

THE WORLD OF
HILARIOUS
INVENTION!

EXHIBIT

EDUCATOR GUIDE



Rube Goldberg™, The World of Hilarious Invention Exhibit! is created by the Children's Museum of Pittsburgh in partnership with the Heirs of Rube Goldberg.

INTRODUCTION

Rube Goldberg™, The World of Hilarious Invention! Exhibit, showcases Pulitzer Prize-winning humorist and inventor Rube Goldberg™'s iconic contraptions, imaginative illustrations, and humorous storytelling, celebrating his skills as both an artist and inventor.

The goal of the exhibit is to showcase Rube Goldberg's contraptions to introduce audiences to the creative processes behind the machines. The exhibit uses authentic 3D recreations inspired by original Rube Goldberg illustrations with newly created interactive components, designed and built by Children's Museum of Pittsburgh, to convey the humorous narratives and inventive thinking that embody Rube's work. His contraptions become not only an entry point for deeper exploration of themes related to storytelling, but to the way things work. A chain reaction can be an important part of developmental thinking, from how our electronics work, to the language of coding, to choosing the right bait, hook, and rod to reel in a fish -- "A" to "B" to "C" logic permeates all aspects of our modern lives.

What better way to learn this cultural truth than through the work of the man who made us laugh at how we problem solve in the first place and seeing his influence on 21st-century makers and artists? Original illustrations by Ed Steckley from the award-winning children's book, Rube Goldberg's Simple Normal Humdrum School Day, a collection of new responsive chain-reaction exhibits, and videos featuring the latest chain-reaction machines from all around the world tell the bigger story of Rube Goldberg's legacy.

In this exhibit, visitors activate and create crazy chain-reaction contraptions that use everyday objects to complete simple tasks in the most overcomplicated, inefficient and hilarious ways possible. Rube Goldberg machines are many things, but they aren't perfect. Find the fun in failure as you step into the role of illustrator, storyteller, and inventor.

"You have to have courage to be a creator" –Rube Goldberg



WHO IS RUBE GOLDBERG?

Rube Goldberg (1883-1970) was a Pulitzer Prize-winning cartoonist best known for his zany invention cartoons. He was born in San Francisco on the July 4, 1883 - and graduated from U. Cal Berkeley with a degree in engineering in 1904. His first job at the San Francisco Chronicle led to early success, but it wasn't until he moved to NYC and began working for Hearst publications that he became a household name. Rube Goldberg is the only person ever to be listed in the Merriam Webster Dictionary as an adjective. It's estimated that he did a staggering 50,000 cartoons in his lifetime. For videos about Rube: <https://www.rubegoldberg.com/about/>.

A Rube Goldberg Machine is “a comically involved, complicated invention, laboriously contrived to perform a simple operation” (Webster’s New World Dictionary). Humor and a narrative are what separate a Rube Goldberg machine from a chain-reaction machine. Each of Rube’s cartoons told a story and his entire goal was to get you to laugh.

Rube Goldberg, Inc. is dedicated to keeping laughter and invention alive through the legacy of its namesake. Annual competitions, image licensing, merchandising, and museum and entertainment opportunities continue to grow and enhance the brand. At the helm is Rube’s granddaughter, Jennifer George. Her her recent book, *The Art of Rube Goldberg* highlights Rube’s iconic career, celebrates his legacy, and reminds people everywhere of the laughter fostered in Rube’s works.

Rube didn’t care if the machine worked, only if it made you laugh.



WHAT'S IN THE EXHIBIT

Like Rube Goldberg, visitors activate and create chain-reaction contraptions using everyday objects to complete simple tasks in the most complicated, inefficient and hilarious ways possible. This unique exhibit experience was designed with the following goals in mind:

- Share Rube's artistic practice and irreverent sense of humor with audiences.
- Inspire visitors to be inventors, storytellers, and critical thinkers.
- Create a vocabulary of elements from Rube's chain reaction illustrations accessible and understandable to visitors of all ages.
- Present STEAM content in a way that encourages socio-emotional learning.
- Provide authentic experiences that inspire joy, creativity, and curiosity.



Not only is this exhibit a true celebration of Rube's imaginative techniques, humorous storytelling, and inventive skills; it is a true testament to how learning happens in many different ways. Educators, learners, and caretakers will see learning manifested in the following themes:

Embrace Humor

Rube Goldberg made nearly 50,000 cartoons throughout his life. His machines use inventive storytelling and are all about the joke. Rube's inventions use extraordinarily complex and indirect mechanisms to perform a simple task. Look for the everyday objects embedded in the machines and ask your child, "How is this a funny machine?"

