation.

In most other bird species, adults and juveniles migrate separately. Ducks and geese migrate in family groups for the southbound flight. This is when the youngsters are shown the route, the good stopover sites, and wintering grounds, memorizing landmarks along the way. Duck families tend to break up over the winter and head north with any local flocks. Females have a strong fidelity to their birthplace returning to the same area that they were hatched. Males do not and they follow their hen, usually a different hen and a different site every year. Geese, on the other hand, take longer to mature and often the family remains together for two migration cycles. Males pick their mates on the wintering grounds and once they mate they tend to be monogamous for life.

• Flying in formation:
Ducks and geese fly in a variety of formations. Geese stay in their flock formation from take off to landing, keeping the flock together throughout the entire migratory journey. Most of us have seen the common V-shape of Canadian Geese flying during migration. There are other formations they use as well – line formations, echelons (a flying formation in which each individual flies behind and slightly to the side of the bird in front of it forming an oblique or step-like line), and formation shaped like a J, V, or W.

These tend to be 2 dimensional formations. These line formations are generally used by birds that use continuous flapping—such as ducks and geese—instead of bounding flight where the birds have more difficulty maintaining even spacing between individuals. Other birds like songbirds fly in 3 dimensional clusters sometimes called globular clusters that may make it

difficult for predators to catch them since they are moving up and down in altitude.

Movement Exercise: The Leader of the Flock

Concept: Birds migrate in different types of formations to help them fly more efficiently.

This exercise can take place outdoors or in an open indoor area such as a gym or on a stage. The students in the class are the "flock" for the activity.
• One person is designated as the leader. They instruct the "flock" to make formations such as a "V" or "echelon" formation. For each new formation, the leader sets a constant rhythm, moving around the space and the flock follows the leader keeping in formation.
• Each member of the "flock" is given a number. The flock forms a "globular cluster". The leader calls out random numbers. When a student's number is called, they lead a spurt of movement in a new direction.
• Discuss how the members of the "flock" reacted to the two different types of movement. Why do you think ducks and geese flock and fly in formations?

Movement Exercise : Look Out
Concept: Birds use their peripheral vision like chorus lines of dancers to move in unison in space.

This can take place outdoors or in an open indoor area such as a gym or on a stage.
• Start by becoming conscious of what you are seeing with your peripheral vision. Without moving your head, look as far as you can to the left and right and up and down. How far behind you can you see? Have someone move from behind towards you until you can see him or her in your sight lines. How big is the horizon of your sight line?

This exercise is a little bit like Simon Says, except that any one can be Simon. The important thing is to really take time and have the changes be very gradual.

• All students stand in a fairly tight clump. The leader should begin the group movement with a very simple movement such as shifting weight from one foot to the other. Let the movement grow in size and begin to move through space

• After the group is moving together for some time you will begin to feel the group functioning as a unit, new movements will suddenly appear with in the group without verbal prompts.

• Each student needs to really focus on his or her peripheral vision and on the energetic connection of the entire group. At first it may seem like one person is behaving as a leader at a time. The goal is to get to the point where the changes are happening as a group, with no clear leader.

• Once the group has practiced this type of movement, specify certain activities that have to be completed in this flocking dance. Give the flock a couple of goals both in movement and space. For example, move to the north side of the space,

break into a run, make a sharp turn to the south, walk very slowly and crawl. These events can happen in any sequence but see if the flock can make a group decision without talking, just by sensing the energy and noticing the changes in peripheral vision. For example, the group needs to move to a certain destination, or at some point the whole group has to run, walk backwards, or crawl.

• Try working with different kinds of flapping movements and traveling formations.

Movement exercise: Energic Unison

Concept: One idea that Jennifer Monson is working with in her creative process is 'energetic unison' in which dancers move together in the same energy, with the same quality, but not necessarily the same movement.

• Have the students find partners. One partner moves with their eyes open, the other close theirs. The eyes-open partner can move slowly in any way that they want to. The goal of the eyes-closed partner is to move in unison with their partner by feeling their energy, not by copying their movement.

"This is an amazing exercise to watch. People that know each other well will sometimes move in very similar ways and the listening factor of the person with the eyes closed is very intense to watch. You can see all the senses at work."

-- Jennifer Monson

VI. Habitat: Field Observation and Responses

"Because they travel such extraordinary distances, often with different requirements for food and shelter along the way, migratory birds pose one of the stickiest conservation challenges in the world. In the past, preservation programs focused on saving breeding areas, but experts now realize they must also save wintering grounds and migratory stopovers if this global web isn't to unravel."

-- Scott Weidensaul
Living on the Wind: Across the Hemisphere with Migratory Birds

Student Introduction:
As we have been studying birds this year, it has come up many times that birds need habitat in order to live and migrate. What needs to be part of the habitat for a migrating bird? We will be visiting a place near here that has been identified as a migrating bird habitat. We will use the skills we have developed in observing birds to record our visit. We will also have a chance to look at birds with our creative minds.

Teacher Notes:
Identify an area in you community that is a habitat for migrating ducks and geese. Time this visit when it is likely to see these birds as they stop over on their journey north.
You may arrange for guided tour of the site or plan your own visit as a class.

Why is habitat important for migrating birds?

Many birds that breed in North America migrate to areas south of the Tropic of Cancer (southern Mexico, Central and South America and the Lesser and Greater Antilles in the Caribbean Sea) in the fall (August-October) because of a decrease in their food supply. Many of these birds are insectivores; they eat mainly insects. (Most insects do not survive the North American winters except in larval or egg forms.) These birds remain on their non-breeding (wintering) grounds until April. Then in spring they migrate back to their breeding grounds in North America to take advantage of the plentiful insect food supply to breed and raise young.

