Cool Moves! The Artistry of Motion

Science Content for Explainers
Training Video Script

In case you couldn't tell by the title, Cool Moves is an exhibition about motion, but not in the traditional sense. Sure, there is lots of science to be learned about the different forms of motion, and mostly that's what we will be looking at in this video, but, when you get down to the nitty-gritty, Cool Moves is about exploration and experimenting. The developers worked really hard to have each piece be as flexible and as open-ended as possible. The best thing an explainer can do is encourage visitors to experiment. There are no "wrong" things to try, as long as what someone tries is safe and won't damage the exhibit. Sometimes the best way to interact with a visitor, especially kids, is just to be a playmate. Don't feel like you need to be the expert. Let them tell you what the science is all about!

Let's start with the Giant Pendulum. You can move around the magnets on the base, flip them up or down, and let the pendulum swing to see what happens. As the pendulum swings, the magnet at the end of it will interact with the magnets on the base, causing it to either be attracted or repelled. The resulting motion is called chaotic because it is unpredictable. Now a word of warning, getting visitors to really understand chaotic motion is a tough nut to crack! In the dictionary, chaos is defined as a condition or place of total disorder; essentially, something out of control. It would seem that if you know the strength of each magnet, and the angle of approach, that you could predict how the pendulum will move, and that's kind of true. Try swinging the pendulum towards one magnet, so that it swings right back to your hand. Does it work? Can you do it twice in a row? Why not? The problem is that there are thousands of little variables that we can't control: like the breeze of someone walking by, or slight changes in how your hand releases the pendulum. These changes make it impossible to really predict how the motion starts. In a perfect world, we can do some math to predict how the pendulum will move, but the world isn't perfect. In the real world we can't control the initial starting point of the motion enough to be able to predict exactly what will happen beyond a short period of time. Small mismeasurements eventually add up to a big discrepancy between calculated and observed behavior.

Kids love to play in the Ripple Tank, but the real action is actually underneath, in the shadows. The waves of water created in the Ripple Tank can act like a model for the motion of waves of light or sound because one way energy travels is in waves. Let's put this parabola in the tank and see what happens. Do you see the circle forming in front? It looks almost like a bulls eye. That's a result of reflection. Reflection is when waves, bounce from a surface back toward the source. The inside of our ear is shaped like a parabola to reflect sound waves

and focus them towards the middle. A handy tool for explainers to have on the floor is a ruler. Try putting the ruler in the tank at different angles and see what happens to the ripples. Where do they go? The waves are bouncing off the ruler at different angles, like balls off the side of a pool table. The checkerboard pattern that forms in the shadows is because the waves reflecting off the ruler are running into and over the waves that are hitting the ruler. Another way waves move is diffraction. Try putting some cassette boxes in the tank, so that they are on end with small spaces between each other. Look at the ripples as they go through the spaces between the boxes. Do you see how they get bigger and bigger? Diffraction is when a wave goes through a small hole and creates a flared out shadow of the space when it comes out. We can hear around a corner because of the diffraction of sound waves. For instance, if a wall is next to you when you yell, the sound will move along the wall. Even though the wall stops, but the sound doesn't; sound will almost turn the corner of the wall. Now, lay the semi-circle so that it is completely under water. Now what do the waves look like? Look how they create this shape as they go over the semi-circle. This is refraction. Refraction is how waves are deflected when they go through or in this case over and around something. The wave changes the angle of its direction.

Wind Over Water uses a shallow pool of rheoscopic fluid. Rheoscopic fluid is a non-toxic liquid made up of tiny crystalline plates suspended in water. To be honest, it's made up of ground up fish-scales. Some people think the fish-scales are kind of gross, so we don't write that on the label, but it's your museum, so you make the call! When the liquid starts to move around, the microscopic platelets align themselves along the lines of flow. Scientists all over the world use fluids like this to help them visualize the motion of fluids around different objects to study things like wing aerodynamics. Let's take a look at what happens when the boats move through the fluid. Do you see these patterns coming from around the boat? The lines look pretty straight, curving around the boat. When a fluid travels along a smooth surface like the hull of our boat, without a lot of turbulence, it is called laminar flow. Water flowing smoothly and slowly from your faucet is another good example of laminar flow. Now, let's look for where it stops being laminar! There! See it! The lines start to swirl around in eddies and vortices. Turbulent flow causes a lot more drag, and slows down the boat. A good boat, car, or airplane is designed to have as much laminar flow and as little turbulent flow as possible. Too much turbulence over the wing will cause an airplane to lose its lift. A fun thing to play with is a golf ball! When you put the right spin on a ball through the air, it will actually create a "wake" in the air, moving the turbulent flow away from the ball's surface and reducing drag. Try spinning the golf ball clockwise. Where does the wake move? The ball deflects the fluid left causing, so this golf ball would curve to the right. If we spin it counterclockwise, the ball deflects fluid to the right, and the ball would curve to the left.