Sensory Exploration & Experimentation

This exhibit is all about hands-on experimentation. Feel free to touch different parts of the machines and spend time exploring the different elements. What sounds do you hear? What textures (both familiar and unfamiliar) do you notice? How might they help with the machine's function? What happens when you manipulate the different parts? Can one thing work more than one way? YOU get to be the storyteller. Explore the cause-and-effect relationships of each machine. The Free Play table with dominoes and other objects is a great place to start this process.

Teamwork & Collaboration

Understand how each machine works by working together. How can you work together to make the machine accomplish its intended task? How does collaboration affect the reset process? Team up with your child or other visitors to troubleshoot and model investigative learning.



WHAT'S IN THE EXHIBIT, CON'T

Cause and Effect Relationships



Investigate the different parts of each machine separately. Explore how each individual step affects the resulting processes and notice how each individual part of a machine relates to the whole. Follow along with arrow, number, and letter sequences to guide your progress.

Energy and Scientific Elements

This exhibit is rich in opportunities to explore basic engineering concepts and expose children to the scientific method. Ask open-ended questions: “What does this remind you of?” or “What does this part look like?” Then, form and test hypotheses and work together to problem solve. Engage in the process of trial and error and discuss what steps help the machines perform the intended tasks. Explore the concepts of gravity and momentum. Point out the different scientific elements embedded within each machine: turn cranks, test magnets, move pulleys, and point out springs.

Patience & Anticipation



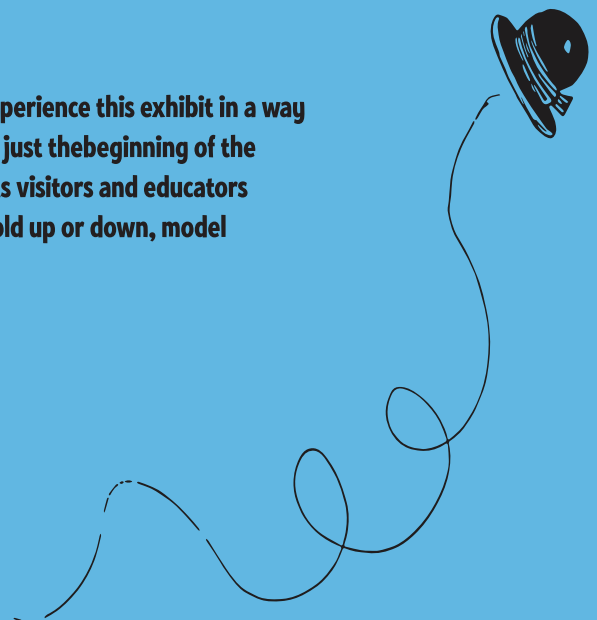
Don't rush - spend as much time as you'd like at each machine. Try them more than once: how is each experience different? What new things do you notice with repetition? Savor the anticipation that builds at each step of the machine. Keep in mind that younger learners need time to experiment with repetition.

Embrace Failure & Celebrate Success



To create and innovate takes courage. It also takes patience and perseverance. Find the fun in failure and enjoy moments of victory while figuring out a complex process. Try framing failure for your child as just a form of practice that helps us learn: if we make mistakes, we know we are learning and growing! And remember, Rube never intended for his machines to actually work!

With these themes in mind, learners, caretakers, and educators will experience this exhibit in a way that is in true Rube fashion. Please keep in mind that these themes are just the beginning of the learning and experiences that will happen in Rube Goldberg exhibit. As visitors and educators become more comfortable, there will opportunities for people to scaffold up or down, model learning, and explore in new ways.



VISITING TIPS

In this section, tips and tricks are provided to ensure that caregivers, educators, and learners of all ages experience the exhibit in the best way possible.

For Caregivers & Families

Connect it to Home

All of the machines depict actions that you might do at home: cleaning, cooking, ironing, or making music. Connect with your child by looking for familiar household objects. Use the machines as a launchpad for making chores more playful. For example, challenge your child to invent a cleaning apparatus at home.

Ask Open-Ended Questions

Rube Goldberg machines are designed around a narrative. Ask questions with your child to fill in some of the details, such as:

“What is this machine trying to accomplish?”

“What makes this machine funny?”

“What object would you add to this machine?”

Team Up

Approach the machines as a collaborative component. Try to work with your child instead of directing from afar, but give them space to try and fail. Model how you would solve a challenge, encouraging patience and persistence.

General Tips

Allow ample time in the space. Prepare for more time than expected due to trial and error and experimentation.

Point out the context cues like arrows and number and letter sequences.

Resetting the contraptions can happen forwards or backward. See what works best!

Let children know that machines can be tricky. Frame the exhibit as an opportunity for problem-solving.

VISITING TIPS

For Museum Staff & Visiting Educators

Act as a Model Learner

Prepare students and visitors for the experience of not knowing how something works. The machines are intricate enough that adults can also experience learning through trial and error. When you first see a machine, the task or goal may not be obvious. Approach this feeling of not knowing with the same open-mindedness and persistence you wish the students to have. Keep in mind that talking aloud through your thinking can be a powerful example for learners. “What does this slide do? Oh yeah - it slides!”

