



Teacher's Guide for: **Tablecloth Pull**

Note: All activities in this document should be performed with adult supervision. Likewise, common sense and care are essential to the conduct of any and all activities, whether described in this document or otherwise. Parents or guardians should supervise children. Rock-it Science assumes no responsibility for any injuries or damages arising from any activities.

NOTE: This is the transcript of a lesson that was videotaped during an actual Rock-it Science class with real students, not actors. The students' brainstorming comments are included on the video but are not transcribed here because they're not part of the lesson presentation.

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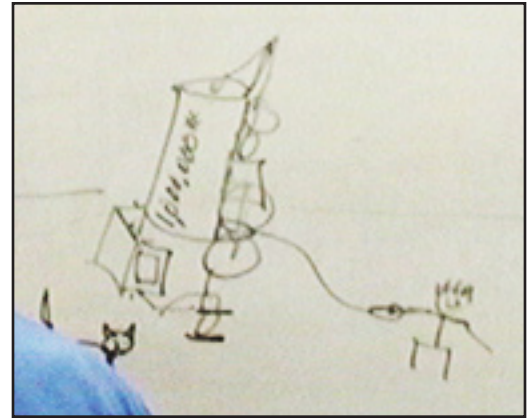
Tablecloth Pull
A Rock-it Science Lesson
Filmed July, 2009

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Intro Quick Recap: "Inertia"

- You have a steam locomotive that weighs a million pounds. You put a leash on it and take it for a walk.
- Your locomotive is afraid of cats, and you see a cat coming along. You want to get your locomotive away.
- Can you pull or move it easily?
- Suppose it's winter and there's ice on the ground and you put ice skates on it?
- Inertia is related to really big heavy things.
- If it's sitting there, it wants to stay sitting there. If it's moving, it wants to keep moving. It's hard to change its direction.



Locomotive on a leash.

Experiment #1 Quick Recap: "Stacks of Blocks"

- Objective: To set up a stack of blocks and remove the bottom one without touching the ones above. Students work in groups of three or four. Each group gets a different kind of blocks and a flexible plastic stick.
- A bunched-up blanket is placed down the center of the table so if the blocks go flying, they won't hit the students on the other side of the table. Students also wear goggles.
- After trying for a few minutes, if students aren't able to figure it out, suggest that they do it the way a minion would. (Using a baseball bat.)
- If they still don't figure it out, Instructor shows them how to place the plastic stick flat against the table and bend it back so that when it springs forward again, it sweeps the bottom block away and the upper blocks drop into its place without collapsing the stack.
- After awhile, let students move around to other groups to try different kinds of blocks.



Student rests the flexible plastic stick on the table, aims it at the bottom block in the stack, and bends it.



When she releases the stick, it sweeps away the bottom block, leaving the rest of the stack intact. (In this photo, you can see the upper blocks momentarily suspended in midair before they drop onto the table.)

Intro Quick Recap: "Tablecloth Pull"

- Suppose it's your job to change the tablecloths at a restaurant, and you're in a hurry. So you grab the tablecloth and pull.
- Instructor demonstrates with a piece of cloth and some plastic dishes. Tell students it's best to pull the cloth downward; otherwise, the dishes go flying up in the air.
- Instructor places padded mats on the floor in front of the table in case dishes fall. Students stand on the mats and work standing up at the table in the same groups as before.
- Each group gets a tablecloth and sets up a place setting on it. Then each person takes turns pulling the tablecloth.
- After students have had a chance to take a few turns, the Instructor brings out some plastic dish-pans with a basketball in each one so students can try the trick with a heavier object.



Students practice the tablecloth pull. The girl in the center has the "roast chicken" (basketball).

Equipment List: "Tablecloth Pull"

Items needed for Instructor:

- Blankets, 2
- Mats, padded, long enough to surround the table on the floor

Items needed for Students:

Consumables:

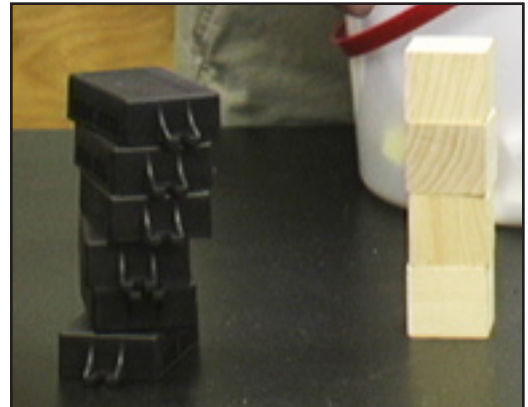
- (None)