The demonstration cart gives floor staff a place to store things for easy access, like extra beach balls; and acts as a central location to do activities on-floor with

visitors. One of the demonstrations that has been most popular on our floor is the Spouting Bowl. This Chinese Fishing Bowl was cast from bronze in China, and behaves like a tuning fork. Just fill the bowl half-way with water, wet your hands a little, and rub the handles. It takes a little time to find the best spot on your hand to make it work, and there is not one best way to make it work, so the best advice I can give you is to play around with it until you find what works best for you. Once you get it going, the vibrations will be transferred through the metal, to the water, and you will see spout patterns form. There are four spout patterns on the normal tone, but there is also a higher tone that creates 8 patterns. One of the biggest hurdles is that first interaction with a visitor. Often, explainers are afraid of being intimidating or interrupting a visitor's activity. We have found this is a great way to draw in visitors and start a conversation. Just put the bowl on the cart, start playing, and the visitors come to you. Let them try the bowl! If they have a hard time getting it to work, ask to do it together. In reality, you are the one working the bowl, but the visitor never knows that. They can hear, see, and feel the sound as if they were doing it themselves.

Well that's a quick science tour of some of the exhibits in Cool Moves! Of course, there are lots of other science principles to talk about, like Bernoulli's Principle of Fluid Dynamics at Windy Wonders, or Simple Machines at Three-Wheeled Racers. Just remember to have fun and enjoy the process of exploration with your visitors. With any luck, they'll never look at motion the same way again!

Cool Moves! The Artistry of Motion

Floor Staff Maintenance Checklist
Training Video Script

Hi! Welcome to Cool Moves! The Artistry of Motion built by the Sciencenter in Ithaca NY, and the Rochester Museum & Science Center. My name is Calvin Uzelmeier, and I'm an Educator here at the RMSC. I'll be guiding you through this video, that's designed to help floor staff work with the exhibits better.

The video will be broken into 2 parts. First we will look at each exhibit to create a checklist of things that floor staff can do to help maintain the exhibits. Second, we'll work with a few of the exhibits and look at some of the science content, and fun ways explainers can interact with visitors.

Let's get started!

It's useful to create a checklist for floor staff to go through each morning. That way, if something is missing or needs adjusting, they can notify the right people. This is not a list of things for floor staff to fix. These are things that floor staff can look for, because the quicker they find them, the quicker they can be fixed. Whenever you find a problem, go through the proper channels so that your exhibits staff gets the word and can fix it.

Let's start with the entry piece, Turbulent Orbs. A lot of people will walk through here over the course of a day, and after awhile the base might slide enough that the plug comes out. Just look to see that the fluid is moving in the orbs, and that the orbs light-up when you step on the pressure pads.

The Animals in Motion kiosk will automatically turn on if plugged in, but the program itself needs to be booted. If your museum turns off the power every evening, just reach down to the hole that is on the bottom right-side of the cabinet, and press the button that is inside to boot the program. Once the program is up and running, just select an animal and move the dial a bit to make sure the motion control is active.

At the Three-Wheeled Racers exhibit, check to be sure that there are 4 wooden bodies, and 4 white wheels at the track. You should also give the steering wheel at the back a full 360 degree turn to make sure the track is moving up and down OK.

Turn on each Touchable Tornado and make sure they are working. If no tornado forms, they need to be refilled with water.

Wind Over Water contains some rheoscopic fluid that sometimes settles if the exhibit is turned off overnight. Each morning just put your hands in here and move them around to help get the crystals off the bottom of the tub.

At the Giant Pendulum, how many magnets you use at a time is up to your individual museum. At the RMSC, we use 3, but the Sciencenter uses 5. However many your museum decides to use, make sure they are all there, and none are broken.

The TV for the Artistry in Motion video will turn on as soon as it receives power, but the DVD player needs to be started. I would suggest storing the remote control somewhere safe where floor staff and exhibits staff can access it when needed. To start the video, point the remote control towards the bottom of the TV and hit "Play".

At the Ripple Tank, there are 3 plexi shapes to look for: A parabola, an "L" shape, and a half-circle. Also, turn on the tank and make sure that the light turns on and the ripple generator starts.

At Swivel Art, make sure there is enough blank paper, and that the pen works. You may want to check back to this a few times each day to see if the pen needs to be replaced, paper needs to be refilled, or trash can needs to be emptied.

Windy Wonders comes with several different objects, You can choose to have them all out at the same time, or you may want to switch them around. If you would like to only keep a few out at a time, the morning is the perfect time to choose which ones will be out that day, and store the others back in the Demonstration Cart.

Well that's the whole checklist! By taking a few minutes each morning to run through this, you should be able to catch any potential problems early, so that your visitors and your staff can enjoy the rest of the day!