



Homeschool Teacher's Guide for:

Parachutes

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.

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Title Page of Video

(Numbers in the text are **time codes**, so you can refer back to the video.)

[00:03:09]

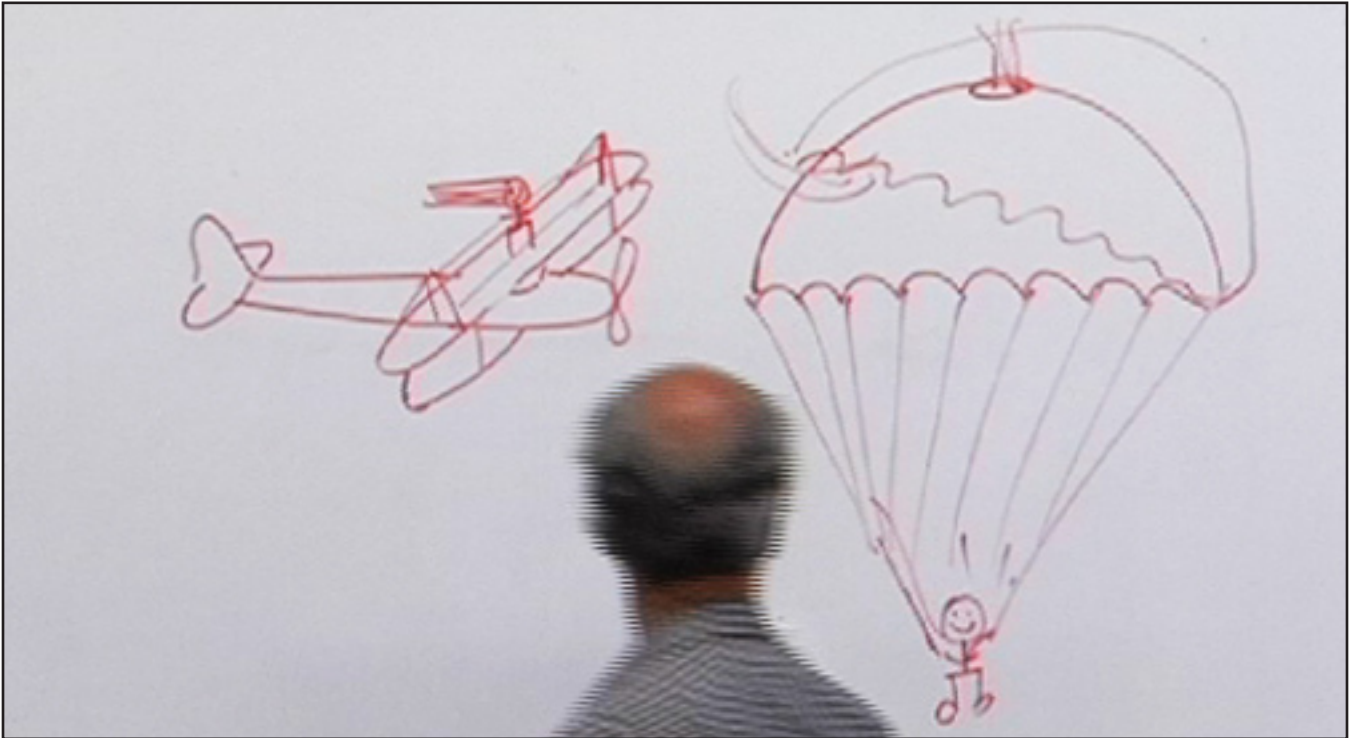
Parachutes
filmed May, 2010

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Students' images in this video should not be used publicly unless their nametags are rendered unreadable and their names are bleeped from the audio track.

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Intro Quick Recap:



- Guys who learned to fly airplanes in World War I could become wingwalkers.
- The planes had a wing on the top and one on the bottom, held together with wood and wires.
- The pilot would fly the plane and the wingwalker would stand on top and hang onto the wire.
- They'd walk back and forth and do handstands and such.
- Sometimes the plane would turn upside down with the wingwalker on it.
- Sometimes the wingwalker would fall off, but not get hurt. Why not? (Parachute.)
- The earliest parachutes would make the guy swing back and forth so he got seasick.
- Later they discovered that if you put a hole in the top of the chute to let some of the air escape, it wouldn't swing so much.
- Cargo pilots get to have parachutes because it's okay to let the plane go down with cargo, but pilots on passenger planes don't get parachutes; they can't jump out and leave the passengers behind.