Other:

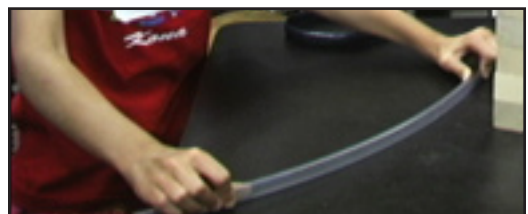
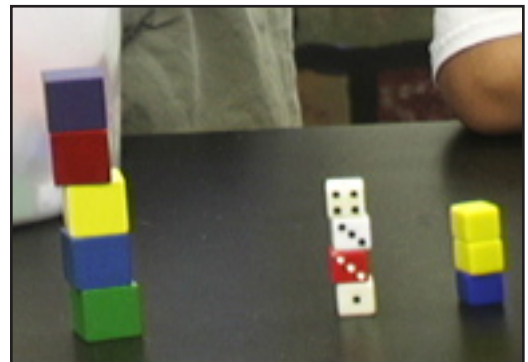
- Blocks, 5 different types/sizes (wood, plastic, dice, etc.), at least 6 of each type.
- Stick, flexible plastic, about 18" long x 1/2" wide x 1/8" thick. (The ones we used were manufacturing castoffs.)
- Dishes, bowls, and cups, plastic, at least 5 place settings
- Cloth for tablecloths, various sizes and fabrics, at least 18" x 36", preferably 24" x 36"
- Dishpans, plastic, at least 3
- Basketballs, filled halfway with water, at least 3 (one per dishpan)
- Goggles

Prep Work:

- Put water in basketballs

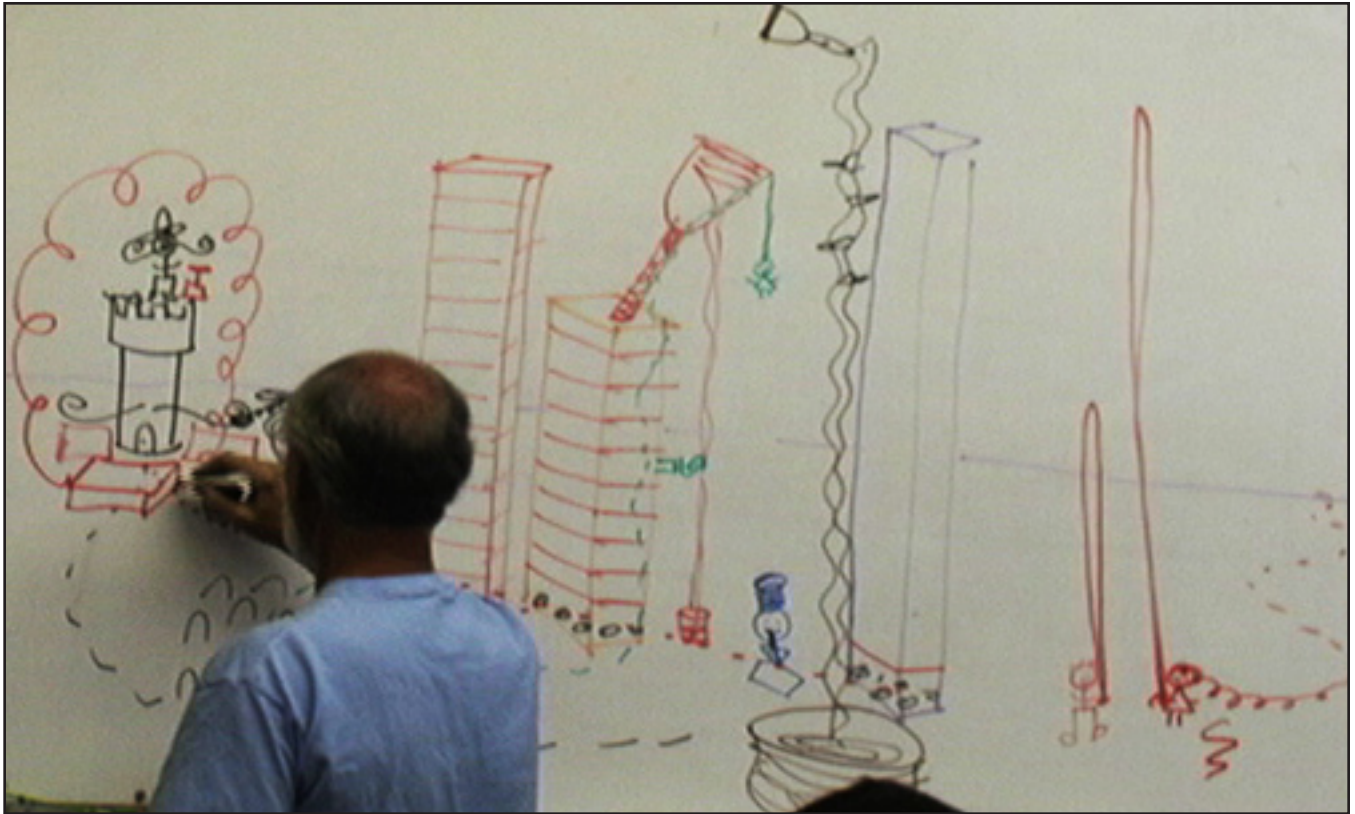


Above and below: various blocks.



Flexible plastic stick.

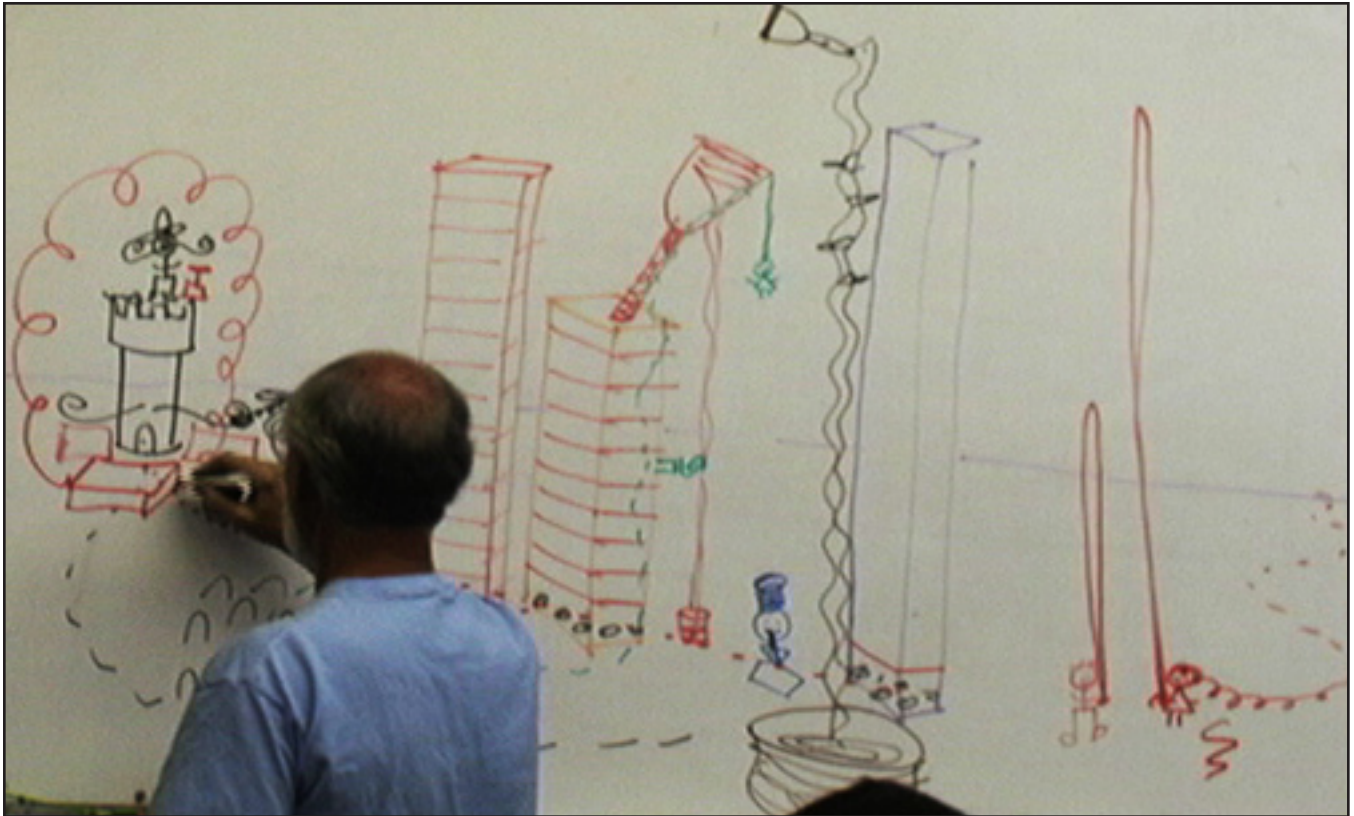
Story Recap: "Jack & Jill and the Skyscraper Snake"