Why are stopover sites so important?

Migrating birds need places to stop along their routes to rest and eat. Without food and safe resting places they cannot complete their migration. The American Midwest is one of the great migratory corridors because it is dotted with wide rivers and abundant wetlands and full of food for hungry travelers.

A migrating bird faced with the dilemma of a stopover site having disappeared may not have any viable options. Without places along the way that provide an adequate food supply for the quick replenishment of fat reserves, shelter from predators, and water, these birds are probably not going to make it.

Loss and degradation of stopover habitat not only can result in more birds dying while on migration, but it can also have serious repercussions in terms of nesting success. For example, birds heading north are already constrained by the relatively short amount of time available to get to the breeding grounds, establish a territory, pair with a mate, and get on with the further demands of raising young. Late arrival, or arrival in poor condition, on the breeding grounds because of inadequate food and rest en route, is likely to jeopardize a bird's ability to reproduce.

Sources:
Milwaukee zoological, society
http://www.zoosociety.org/Education/BWBASF/library/birdmigrationfacts
Wild Birds Unlimited
http://www.wbu.com/edu/migr.htm

For more information on wet lands as bird habitat:
http://water.usgs.gov/nwsum/WSP2425/birdhabitat.html

Classroom Activities

Activities before your trip

- Make a notebook or field journal to record your trip.

- Locate the site you will be visiting on a map of your city/region. Paste a copy in your field journal.

- Discuss why you choose to visit this site.
  List what is important for migrating birds' habitat. Which of these features do you think can be found at the site you will be visiting?
  Turn this into a checklist for your trip.

- Generate a list of questions you have about this habitat. Include questions about the history of the site. How it has changed over time? Is it protected or threatened?

- Leave blank pages in your journal for writing, drawing, or to paste in photos of your trip.

Activities during your trip

- Movement Activities
  Try your favorite movement exercises outside in this new habitat. Go back to the sensory exercises of Section I. to get yourselves oriented in this new environment. Try some of your dances outside.
  Discuss:
  How do the dances change in this new environment? Are the changes happening because—like birds— you must adapt and respond to factors such as the wind, the rough terrain beneath your feet, or the new sounds and sights.
  Dancing can be a profound way of experiencing the world. Reflect on your thoughts and experiences and share them with others.

- Search for things on the checklist of important elements for a migrating bird's stopover and add any new features that you see at the actual site.

- Bring along copies of the Bird Brain data collection sheet and record bird sightings.

- If you see ducks or geese, describe what you observe about their flocking behavior.

- Bring cameras to record bird sightings and other features of the habitat.

- Bring a video camera to record a dance you or your classmates did at the site.

• Draw birds, plants, and other examples of nature in the habitat.
• Interview a tour guide or worker at the site about the history of this habitat. Use the questions you generated before your trip. Record the answers in your journal. Find out if this habitat is protected.

• Make tape recording of the sounds heard at the site. List both natural and human-made sounds. Record the relative distance of the sound from where you are standing.

• Spend some time by yourself. Look in all directions both close-up and far distant. Close your eyes and experience the site with your senses of hearing, smell, and touch. Make of lists of what you saw, heard, and felt.

<u>After the trip</u>

• Create a report of your personal experiences of the trip.
Your report may take many different forms:
- a scientific study of the site including data collections and photographs.
- a collection of drawings from the site
- a short story about an animal and their habitat
- a report of the importance of this site and how it can be preserved
- a poster about animals/birds/plants that make up this habitat using photographs from your visit.
- a video of a dance you or your classmates did at the site.
- a poem about how it felt to sit quietly in a habitat for birds.

• Post your reports on the Bird Brain web site.

â€œThe amazing thing about the Finch Robots was how quickly my students were able to figure out how to use them and make them do what they wanted â€” this was a major confidence boost for many of our students that were less confident with new technologies. Plus, they had a blast while learning! Whatâ€™s better than that?â€ â€œThe Finch robots are so simple to use and easily span classes. It was literally a â€œsnapâ€ to use the Finches with our 3 and 4 year old classes! Overheard in a 4 year old class: â€œThis is the best day of my lifeâ€!â€ Nervous System: Brain and Special Senses II. Vision - Birds, with the possible exception of diurnal primates (e.g., humans), are the vertebrates which may rely most heavily on vision to function in their environment. The most obvious visually-dependent behavior of birds is flight, but birds also exhibit an impressive range of visually-guided behaviors other than flight, e.g., foraging, predator detection, & mate choice. Swamp Harrier (Circus approximans). The avian eye is large relative to the size of the head & brain. â€œFace my blue-bottomed fury!â€â€”Bird Brain Bird Brain is the secondary antagonist of T.U.F.F. Puppy. He is an evil criminal genius and mad scientist. He's a blue-bottomed booby who can't fly, so he uses gliders, cannons, and other flying contraptions he built, and has problems finding decent henchmen to help him. He does have a little hummingbird ally named Zippy, who is completely oblivious to the fact that he can't fly and constantly tells him that he can fly if he believes. He has laid eggs for... Bird Brain Records.USR is the file that contains your sighting data and the structure of the database. This is the file you copy to back up your database. Can I rename or move the Bird Brain files? Please leave the files in the Bird Brain 7.4 Folder alone! They need to stay in their respective folders and stay named as they are for the program to work properly. The Physical â€œBird Brainâ€. How do birdsâ€™ brains stack up in comparison with mammalsâ€™ brains? Does neurology give us any reason to suppose birds should be intelligent? Up until about 30 years ago most scientist believed that intelligence required big brains. Birds were observed to be small animals with small brains and so they were, for the most part considered to be very machine like, possessing no conscious thought or ability to learn. However that idea has now been proven entirely false.