Experiment Quick Recap: "Parachutes"



- Students take half of a plastic garbage bag and tape lengths of ribbon to each corner.
- If using the whole bag, tape the open end shut.
- Instructor injects 15 ml of water into a balloon and knots the opening.
- Water balloon is tied to the ends of the ribbons so it hangs straight down from the parachute.
- Students insert their parachutes into the bottom end of a "dancing balloon." The fan blows them out the top and they sail across the parking lot.



Syringe is used to inject 15 ml. of water into balloon.

Equipment List: "Parachutes"

Items needed for Instructor:

Consumables:

- (same as students)

Other:

- Syringe to inject water into balloons
- Balloon, "Dancing" 20-ft.
- Cardboard Tube ("Quik-Tube" building forms), 10" Nominal, approx. 3 ft tall.
- Fan, 1 horsepower blower
- Power strip with on/off switch
- Extension Cord
- Plastic crate
- Pole, extendable to 25'
- Stepladder, 6 ft.
- Rolling platform, approx. 4' x 6'
- Bungi cords, approx. 4' stretched (4 ea.)
- Eye hooks screwed into platform for bungi cords (4 ea.)
- Wood, 2" x 4", approx. 5' long
- Clamps, spring type (5 ea.)
- Clamp, screw type (to keep ladder brace from slipping)
- Tape, Gorilla (NOT duct tape)

Items needed for Students:

Consumables (per student):

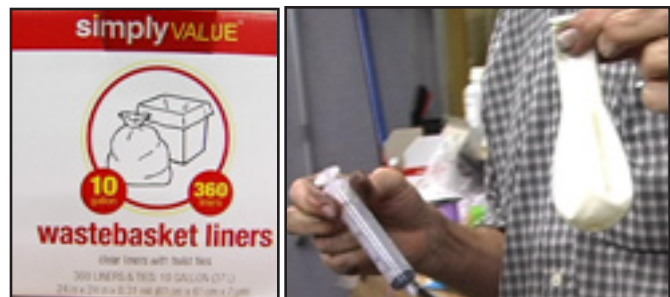
- Plastic garbage bag, 10-gal, clear, 24" x 24"
- Ribbon, curling, approx. 8 ft.
- Tape, cellophane, approx 1 yd.
- Balloon, 11"
- Water, 15 ml.

Other:

- Scissors

Prep Work:

- Cut ribbon into 24" lengths (4 per student)
- Fill and tie water balloons
- Assemble Dancing Balloon apparatus



Complete apparatus. (See next page for detail shots.)

Equipment List: "Parachutes" (cont.)



Bottom of balloon is taped to cardboard tube. Tube is clamped to 2"x4", which is clamped to ladder. More tape is wrapped around tube, 2"x4" and ladder. Bungee cords secure ladder to platform below.



Bungee cords secure ladder to eye hooks in wheeled platform. Spring clamps secure fan to crate.