Part 1:

- Jack and Jill lived in a city with a lot of skyscrapers. They call them that because the buildings had big putty knives on the top that scraped the sky as it went by, so they had a nice clean sky.
- A new guy came to town from the country, and he was a snake charmer. He said where he comes from, they use snakes to clean the sky.
- He played his flute to make the snake rise from the basket, and it rose as high as the skyscrapers, opened its mouth, and used its putty knife tongue to scrape the sky clean.
- The snake cleaned ten times as much of the sky as the skyscrapers.
- Evil Mister Fred sent his minions to steal the snake, but the snake thought they were mice and swallowed them.
- Now there were minion-shaped bumps inside the snake, with baseball bat lumps sticking out. The bats looked like legs, and when the minions swung the bats, it made the snake move right over to Evil Mister Fred's castle.
- Evil Mister Fred grabbed the snake, opened its mouth, and the minions ran out. Then he handcuffed the snake to his mustache so it couldn't get away.
- Evil Mister Fred wanted to destroy all the skyscrapers so he'd have the only way to clean the sky, and rent out the snake for sky cleaning.
- He put bombs on the first floors of all the skyscrapers and demanded a million dollars.

Story Recap (cont.):

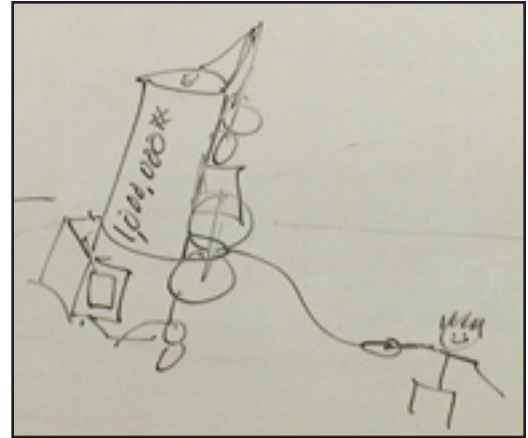


Ending:

- The people called Jack and Jill to help them because Evil Mister Fred had put bombs in their buildings.
 - Jack and Jill called the Acme Store of Everything and ordered giant baseball bats.
 - They swung the bats at the bottom floor of each building, and those floors went flying away, over toward Evil Mister Fred's castle. The upper stories of the buildings just dropped straight down onto the ground where the first floor had been, with no damage.
 - Evil Mister Fred didn't know what was going on, but he had his plunger and prepared to detonate the explosives.
 - When he pushed the plunger, all the bombs from the first floors, which had landed right next to his castle, exploded.
 - The snake escaped with minor burns and injuries.
-

Transcript: Intro

Here's a steam locomotive, and it weighs a million pounds, and you want to take it for a walk. So you put a leash on it and you go out for a walk in Central Park. Now suppose that your pet locomotive there is afraid of kittycats. And a little kittycat comes running along. And you say, "Oh no, I see a cat. I've got to get it out of here before it sees the cat, or it'll run away." It weighs a million pounds. Can you pull it and move it easily? *[Students: No.]* No. Suppose it's wintertime and there's ice all over the ground. What if you put ice skates on it? Will it be easier to move if it has ice skates? *[Students: Yes.]* *[Student: Not if you're stopping it.]* Not if you're stopping it, yeah. Stopping it is hard.



Your pet locomotive on a leash.



Kittycat, and ice skates on the locomotive.