Slow Down

The more you put into this exhibit, the more you will get out of it. Tinker with individual elements and allow enough time to focus on each machine in the exhibit. Patience and a slow pace will be rewarded with rich learning opportunities embedded within each machine and contraption.

Collaboration is Key

Visitors will benefit most from working together to make the machines work. Encourage your students to break up into small groups to figure out the exhibits. Allow them to self-select and work with friends with whom they work well together. Once they master their machine, have them demonstrate to the rest of the group. That element of communication and presentation helps cement the learning that has happened!

Follow the Clues

Prime your students to approach the machines like a detective. Look for clues as to how the machine works - the visual signs are often the best clue. Ask leading questions like:

“Where do you think we put the ball?”

“Can we tell how many balls this machine needs?”

“What position does the sign show?”

“How does _____ affect _____?”

Embrace Failure and Celebrate Success

Your students may experience failure as they set up a machine and something goes awry. Embrace these as teachable moments to foster patience and persistence in students. Try to find the humor in the situation, and remember that the machines are designed for laughs. Finally, don't forget to savor the celebratory moment when your students meet success.

STRATEGIES FOR ENGAGING YOUNG CHILDREN

Engaging young children in the exhibit can be tricky. Consider the tips below to scaffold learning for young children.

I Spy. Find household items and talk about how they are used in different ways in the machines. Try to spot animals and find numbers and letters.

Encourage **sensory exploration** of the space. It's okay to pick up balls, interrupt the sequence, or move magnets around. Encourage and accept the curiosity and exploration that naturally happens in this exhibit!

The **free play table** is a great place for young learners to begin exploring cause and effect relationships. Experiment with dominoes and move around different objects to see how sequence and placement affect outcomes.

Try focusing on one part of the exhibit. See what **small details** children are naturally drawn to and talk to them about their observations. What are they curious about?

Have young children **make up their own story** for the machine. What new sounds could they invent to add to the machine?

Identify feelings: Does you or your child feel frustrated? Confused? Victorious? Express and share these feelings. Validate their emotions: let them know it is okay, even natural, to be frustrated or confused. Model curiosity and persistence and work through emotions together as you problem-solve. Approach each machine like a puzzle to be solved, using phrases like, "I wonder if..." or "What if we tried..." And, of course, do not forget to celebrate when you accomplish a goal!

Explore basic physics together: What happens when a ball is released on a ramp? Why does it roll? What happens when your child activates a lever or turns a wheel? How do these simple actions influence the other parts of the machine?

INDIVIDUAL COMPONENTS



Inspired by Rube's original illustrations and inventive storytelling, this exhibit contains a collection of three-dimensional life-size machines and hands-on, interactive components that connect Rube's iconic cartoon contraptions to the way things work in the physical world.

In this section, each individual machine in the exhibit will be highlighted to provide insight into the legacy of Rube and how classic engineering principles can be reimagined as entry points for deeper exploration of STEAM concepts for 21st-century learning.

All About Energy

Keep in mind, kinetic and potential energy are at play throughout the exhibit.

Energy is the ability to do work. Objects have potential energy when they're in a position that can lead to motion (like being held back by a spring or resting on top of a hill). Kinetic energy occurs when the object starts to move and can have different results depending on the object's mass and velocity.

| <h2 style="text-align: center;">COMPONENT</h2> | <h2 style="text-align: center;">DESCRIPTION</h2> |
|--|---|
| <p style="text-align: center;">SELF-OPERATING NAPKIN PHOTO OP</p>  | <p>Step into one of Rube’s wearables, “Self-Operating Napkin Machine.”®, for a one-of-a-kind photo opp experience that lets the visitor be professor Butts in the iconic invention illustration.</p> <p>Embrace Humor: Don’t be afraid to have a little fun and laugh at yourself. Embrace being a part of a Rube classic.</p> |
| <p style="text-align: center;">ART STUDIO</p>  | <p>In the art studio, you can look at some of Rube Goldberg’s iconic drawings and comics and also create some of your own. Turn the knobs on the View Ffinder to look at examples of some of Rube’s original comics showing his wacky inventions. Once you’re feeling inspired, try out some of Rube’s drawing techniques at the drafting table and create your own comic or machine.</p> <p>Embrace Humor: Look for the trademark strange objects featured by Rube in his comics. Do you recognize any elements in his comics that also appear in the exhibit?</p> <p>Sensory Exploration & Experimentation: It’s your turn to be the storyteller. Try out different shading and hatching techniques like Rube used in his drawings. How do different drawing methods create an illusion of texture?</p> |

COMPONENT

DESCRIPTION

VIEWFINDER



Can you believe Rube Goldberg drew nearly 50,000 cartoons in his lifetime? Use the Rube Goldberg Viewfinder to slide through a timeline of Rube’s work. Turn one of the notched wheels and a cartoon will slide into view with a satisfying plop. The Viewfinder features dozens of cartoons, comic strips and articles. Curious about how Rube would design an alarm clock, home vacation machine, or an alternative to gasoline-fueled car? Find it here by exploring Rube’s wheelhouse - literally!