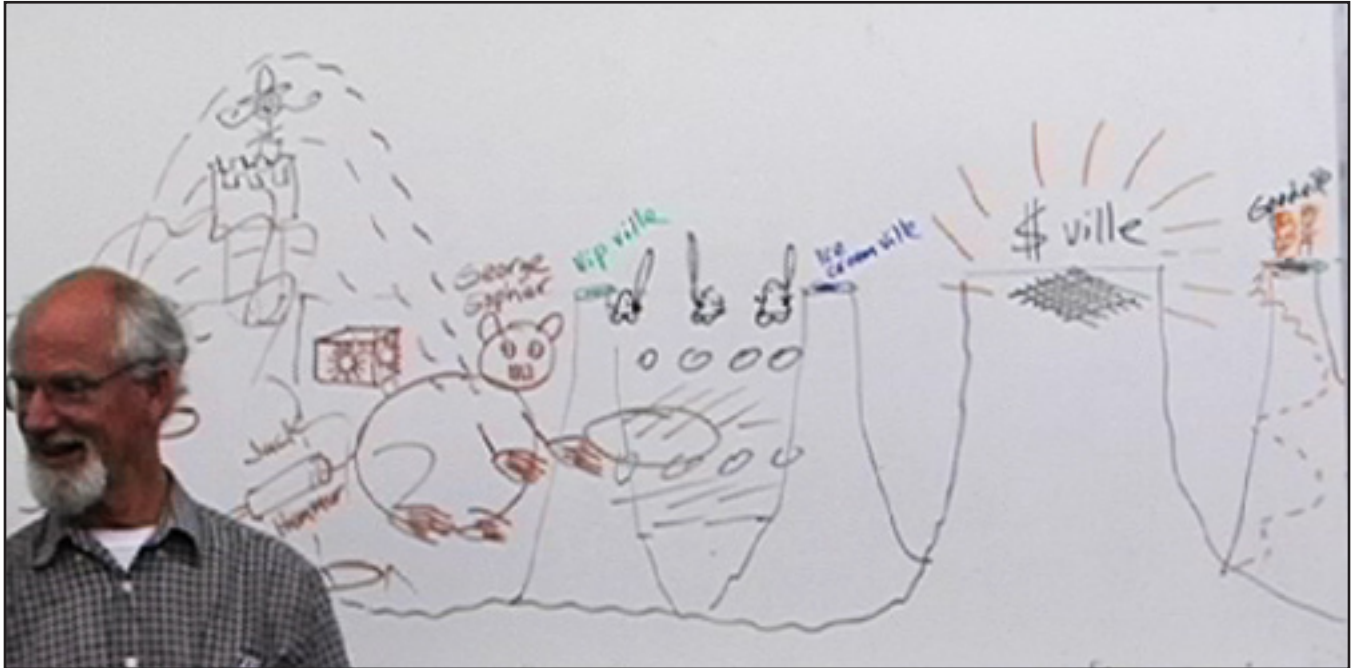


Screw clamp keeps ladder brace from slipping.



Tape covers top of 2" x 4" to keep rough edges from damaging balloon.

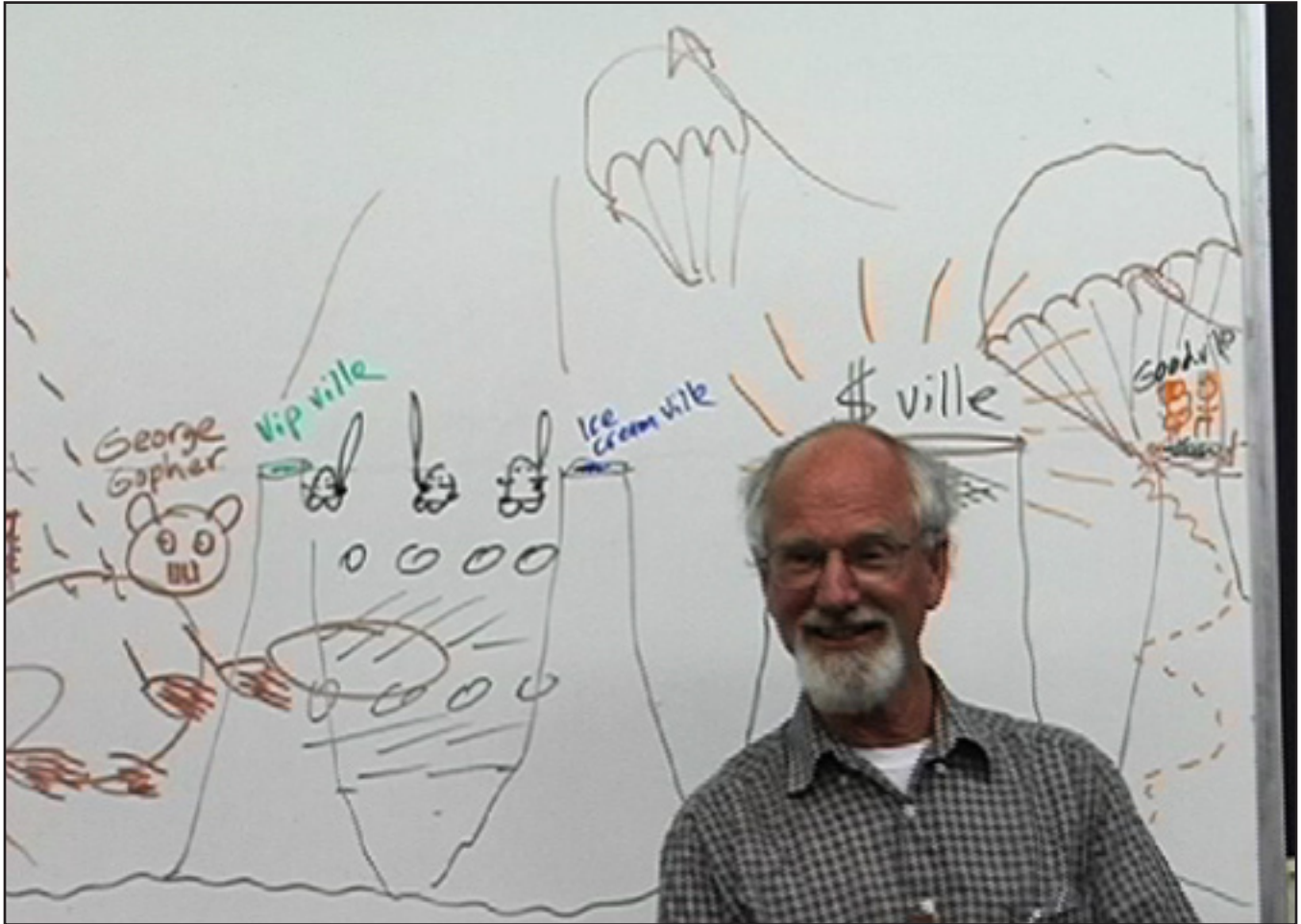
Story Quick Recap: "Jack & Jill and the Giant Gophers"