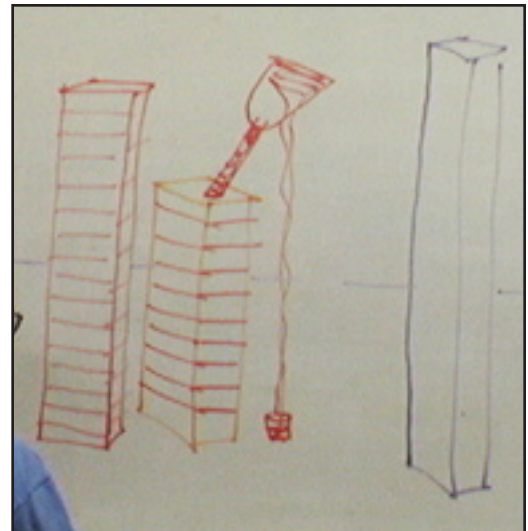
There's something called inertia that's related to really big heavy stuff -- that if it's sitting there, it wants to stay sitting there. If it's moving, it wants to keep moving. It's going to be hard to make it change its direction.

Today we're going to be using some inertia in our magic trick.

Story: "Jack & Jill and the Skyscraper Snake"

Once upon a time, Jack and Jill were living in a big city. Here's the big city. What do they have in big cities? *[Student: Skyscrapers.]* Skyscrapers. Do you know why they call them skyscrapers? *[Student: Because they scrape the sky.]* They scrape the sky. They've got big putty knives on the end to scrape the sky. As the sky moves by, the putty knives just scrape off all the dirt and scum and stuff. And all the stuff that it scrapes off drools down into a waste can. Like that.

So the higher you make your skyscrapers, the cleaner the sky gets. So everybody in the city was making taller and taller skyscrapers, because they liked nice blue sky. And it was actually working. They were getting some of the best blue sky, and all the other countries were jealous because they had the best skyscrapers. *[Student: Real skyscrapers don't have those things.]* They don't have putty knives? Well, what kind of city do you live in? No putty knives on their skyscrapers? Wow, that's sad.



Skyscraper with putty knife and waste can.

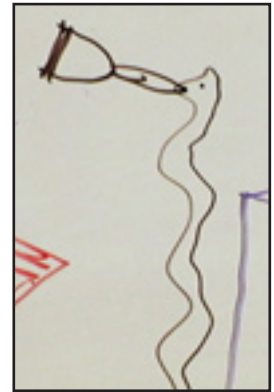
And in the city there, after building all these great skyscrapers, a new guy moved into town. And he was from out in the country, wasn't too smart, and he looked at all those skyscrapers and their putty knives. And he said, "Why are you building those?" And everybody said, "Well, don't you know, this is how we keep the sky clean." He said, "Well, that's not how you do it where I live." And Jack and Jill said, "Well, what do you do?" And he says, "Well, I'm a snake charmer." And they said, "How does a snake charmer make the sky clean?" He said, "Watch, I'll show you."



Snake charmer with flute & basket.

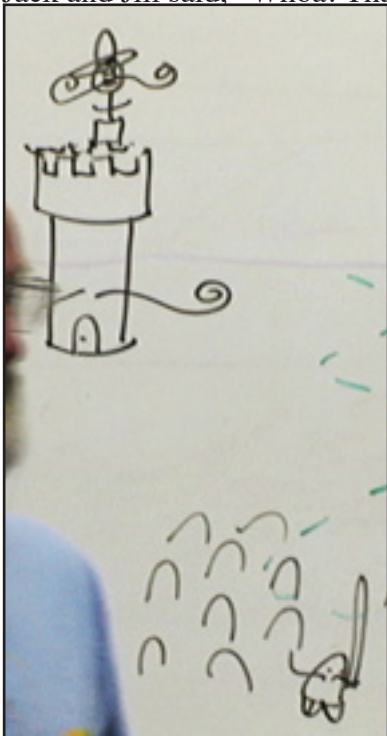
So he sat down. Let's give him a snake charmer's hat and a snake charmer's head, a snake charmer's thighs, because snake charmers usually cross their legs, and they play a snake-charming flute. Okay, he's a snake charmer. Now he needs a snake.

So their snakes usually live in a basket. So he's got a basket. And he starts playing his flute *[whistles a snake-charming tune]*. And the snake came out of the basket and started going up and up and up and up and up into the sky. And then the snake opened its mouth and stuck out its tongue. And its tongue was a putty knife. And the snake started waving all around and cleaning up the sky, and before you knew it, the snake had cleaned up ten times as much sky as all those expensive skyscrapers.



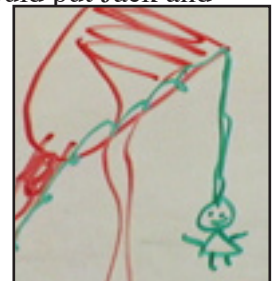
Snake with putty knife tongue.

