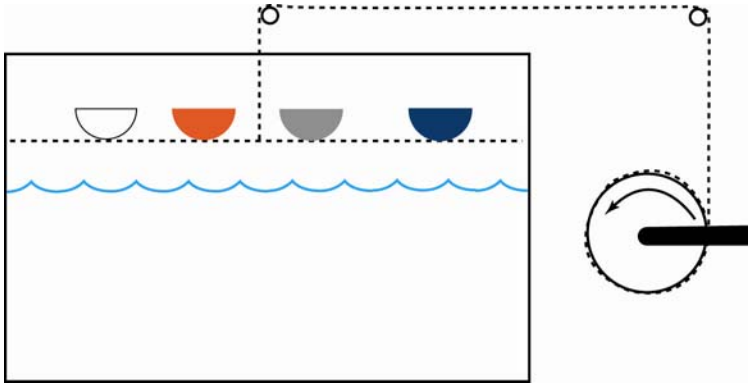
Why do ships float?
Melanie Hopkins
MSCOPE Project Proposal 2007

Type of Project: Hands-on exhibit
Target museum: SciTech
Target audience: Children 7-12

***Big Idea*:** The question posed above will be answered while illustrating the concept of density. Understanding that ships float because air, not solid metal, is displacing the water, promotes a general understanding how basic scientific principles may be used to great technological advantage. This concept may also be extended to the natural world, such as the structure of icebergs.

While the verbalization of such concepts is more suitable for older children (12-14), experimenting with floating and non-floating objects is experience that may be internalized by a younger student even if they are not yet able to verbalize "why". Younger students are thus exposed to the general concept that objects have different properties and can be made of different materials and that these properties may be measured in different ways.

***Exhibit description*:** The exhibit consists of a closed tank of water with a mesh grid resting above the level of the water. Different objects rest in the grid. The grid is attached to a handle with a spring. The visitor turns the handle to lower the grid and see which objects float and which do not. The spring release returns the grid to the level above the water when the visitor is done.



Objects may include solid materials with densities greater and less than water as well as at least one object which is made of a denser material with enclosed air spaces, either hollow or cup-shaped. A diagram above the tank identifies the different objects. A replicate set of objects is attached to exhibit but available for hands-on inspection.

Explanation *(potential label) with pictures of ships and diagrams of the particular objects the children are playing with:*

Objects of the same size and shape but made of different materials will have different weights. This is called **density**. Pick up and compare the objects below.

Which objects do you think will float and which will sink? Turn the handle to find out.

Why does an object float? In order for an object to float, the materials that it is made of must be on average less dense than the water it is displacing.
How do heavy objects, like ships, float? For big heavy things made of materials that are denser than water, like ships, the part of the ship which rests in the water must contain space filled with air. Because the air is less dense than water, the ship will float. Object X acts like a ship does because it is hollow and filled with air.

Evaluation I: Which objects to use?

The first concern is what sorts of comparisons best help children with the concept. For example:

(1) Objects are visibly different from one another (paint, color of material itself) but all the same size and shape. Here the control is the size and shape of the objects.

(2) Pairs of objects are made of the same material and weigh the same amount but are shaped differently, such as a half-sphere and a cup. Here the control is the weight of the pairs of objects.

Evaluation of the exhibit will begin by facilitated interaction of children with various objects in water. Pictures of ships will accompany toys and objects that both float and do not float and an open container of water that children can experiment with. This is an opportunity to experiment with different pairs of objects. This stage of evaluation is meant to answer the following questions:

(1) Is it easier for children to compare similarly shaped/sized objects or similarly weighted objects?

(2) Do children need to be able to compare a volume of water (say in a plastic bag) to the objects in order to make predictions about what will float and what won't?

(3) How much like a "ship" does a floating object have to be visually for children to make the connection between why each object floats?

Evalution II: Prototype

If the exercise appears to communicate the concept successfully, and suitable objects may be chosen, will students achieve the same learning if the exhibit is unfacilitated (and if they cannot place the objects in the water themselves?)