Embrace Humor:

With the Viewfinder, you can immerse yourself in Rube’s visual language, almost as if you were flipping through the artist’s portfolio. Discovers many of his most hilarious machines, such as “No More Oversleeping.”



DRAFTING TABLES





The Drafting Tables offers you the chance to inhabit the role of cartoonist. Have a seat at an angled drafting table and practice your cartooning skills. Try your hand at cross-hatching, the technique Rube and many cartoonists use to give shading and texture to their drawings. Once you practice your strokes, use what you have learned from Rube’s visual language to draw your own machine.

Sensory Exploration:

The Drafting Table helps you get into the cartoonists’ mindset. Explore how it feels to make thin versus thick lines. Squint your eyes at a drawing with cross-hatching - do you see the patterns of light and dark?

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| <div style="text-align: center; margin-bottom: 20px;"> <h3 style="margin: 0;">DIE CUT A BOX</h3> </div>  | <p>Die cutting is a process in which a machine cuts the exact same shape over and over. In this exhibit, it acts like a cookie cutter for an unfolded box shape.</p> <p>This component highlights the hard work put behind these machines! Visitors have to use their muscles to crank the machine so that it can squish the paper against the die. Then, the challenge is to turn a flat piece of paper into a box!</p> <p>Sensory Exploration & Experimentation: Although boxes share the same shape, they can be made in different ways. Experiment with folding the die cut paper in different ways. How could you make a box using two pieces of paper? What about three?</p> <p>You can also experiment in reverse. Start with a rectangular prism, like a cereal box. What 2D shapes can you find on the prism? How many squares? How many rectangles? Then, dissect the prism so that it is in as few pieces as possible (ideally one flat piece), and examine the folds and shapes that created the 3D object.</p> <p>Energy and Scientific Elements : The tray that holds the die moves back and forth under the roller with the help of a crank. You may have used a crank before if you have sharpened a pencil or used a fishing rod. What other cranks do you see in the exhibit and what are their jobs?</p> |
| <div style="text-align: center; margin-bottom: 20px;"> <h3 style="margin: 0;">REVOLVOMETER</h3> </div>  | <p>The Revolvometer turns the Art Museum on its head. This interactive contraption is based on Rube’s cartoons, “How to Look at Modern Art” and “Revolvometer.” Making art is not only about creating a picture, but also choosing how it is viewed. Take examples of modern art masterworks and view them from different angles on the revolving picture frame. Or, experiment by revolving your own piece of art.</p> <p>Sensory Exploration: Turn the wheel and experiment with your visual senses by viewing art from different angles. Do different shapes or objects appear as you rotate the artwork? You make the call about what is most pleasing to your eye.</p> <p>Embrace Humor: Look at Rube’s cartoon, “How to Look at Modern Art.” What if we used silly contraptions to look at art? Can you imagine going to an art museum and viewing things upside down? Imagine how funny it would be.</p> |

| <h2 style="text-align: center;">COMPONENT</h2> | <h2 style="text-align: center;">DESCRIPTION</h2> |
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| <div style="text-align: center; margin-bottom: 10px;"> <h3>MAGNETIC RAMPS</h3> </div>  | <p>Create paths with magnetic ramps and tunnels. What building strategies are helpful to get the balls from one side to the other? Try different configurations and placements of the parts and pieces: how can you help the balls move from one side to the next? What makes them go faster and slower?</p> <p>Teamwork and Collaboration: Form teams and work together to create racetracks for the tortoise or the hare. How does collaboration affect your success?</p> <p>Embrace Humor: This is a perfect place to create your own funny story! Each ramp has objects from a Rube classic that you can use to narrate your contraption!</p> <p>Energy and Scientific Elements: Explore potential and kinetic energy with ramp experiments. As you change the steepness of ramps, the acceleration of the ball changes. Why? The ball loses gravitational potential energy, which translates into an increase of kinetic energy.</p> |
| <div style="text-align: center; margin-bottom: 10px;"> <h3>CLEANING MACHINE</h3> </div>  | <p>This machine adopts a very playful approach to household chores (for example, dirt is literally swept under a rug). How does it inspire you to make cleaning more fun?</p> <p>Embrace Humor: Study all of the household objects used in this machine. Which ones seem a little out of place?</p> <p>Cause and Effect Relationships: You are the catalyst for this machine. Pull back the boxing glove to punch a ball and set the machine in motion. Study the sequence of actions to get a sense of how each individual part is important for the success of the whole machine.</p> |

COMPONENT

DESCRIPTION

COOKING MACHINE



This machine makes the task of cooking even more challenging and complex than it already is. It provides visitors with a wonderful opportunity to test the scientific method: make and test hypotheses about what will happen, and embrace iteration and problem-solving.