Jack and Jill said, "Whoa! That's great. I like that." And they were admiring it. I should put Jack and Jill in there somewhere. There's Jack. And let's put Jill up here. *[Student: Dangling on her hair.]* Yeah, Jill could be dangling from the putty knife, like this.



Evil Mister Fred & minion.

Now, Evil Mister Fred heard about this, this cool snake that could really clean up the sky. And he said, "Now, there's an opportunity for somebody with my kinds of skills." So that night, he told his minions to go out with a great big black bag and go steal the snake. And the minions usually don't do anything right. They ran out saying, "Yeah, boss, we can do that. No problem. We'll have that snake back here in just a second. You just take it easy, relax. Don't worry about a thing." And Evil Mister Fred said, "Oh, no."



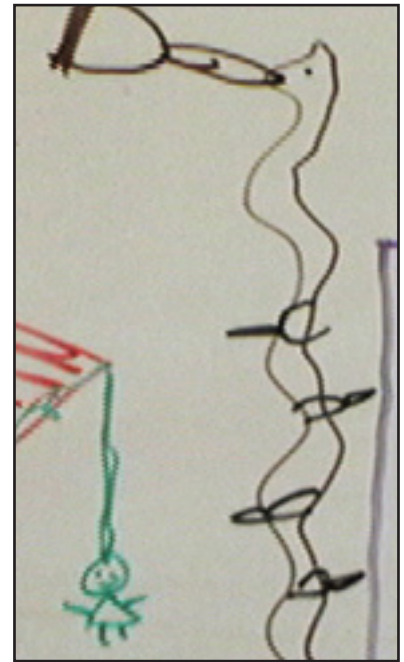
Jill dangling.

And the minions took off with their baseball bats. There's minions all over the place, running around looking for the snake. Then they heard the music of the snake charmer, and they followed his music, and sure enough, there was the snake. And the snake saw the minions, and he thought they were mice. And snakes eat mice. And he took his head

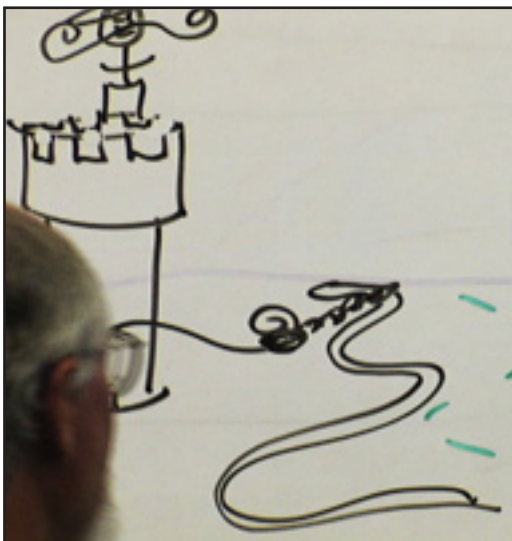
down and he went vroom! -- and used his putty knife tongue and went and ate all the minions.

Now there are minion-shaped bumps inside of the snake, with baseball bat lumps sticking out. And when the minions were inside with their baseball bats, they said, "Hey, it swallowed us whole. We're not dead! This is way cool. It's slippery, but kinda nice in here." And they used their baseball bats, and they were just going like this *[makes chopping gestures]* with their baseball bats. And it ended up making the snake like it had legs. Now the snake was trying to slither along the ground. The minions are all doing this, and the snake says, "Hey, I don't want to go that way. What's going on?"

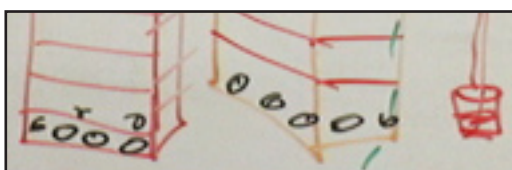
And the snake is moving along the ground without doing the snake thing. And the minions didn't know what they were doing. Next thing they knew, they had made that snake walk right over to Evil Mister Fred's castle. And Evil Mister Fred said, "Whoa! Minions did something right. But where's the minions?" And he ran down the stairs, ran over to the snake, knocked on its forehead, and the snake said, "Who's there?" And Evil Mister Fred said, "Your worst nightmare." And the snake said, "What?" And Evil Mister Fred grabbed his mouth, opened it up, and said, "Who's in there? *[voice echoes]*" And the minions all said, "We are, boss!" And Evil Mister Fred said, "Well, come out!" And all the minions ran out.



