Air in Motion

THE BASICS	THE TOOLBOX
 Grade Level: K-12  Estimated Time: 20 min.	• Whirly bird paper strips, 2" wide by 8.5" long • Paper sheets, 8.5" wide by 11" long • Crayons and markers for decorating papers (optional) • Paper clips • Scissors

EDUCATION STANDARDS	**Physical Science Content Standard:** Understanding the Bernoulli Principle, which among other things states that when air moves, it exerts a lower sideways pressure.
SAFETY CONCERNS	None.
FOR KIDS WITH DISABILITIES	Visually impaired students can work with a partner and feel what is happening to the paper with their hands.

What To Do

Educational Objective:

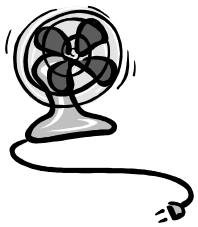
To demonstrate the difference in sideways pressure when air is in motion and when air is at rest.

What to Do:

- Make copies of the whirly bird strips for each student.

Questions to Ask Students As They Do This Activity:

- What happened that you expected to happen?
- What happened that you didn't expect or that was different from what you expected?
- What experiences have you had where something was sucked into a moving stream of air?
- Where else have you experienced the force or pressure of air?



Why It Happens:

When air or any fluid moves, it does not exert as much sideways pressure as when it is still. The faster a fluid moves, the lower the sideways pressure it exerts. This principle was discovered in the 18th century by a Swiss scientist names Daniel Bernoulli, and so it is called the **Bernoulli**

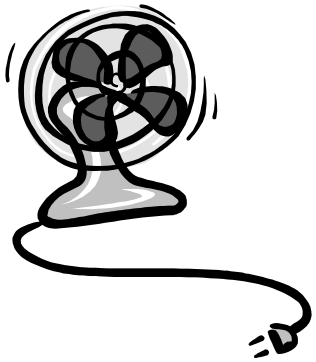
Principle. The Bernoulli Principle also means that the greater the difference in speed between the fast-moving and the slow-moving fluid, the greater the difference in pressure between the fast-moving and slow-moving fluid. Objects will be pushed from the higher-pressure, slower fluid areas toward the lower-pressure, faster fluid areas.

In the first part of this activity, the strip rose up instead of being pushed down as you might have expected. The air above the paper strip was moving faster than the surrounding air. Therefore, the pressure was greater in the still air below the strip than above it, causing the paper to lift up. Additionally, you had to create enough of a difference in pressure so that the downward weight of the paper strip would be overcome by the air forces, making the paper rise upward. This probably could not be done with an object much heavier than paper, unless the air were moving very fast. For example, objects can be pushed into the extremely fast-moving air of a hurricane or tornado with great force. This is also the phenomenon that allows airplanes to take off.

In the second part of the activity, the paper sheets came together instead of being pushed apart as you might have expected. Again, you created a stream of air that was moving faster than the surrounding still air. The pressure was greater outside the sheets than inside the sheets, therefore the paper sheets were pushed together by the greater air pressure.

Extensions:

Follow the directions on the Whirly Bird strips to make a helicopter. There are four different forces that affect the flight of the helicopter. They are **lift**, **drag**, **thrust**, and **gravity**. Lift is an upward force that offsets the force of gravity on the helicopter. Gravity is the force that pulls the helicopter toward the earth. Drag is the air resistance to the downward motion of the helicopter. Thrust is produced if you throw the helicopter downward instead of dropping it, and this force counteracts drag.



Web Sites

- **National Air and Space Museum**
  http://www.nasm.edu (Grades K-12)

Software

- **Introduction to Airplane Design**
  Seeds Software, 1996.
  (Grades 6-9)
- **Whelmers**
  The Learning Team, 1997
  (Grades K-12)

Reading Room

- Blackburn, Ken and Jeff Lammers. **Kids' Paper Airplane Book**. Workman, 1996. (Grades K-8)
- Hansen, Ole Steen. **Aircraft**. Raintree Steck-Vaughn, 1997. (Grades 1-6)
- Schmidt, Norman**. Super Paper Airplanes**. Sterling, 1995. (Grades 5-12)

Career Connections

Many occupations require the knowledge of air pressure and how air moves. Some examples are pilots, track and field athletes, and hot air balloonists.

AIR IN MOTION ACTIVITY SHEET

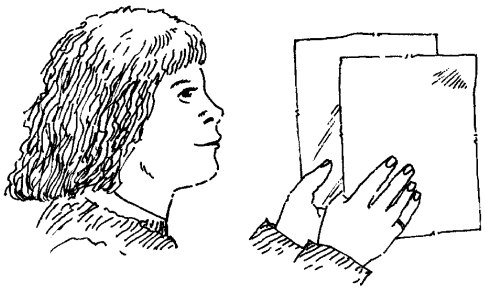
Activity 1

1. Place the end of the paper strip against your chin.

2. What do you think will happen if you blow across the top of the paper? Try it. Blow straight outward in a steady stream across the top of the paper. Direct your airstream outward and not downward at the paper. What happens to the paper? Why do you think this happened?