Embrace Failure & Celebrate Success:

Take the time to focus on some of the smaller tasks to better understand how the machine operates. Learn from mistakes and multiple attempts and approach the task with the same humor and playfulness Rube used.

Energy and Scientific

Elements: A variety of fundamental scientific concepts are embedded here waiting to be discovered. Study how the hedgehog uses momentum to gain speed, look for the potential energy of the hammer, and discover how pulleys of different sizes can change the direction of the force.

MUSIC MACHINE



The Music Machine contains no fewer than 3 musical instruments. Have a sonorous experience as you pull a string and unfold a chain reaction involving a roving bookshelf, magical wind chimes, step levers, slide whistle, magnetic-break ramp, and a dramatic cymbal crash. Watch as some things move fast and others crawl at a snail's pace.

Teamwork and Collaboration:

There are a lot of moving parts to making music. Don't be discouraged if someone is working on a different section of this machine. Instead, work together to the sweet sound of music.

Energy and Scientific Elements:

The instruments in this exhibit aren't in your normal orchestra. The whistle sound that is made from the machine is controlled by a piston that compresses air. Take a closer look and see how the sound is being made.

Science Behind the Machine:

Thanks to a combination of friction and magnets, acting as a small brake, there is a spot in the Music Machine that has a fixed speed. Can you find it?

Sensory Exploration:

This machine is literally music to your ears. Which sounds do you enjoy most? Can you change any sounds by manipulating the contraption?

COMPONENT

DESCRIPTION

CHALLENGE TABLE



Jump in and explore open-ended chain reactions at the Free Play Table. Create your own challenge with recognizable components such as wheels, dominoes, tires and things that move! Use the terrain of the table to get from A to B. If you're looking for a goal, try to ring one of the bells. And remember, its okay if your machine doesn't work!

Sensory Exploration and Experimentation:

This is the perfect spot to engage with all of the elements of the exhibit that learners may not be able to see or touch. Experiment with ramps, wheels, and obstacles.

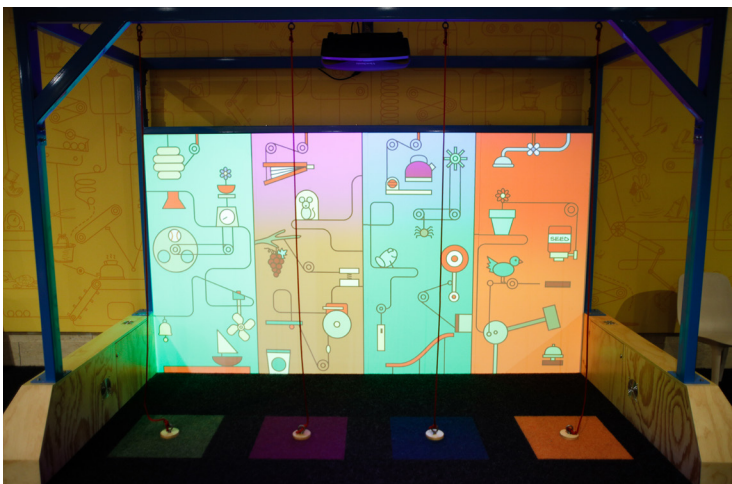
Embrace Failure and Celebrate Success:

There will be plenty of times where things don't go as planned at this table. Things will tumble, fall, or stay standing. It's important to embrace failure and celebrate successes. Some will be caused by you, and some will be caused by others - but keep a good attitude.

Teamwork and Collaboration:

This table allows many opportunities to work by yourself, or as a team. Try collaborating with your neighbor to build a chain reaction.

MUSIC MURAL



Witness unique interactions between the real world and a digital screen at the Music Mural.

Sensory Exploration & Experimentation:

Pull the ropes to start the music. Starting at the top of each panel, track the progress of each task. Listen for the sounds at each step: can you detect the change in pitch?

Cause and Effect Relationships:

Observe the importance of each small step for the success of the larger task. Pay attention to the different levels. When the bee pollinates the flower, how does it activate the next step in the process?

ADDITIONAL RESOURCES

These ready-to-go resources are a great catalyst for learning.
These suggestions can be used before or after visiting the exhibit.

Book List

Rube Goldberg's Simple Normal Humdrum School Day by Jennifer George

Rube Goldberg descendant Jennifer George celebrates all aspects of her grandfather's career, from his very first published drawings in his high school newspaper and college yearbook to his iconic inventions, his comic strips and advertising work, and his later sculpture and Pulitzer Prize-winning political cartoons. This book can be a great resource to make direct connections between Rube Goldberg's original comics and the exhibit.