Minions' baseball bats poking out from the snake.



Handcuffed snake.



Bombs on the first floors.

Then Evil Mister Fred put handcuffs on the snake. *[Student: How can you put a handcuff on a snake?]* You put it around his neck. So he's got a handcuff around his neck, and he tied the snake with a chain to his mustache. Now he has the most powerful skyscraper in the world, trapped. And he says, "I'm going to rent this out to keep people's sky clean." The minions said, "Oh, good job. Good, boss. That's great, okay. Well, what about all those other skyscrapers?" And Evil Mister Fred said, "I have a plan for them." Evil Mister Fred sneaked out there, and he put bombs on the floor of every building. And then he sent notes to the people in town: "Pay me all your money, or it'll be the end of your buildings. Mwaa-ha-ha-ha!"

He was going to blow them up anyway, but he wanted some money for it, too. Now, Jack and Jill heard about the bombs. They said, "Oh, no. We've got to get rid of those bombs. We've got to somehow stop that Evil Mister Fred. If you were Jack and Jill, what would you do?"

Imagination and Brainstorming Time

[Students make suggestions] (THERE ARE NO WRONG ANSWERS! Whatever they say, you should reply: "That's a good idea," "They might do that," etc. After brainstorming, proceed with the experiments, then finish the story.)

We'll leave this To Be Continued . . .

Experiment #1: "Stacks of Blocks"

First part of the experiment -- it's a two-part experiment -- is, you're going to make a building. And there's several things we can make buildings out of. *[Instructor sets out blocks in various sizes and materials, such as wood, plastic, and dice.]* So there are five different kinds, and the objective is to build a tower as tall as you can and then take the bottom block out without touching any of the above blocks, and have it still stand. You could maybe pull really fast *[pulls the bottom block from a stack quickly, and the stack falls]* -- aww, not fast enough. *[Student: Pull slow.]* You could pull really slow. *[Student: Try it.]* *[Instructor takes the bottom block and moves it slowly across the table, and the blocks above move along with it.]* Okay, so you can think about how to do it with your particular tower, and there's quite a few blocks of each type. So there can be five groups. We'll also give you something to make it oh, so much easier. We'll give you a pokey stick. There are different sizes of pokey sticks. So if you want to, you can try to poke that block out. Or whatever you feel like.



Five different types of blocks.

Now, some people get carried away with the game, and you end up with blocks flying across the room at high speed. So we're going to put a blanket across the middle, and we're going to kind of jumble it up. So whenever you're doing something to the blocks, make them fly towards the blanket rather than your neighbors. I'm going to randomly choose groups.



Blanket runs down center of table.

[Before beginning the experiment, students push their chairs back away from the table so they can work standing up. They work together in groups of three or four. Instructor gives each group a different kind of blocks and a flexible plastic stick. Students wear goggles.]

They all have to be stacked on top of each other, not side by side. Take turns doing it. *[Students experiment with the blocks for a few minutes without success.]* I'll give you a hint: If you were a minion, how would you do this? *[Student: Use their baseball bat.]* How would a minion use a baseball bat? *[Student: Poke it.]* *[Students try poking and pushing the bottom block with the plastic stick. After a few minutes, the Instructor shows them how to place the plastic stick on the table and bend one end back, then release it so it springs forward and sweeps away the bottom block, leaving the others in place. Then the students*

try it. For smaller bricks, the stick works best if it's lying flat. For larger blocks, the stick needs to be on its side.]

Now, if there's a particular block you would like to try, you can move to another group of blocks. Okay, go. Work with any block you want. [One student finds a way to do it by swinging the stick like a baseball bat.]



Student rests the flexible plastic stick on the table, aims it at the bottom block in the stack, and bends it.



When she releases the stick, it sweeps away the bottom block, leaving the rest of the stack intact. (In this photo, you can see the upper blocks momentarily suspended in midair before they drop onto the table.)

Experiment #2: "Tablecloth Pull"

Suppose it's your job to change the tablecloths at a restaurant. [Instructor lays out a cloth on the table.] There's a tablecloth. And the tablecloth has things on it [places some plates and cups on the cloth]. And you don't have much time. You have to change all the tablecloths quickly. So, you grab the tablecloth and you're going to pull. Now, when I pull, dishes go flying everywhere, lights break, people scream, they hide under the tables and stuff. But I saw this on MythBusters. It can be done. The trick they use is something -- I'm not going to tell you what it is, I'm just going to try it. And if I get covered with dishes, feel free to laugh. Okay, one, two, three [grasps the table cloth with both hands and pulls. The dishes remain on the table.]