Activity 2

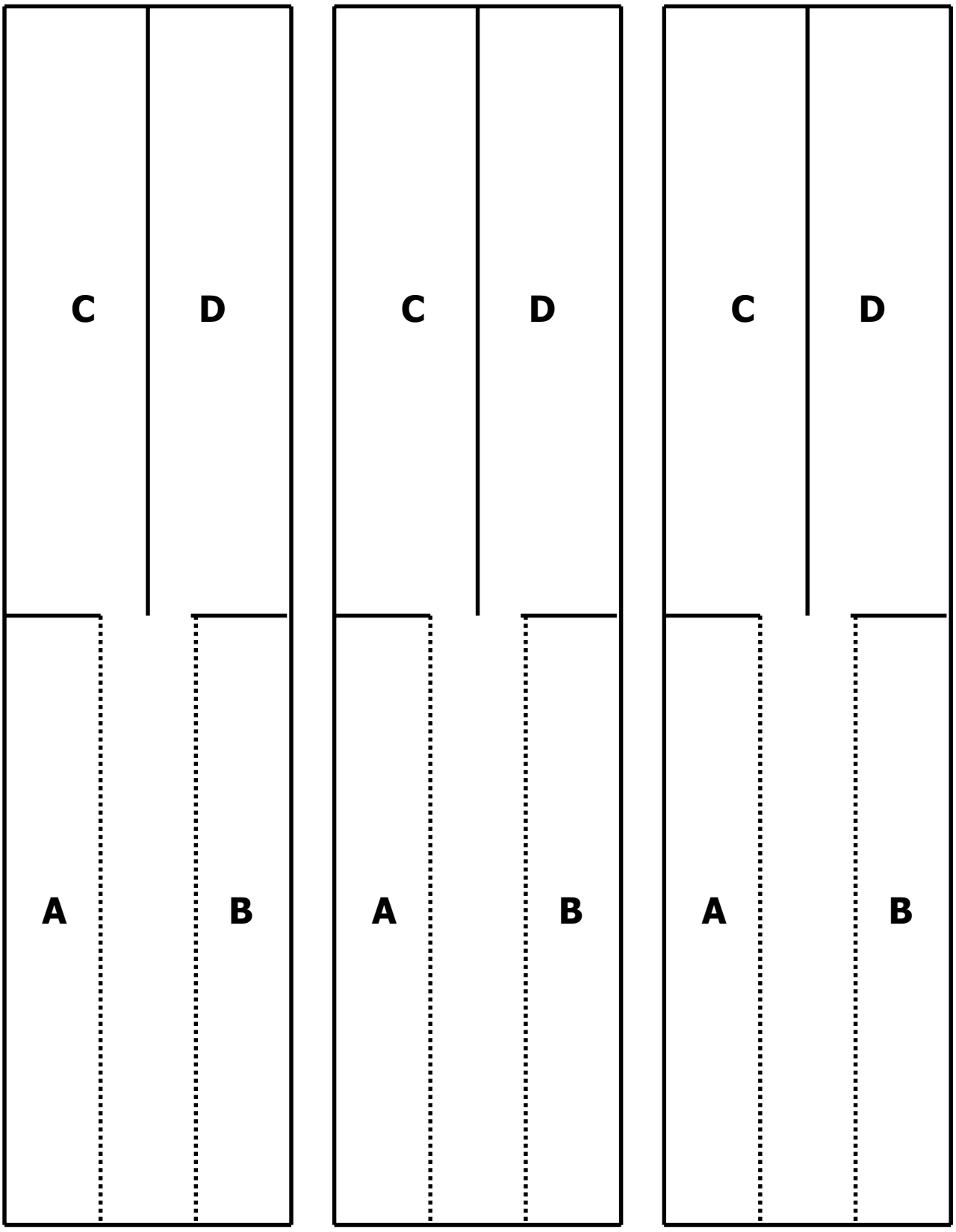
1. Hold 2 sheets of paper in front of your face, about 2 or 3 inches apart and side by side so that you are looking at the edges and the flat sides are facing each other.



2. What will happen if you blow a steady stream of air between the sheets? Try it. Blow a steady stream of air between them to try to blow them apart. What happens if you blow even harder? Why do you think the paper moves this way?

Extension: Whirly Birds

- Follow the directions on the Whirly Bird pattern on the next two pages to construct a Whirly Bird.


C
D
A
B
C
D
A
B
C
D
A
B

Whirly Birds

1. Cut along all of the solid lines of the Whirly Bird pattern.
2. Fold sections A and B toward each other along the dotted lines.
3. Hold the folded sections together by putting a paper clip at the end or by making one or two small folds at the end.
4. Point sections C and D in opposite directions.
5. Hold the Whirly Bird high above your head, with the blades on top and the folded section with the paper clip pointing down. Release the Whirly Bird.
6. Did the Whirly Bird rotate clockwise or counter clockwise? How can you make it rotate in the opposite direction?

Whirly Birds

1. Cut along all of the solid lines of the Whirly Bird pattern.
2. Fold sections A and B toward each other along the dotted lines.
3. Hold the folded sections together by putting a paper clip at the end or by making one or two small folds at the end.
4. Point sections C and D in opposite directions.
5. Hold the Whirly Bird high above your head, with the blades on top and the folded section with the paper clip pointing down. Release the Whirly Bird.
6. Did the Whirly Bird rotate clockwise or counter clockwise? How can you make it rotate in the opposite direction?

Whirly Birds

2. Cut along all of the solid lines of the Whirly Bird pattern.
3. Fold sections A and B toward each other along the dotted lines.
4. Hold the folded sections together by putting a paper clip at the end or by making one or two small folds at the end.
5. Point sections C and D in opposite directions.
6. Hold the Whirly Bird high above your head, with the blades on top and the folded section with the paper clip pointing down. Release the Whirly Bird.
7. Did the Whirly Bird rotate clockwise or counter clockwise? How can you make it rotate in the opposite direction?