Part 1:

- Evil Mister Fred was raising gophers because he wanted to take over the world by going underground and digging tunnels.
- He fed the gophers lots of food to make them big, but they only got fatter, not bigger.
- He called the Acme Store of Everything and ordered a Gopher Biggerizer.
- It made the gophers 100 times bigger, and they had jackhammers on their tails.
- The first gopher dug so fast and threw up so much dirt, it covered the castle and the minions had to shovel it out.
- He sent a gopher to Moneytown to tunnel under the bank, but the gopher kept missing it.
- So Evil Mister Fred told all the gophers to make layers of tunnels everywhere except directly under the towns. Then he had the minions jump up and down and pound on the ground until all the tunnels collapsed, so the towns were left standing on top of cliffs with sheer drops all around.
- Evil Mister Fred told the people he'd keep the gophers from tunneling under their cities if they gave him money.

Story Quick Recap (cont.):



Ending:

- Jack borrowed a few hundred miles of Jill's hair, and had all the people weave a giant parachute out of it.
- Then he put long sticks under the city, tied the parachute to the city, and the whole city floated into the air. He did the same for the neighboring cities, and everybody was happy and thanking Evil Mister Fred.
- Jill can talk to animals, so she tells the gophers to go eat Evil Mister Fred's castle.
- So the gophers tunnel over to the castle and use their jackhammer tails to make big cracks in the castle.
- The castle starts tilting sideways, then crashes down into the deep pit.