You're going to set up a table setting, either on this side or on that side. [The Instructor places padded mats on the floor in front of the table to protect items if they fall. Students stand on the mats. Instructor lays out several tablecloths of different fabrics.] Stay with the same group you were with before. There's a whole bunch of stuff. [Instructor sets out piles of plastic dishes and cups.] And the thing that they showed on MythBusters is, you pull downwards. [Student: What if you pull upwards?] If you pull upwards, they all fly off.



Students set up place settings.

Come select some stuff with your group, make your table settings, and try to pull the tablecloth out from under it. [Students set up their place settings and take turns yanking the tablecloth.]

After you do that, we'll give you the "roast chicken." *[Instructor brings out a few plastic dishpans with basketballs in them. Students place the heavy dishpan on the tablecloth and try pulling it. After a few minutes, Instructor gathers up the mats, tablecloths, dishes, etc., and the students return their chairs to their usual position at the table.]*



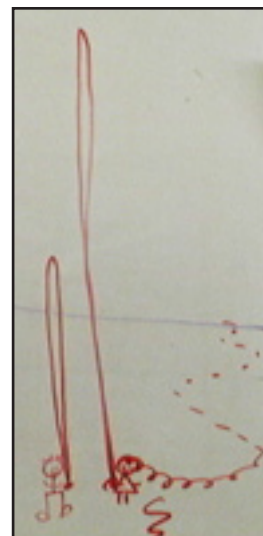
Student tries to to pull the tablecloth from under the heavy "roast chicken."

End of Story

*** DO NOT * present this part of the lesson until after the experiments!**

Evil Mister Fred had lured all the tiny snowmen of the Abominable Snowpeople into a mountain cave. The people in this country were keeping the sky clean with skyscrapers. They had putty knives on the tops of all the skyscrapers. And the taller the buildings, the better they cleaned the sky. But Evil Mister Fred had stolen their skyscraper snake, and he was going to monopolize the whole skyscraping business. And he had told the minions to put bombs in the bottom of all their skyscrapers to blow them up, and he would have the only sky cleaning equipment around, in the form of a very tall snake with a tongue like a putty knife. And the minions placed the bombs, and then they said, "Mwa-ha-ha! Pay us a million dollars, or we'll blow up all your buildings." And the people called Jack and Jill, and they said, "What are we going to do? There's bombs in our buildings. We've got to stop them."

And Jack and Jill said, "Well, okay, I think we've got a plan here." So they called the Acme Store of Everything and ordered some big baseball bats. *[Student: Baseball bats?]* Yep, just like the minions use. There's Jack, and he's got his baseball bat. Let's give him a nice big bat. And these aren't your ordinary baseball bats. They're kind of springy. And Jill has a baseball bat. And they said, "Okay, everybody in town, go hide. Cover your ears. This is going to be exciting." And Jack went to the first building there, took his baseball bat, aimed at the bottom floor, and went whack! *[swings his arms as if swinging a bat]* -- and he knocked the bottom floor right out of the building, just like you guys did with the blocks. And the bottom floor, including all the bombs, went sailing this way *[toward Evil Mister Fred's castle]*. And Jill went to the next couple of buildings and she went whack! -- and their bombs went sailing that way. And the buildings just went ker-plunk right back where they were, one story shorter than they were before.



Jack & Jill's bats.



And Evil Mister Fred said, "What are they doing?" And just as those words left his mouth, he saw the bottom floors of these buildings come to rest right next to his castle. And he didn't realize what was going on. And he had a big box there with a plunger handle on it. And he said, "All right, people. I'm not seeing a million dollars from these buildings. That's it for you guys." And he pushed the plunger. And what do you suppose happened to Evil Mister Fred? *[Student: Ka-boom!]* Yeah, he blew up his own castle. Luckily, the snake escaped with minor burns and injuries. And everybody lived happily ever after, except Evil Mister Fred.

The bottom floors with bombs landed next to the castle. Evil Mister Fred blew them up, along with the castle.

End of Lesson

If you have questions about this lesson, please ask them through the online [Teacher Support Forum](#) on our web site.