Program Description:

Students are introduced to the concept of complex machines made from simple parts, in which each step relies on the previous and triggers the next. They are shown examples created by Leonardo DaVinci and Pitagora Suicchi, a Japanese children's show. They discuss energy and the transfer of energy as well as force and motion. They use tracks, marbles, and other parts to build their own machines, developing a working understanding of energy transfer, motion, and precision. Discussion and follow-up materials can focus on analyzing the machine in terms of energy or force and motion, depending on the needs of different groups.

Learning Objectives:

1. Students will identify examples of energy, force, motion, and momentum in a system they create.
2. Students will learn to select from and use available materials to control energy, force, and motion.
3. Students will develop precision and problem-solving skills as they construct a reliable sequence of parts.

Alignment with Connecticut Core Science Curriculum

7.1 *Energy provides the ability to do work and can exist in many forms*

- Energy can be stored in many forms and can be transformed into the energy of motion.

8.1 *An object's inertia causes it to continue moving the way it is moving unless it is acted upon by a force to change its motion*

- The motion of an object can be described by its position, direction of motion, and speed.
- An unbalanced force acting on an object changes its speed and/or direction of movement.

Key Vocabulary: *balanced and unbalanced forces, potential energy, kinetic energy, transfer of energy, motion, speed, acceleration, trigger, system*

Preparation for Visit:

We can easily adapt the program to focus either on study of energy or study of force and motion, and provide follow-up materials in these areas. *Please let us know if you would like a particular focus.* The project is appropriate at the beginning of a unit in order to provide some experience with concepts and initiate investigation or near the end of the unit when students can apply what they have learned in order to understand why the machine works the way it does.

If the focus of your visit is *academic and related to energy or force and motion*, it is useful for students to have familiarity with the following concepts:

- Energy Study: Energy is conserved within a system, but can be transformed from potential energy to kinetic energy or heat due to friction.
- Force and Motion Study: There are a number of forces that can act on an object, including gravity, friction, or a force applied by another object. Unbalanced forces cause an object to accelerate or slow down.

This project can also be used for the development of *problem-solving, building, and inventing skills*, in which case little prior knowledge of specific concepts is needed.

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