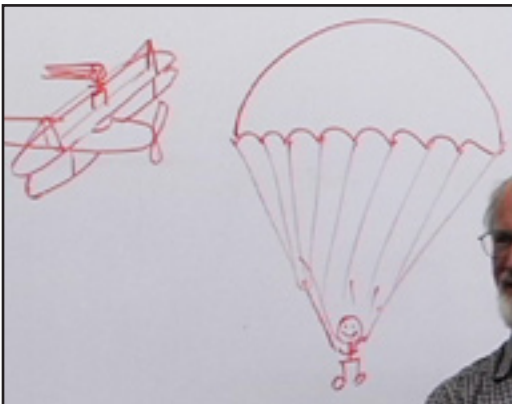
Transcript: Intro

[01:00:11;02] Let's suppose you go back in time almost a hundred years. And you've decided to run away from home and join the circus as an airplane wingwalker. So they call them wingwalkers, barnstormers -- these are the guys that learned how to fly airplanes during World War I. They had planes that looked kind of like that, with a wing on top and a wing on the bottom. And they would put some pieces of wood up here and hold them down with wires, and string some wires across. And then there would be the pilot in there steering the plane. There would be a person who'd climb up on top and hang onto the wire. They walked back and forth and they'd do handstands and they'd do like this stuff [*stands on one leg*] while this guy's flying the plane. And sometimes he didn't fly the plane straight. Sometimes he would turn the plane upside-down with a wingwalker on it. And they're going probably close to a hundred miles an hour. And he's blowing all over the place, and he'd walk on the plane.



Wingwalker balancing on an airplane.

Well, occasionally a wingwalker fell off. But they didn't die. Unless they were too close to the ground. Why wouldn't he die? [*Student: Because they had a parachute.*] Okay, a parachute.

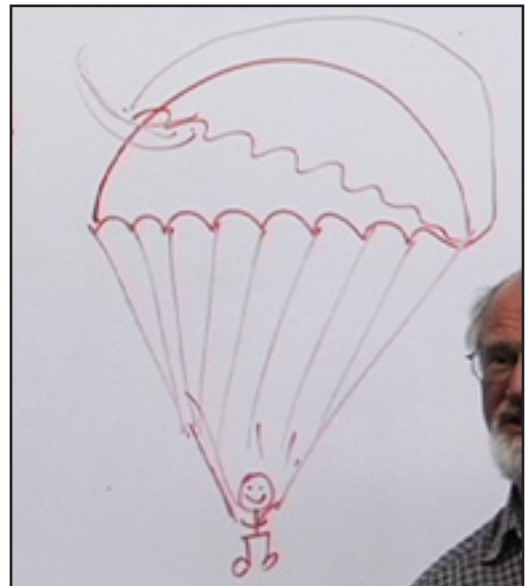


Parachute.

Now, in those days parachutes weren't all that good. They were big silk things like that. And there'd be a harness on there. And they probably didn't attached it to your neck. And the earliest parachutes would puff open, you'd be hanging from this thing, but while you're coming down, you would sway. Now imagine yourself way up in the air, swinging back and forth. [*Student: I'd throw up!*] That's exactly the problem. Guys would throw up. There'd be people down there in the audience and

he'd go "Whoohhhh -- oh, sorry." He'd throw up on them. They'd get down safely, but they'd be all seasick from the ride coming down.

And somebody said, "Well, that's not good. It's gross and ugly. We've got to find some way so that it doesn't swing back and forth." They tried several things, and most of them had to do with trying to make the air spill out. Because when the thing is sideways like this, some air would spill out this way, and then it would flip over and go the other way, and then air would spill out on the other side.



When the parachute tips, some of the air spills out.

So they decided the solution had to do with shotguns. You know, if you've got a shotgun in your hand and the thing's swaying back and forth and you're getting seasick, all you've got to do is shoot the parachute, right? And if you shot a hole right in the center of it, they found out it didn't sway back and forth any more. It had just enough air spilling out the center so that it didn't do the foofy-foofy thing.

We're going to be goofing around with parachutes today. If it's not raining, we'll take out a parachute that a cargo pilot had. Cargo pilots get their own parachutes, because you don't have to worry about going down with the ship if it's just cargo. You just let it go and you jump out. If you're on a passenger plane, pilots don't get to jump out and leave the passengers behind. So as far as I know, they don't have their own parachutes. But first we need a crazy story.



A hole in the top keeps it from swinging.

Story: "Jack and Jill and the Giant Gophers"

[01:04:56;20] Once upon a time, Evil Mister Fred was raising gophers. And Evil Mister Fred would go down into his dungeon with a bunch of gophers. He was going to conquer the world, and he was going to do it secretly, and the best way to do that was to go underground. He needed some way to dig tunnels.