Coppernickel, The Invention by Wouter van Reek

Coppernickel has been reading his big book all morning, about all the inventions that have ever been made. But when he gets to the end, he finds that the last page is blank. "Let's make our own invention," Coppernickel says to his dog Tungsten. What ensues is nothing less than crazy mechanical madness as Coppernickel learns that when it comes to making inventions, sometimes simplicity is best.

Rosie Revere, Engineer by Andrea Beaty

Where some people see rubbish, Rosie Revere sees inspiration. Alone in her room at night, shy Rosie constructs great inventions from odds and ends. However, she hides her inventions away under her bed because she's afraid of failure. Then, a fateful visit from her great-great-aunt Rose shows her that a first flop isn't something to fear—it's something to celebrate.

ADDITIONAL RESOURCES

TOON Book Series

Just as Rube Goldberg used comics to illustrate his inventions, young readers can develop familiarity with comics in an age-appropriate format. TOON Books are comics designed for children ages three and up.

Level 1: First Comics for Brand-New Readers

INTEREST LEVEL: Age 3+

READING LEVEL: Grades K-1

Adele in Sand Land by Claude Ponti

Follow Adele on her sandbox discoveries of a barefoot king, a cloud of fluffy chicks, and a dessert island.

A Trip to the Bottom of the World with Mouse by Frank Viva

There's so much to see at the bottom of the world! Join a young explorer and his best friend, Mouse, on a sea journey to Antarctica, where they make new friends with penguins and a whale - and have all kinds of fun.

Wordplay by Ivan Brunetti

Go "outside," "elsewhere," and down the "rabbit hole" with this humorous introduction to compound words.

Level 2: Easy-to-Read Comics for Emerging Readers

INTEREST LEVEL: Age 4+

READING LEVEL: Grades 1-2

Benny and Penny in The Toy Breaker by Geoffrey Hayes

Benny and Penny hide every toy and tell Cousin Bo he can't play with them. Will the three mice find a way to play without something getting torn, ripped, or snatched away?

Level 3: Chapter Books for Advanced Beginners

INTEREST LEVEL: Age 6+

READING LEVEL: Grades 3+

Zig And Wikki in Something Ate My Homework by Nadja Spiegelman & Trade Loeffler

Zig and Wikki are in search of a pet when they land on a planet full of strange creatures like flies, frogs, and raccoons.

TOON Graphics: Graphics for Middle-Grade Visual Readers

INTEREST LEVEL: Age 8+

READING LEVEL: Grades 3-6

Lost in NYC: A Subway Adventure by Nadja Spiegelman

Pablo's first day in a New York City school quickly goes off the rails during a field trip to the Empire State Building. Pablo accidentally gets on the wrong train, but with help from a new friend and from the city itself, he soon is on the fast track to becoming a local. This story—which features maps, archival photos, and fascinating facts—will help readers explore the subway without leaving their seats.

PRE- AND POST- VISIT ACTIVITIES

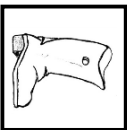
- Draw Your Own Rube Goldberg Machine**
- Catapults/Simple Machine Experimentation**
- Letter Key Overview**
- Rube Challenge**
- Become an Inventor**
- Scientific Scavenger Hunt**
- Draw a Comic: Shading Practice Sheet**

DRAW YOUR OWN RUBE GOLDBERG MACHINE!

CAN YOU ADD ANY OF THESE ITEMS TO YOUR MACHINE?



STRING



BOOT



HAMMER



BOTTLE



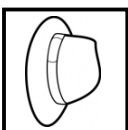
**BOWLING
BALL**



FOUNTAIN



PULLEY



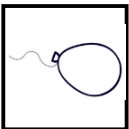
HAT



LEVER



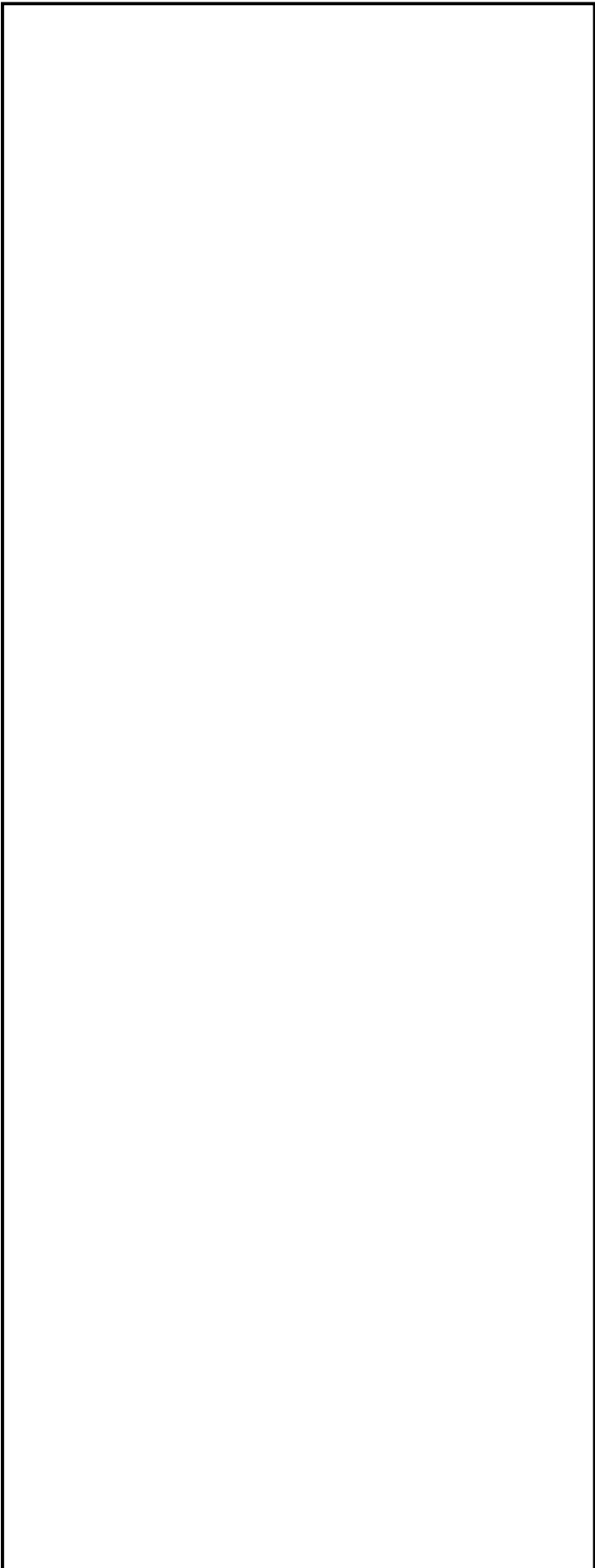
SCISSORS



BALLOON



DOG



CATAPULTS/SIMPLE MACHINE EXPERIMENTATION

Use popsicle or craft sticks, rubber bands, and other household objects to create your own contraption. This activity can be facilitated in collaboration with learners who can count or use manual dexterity to assist in building the machine and can be elevated to complex engineering and design experiments for more advanced learners.

Materials per catapult:

7 popsicle or crafts sticks (jumbo size preferred)

6+ rubber bands

1 plastic spoon

1 ping-pong ball

Step 1

Count five craft sticks. Place them on top of each other in a parallel stack. Use a rubber band to secure the sticks about an inch from one end, then repeat on the other end. Set the stack aside.

Step 2

Take a new craft stick and wrap at least two rubber bands securely around the stick. They should be firm, but still offer enough elasticity to slip the plastic spoon handle underneath.

Step 3

Pulling the wrapped rubber bands up slightly, slide the plastic spoon handle underneath. The scoop end of the spoon will stick out just a little over the stick, with the scoop in a concave position. Adjust the placement of the rubber bands if needed, so that the plastic spoon handle does not move wiggle away from the stick too much. Have this spoon/stick combo ready to combine with the next step.

Step 4

Take a new craft stick and place it underneath your spoon/stick combo, with the two sticks aligned and the head of the spoon at the top in a concave position. Take a new rubber band and secure the bottoms of the two sticks together. Ensure that you are able to stretch the sticks apart slightly on the opposite end (the end with the spoon head) without the rubber band snapping off the bottom, and adjust accordingly.

CATAPULTS/SIMPLE MACHINE EXPERIMENTATION

Step 5

While holding the two sticks from Step 4 open slightly, slide the stack from Step 1 between them, perpendicular to the spoon sticks (it should look like you're adding airplane wings or making a "+" shape). Wedge the stack far enough down towards the rubber band holding the two sticks together so that the spoon head side becomes springy when pressed down, but not so far down that the rubber band at the bottom snaps off.

Step 6

Using one or two rubber bands, secure the three bottom stick ends (excluding the spoon head end) so that they won't wiggle apart. Try wrapping the rubber bands in multiple criss-cross motions, connecting at least two ends with a single rubber band.

Step 7

Test your catapult. Balance a ping pong ball in the concave part of the spoon head, hold or secure the end of the catapult, and use one or two fingers to gently pull the tip of the spoon downward before quickly letting go. Take note of the direction and distance the ball travels, and repeat the experiment.

Tips

Record your findings by marking where the projectile lands with masking tape on the floor. Have measuring tools like yardsticks and measuring tape ready to calculate precise distances.

Rubberband placement and tightness can make a significant change in the projectile results. Add, remove, tighten, and loosen rubber bands and notice any differences. Try moving the spoon up or down to see how the results may change. You can even add more sticks to your wedge stack and change the stack placement to alter your results.

Alter your projectile, but make sure to do so safely. Ping pong balls are a good choice to start because they are light-weight and inexpensive but don't pose a choking hazard. Consider whether different projectile textures and weights might enhance the experiment. Keep in mind that heavier projectiles can injure others if they come into contact with them mid-launch.

SCIENTIFIC SCAVENGER HUNT

Try a scavenger hunt at home or in the classroom with open-ended prompts inspired by elements found in the Rube Goldberg machines.

Find something **magnetic**

Find something that **rolls**

Find something that uses a **pulley**

Find an object that uses a **spring**

Find something that makes a **unique sound**

Find an **everyday object** that could be used for **something else**

Draw a picture of what you found.



BECOME AN INVENTOR!

HIS INVENTION CARTOONS WERE WHAT MADE RUBE GOLDBERG A HOUSEHOLD NAME. THEY WERE RENDERED IN THE EXACT STYLE OF US PATENT APPLICATIONS LABELED WITH A LETTER SO THAT THE READER COULD FOLLOW THE CHAIN REACTION SEQUENCE. RUBE'S INVENTIONS WERE DESIGNED TO WORK, BUT DRAWN FOR LAUGHS.

DREAM UP YOUR OWN INVENTION AND CREATE A PATENT APPLICATION BELOW.

INVENTION:

INVENTOR:

DATE:

DESCRIPTION OF INVENTION:

DRAW AND LABEL INVENTION HERE:

LABELED PARTS OF INVENTION:

A-

B-

C-

D-

E-

F-

G-

H-

I-

J-

RUBE CHALLENGE

You are invited to a Rube Challenge!

Challenge yourself and your learners to an exciting contest where you will make a unique contraption that completes a simple task using everyday items, teamwork, humor, and their imaginations. This Rube Challenge is held to celebrate the Rube Goldberg™, The World of Hilarious Invention! Exhibit at the Children's Museum of Pittsburgh.

What Should Your Contraption DO?

Create a contraption that can creatively POP a balloon.

What is a Rube Goldberg Machine™?

A Rube Goldberg Machine™ is a crazy contraption which accomplishes a simple task in the most complicated - and funniest - way possible. It uses everyday items (mostly junk.) to tell a story and, most important of all, it makes you LAUGH.

What will I need?

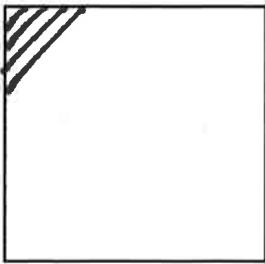
There is no wrong way to build your contraption, so you can use anything to make your idea come to life. Some tried and true materials are:

**Hot Wheel Cars
Ramps
PVC Pipe
Bouncy Balls
Duct Tape
Cardboard
Paper Towel Rolls
Funnels
Ping Pong Balls
Scissors
Hot Glue**

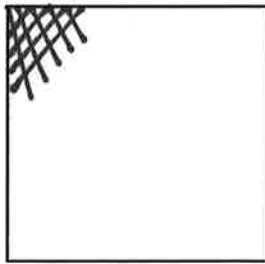
What do you do when you are finished building?

Record it! Share your invention with friends, families, and other investors all over. Inspire them to make their own, and you can even collaborate to make a new challenge.

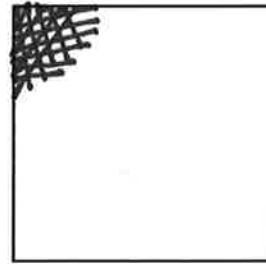
RUBE GOLDBERG USED VARIOUS LINE MARKINGS TO SHADE HIS CARTOONS. PRACTICE THESE DIFFERENT TECHNIQUES IN THE SQUARES BELOW.



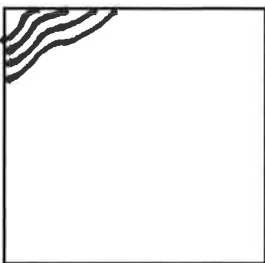
Hatch
(Lines in 1 direction)



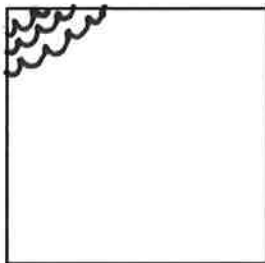
Cross Hatch
(Lines in 2 directions)



Triple Cross Hatch
(Lines in 3 directions)



Curved Lines



Wavering Lines



Short Strokes

CAN YOU DRAW YOUR OWN PICTURE NOW AND SHADE IT USING THE TECHNIQUES YOU PRACTICED ABOVE?

Questions? Please contact exhibits@pittsburghkids.org