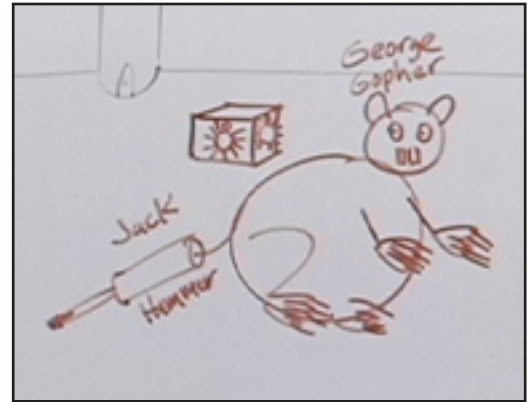
Now, the gophers are kind of small, but they dig tunnels. So all he had to do was make the gophers big. Not that big of a problem. So he started feeding the gophers lots and lots of stuff. And gophers are more or less vegetarians, so he fed the gophers a lot of stuff, and pretty soon the gophers got fat, but they didn't get big the long way. And he said, "Huh. That didn't work out."

So he called the Acme Store of Everything and he ordered a Gopher Biggerizer. And when it showed up, it looked like an ordinary cardboard box. It had a dial on the side that went from zero to one, two, three, four, five, six, seven, eight, nine, ten. And there was another one on the other side that went from zero to one, two, three, four, five, six, seven, eight, nine, ten, like that. No instructions. When you buy things from the Acme Store of Everything, you're on your own. You've got to figure this out.



Evil Mister Fred and the Gopher Biggerizer.

So Evil Mister Fred put a gopher in there, and he set this dial on ten and he set that one on ten. And he put the gopher in there, and it went phoom! And the gopher got a hundred times bigger. And he thought, "Wow!" Do gophers have teeth? [*Student: Yes, they have teeth like rats.*] And they probably have hands with claws on them. Do gophers have tails? [*Student: Yes. They have little tails.*] Little tails? This one has a tail that has a jackhammer on it. So he can turn around and go da-da-da-da-da-da-da and break the rock. [*Student: What's his name?*] His name's George. George Gopher.



Giant gopher with a jackhammer tail.

And Evil Mister Fred says, "Wow! It worked! George -- start digging." And George, he was big, and he was really strong. He just went [*makes fast digging motion with hands*], and as he was digging, he'd throw piles of dirt up into the air. And before you know it, he'd covered up the entire Evil Mister Fred's castle, like that. So now George has a big hole. And Evil Mister Fred had to throw off all the dirt and get his minions out there and shovel the castle free.



The dirt covered the castle.

And Evil Mister Fred said, "That's it! This is great!" So he took a bunch of gophers, about a hundred of them, and threw them all into the box. Now these gophers are going crazy. There are big holes all over the place and piles of dirt. And Evil Mister Fred said, "Wow! These guys are digging a mile a day. And there's a hundred of them. That's a hundred miles of tunnel a day." And he thought, "Wow, if I dig under the big cities, I can tunnel under the banks and steal all their money. This is perfect."



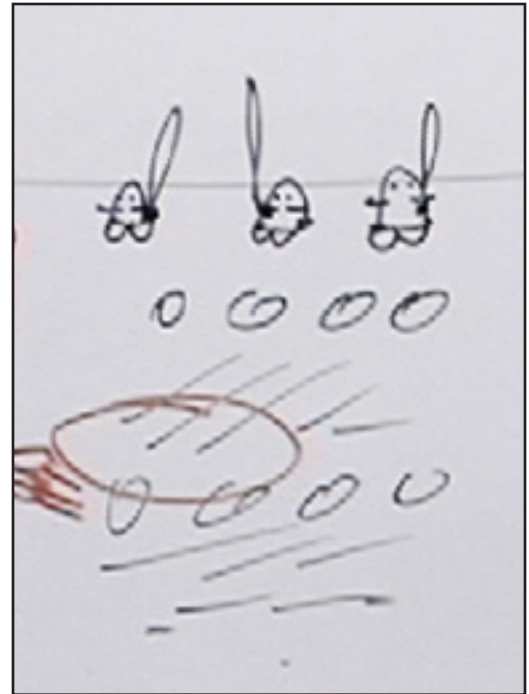
Not too far away was Moneyville. [*Student: People lived in banks.*] People lived in banks, cars were made out of pure gold, and there was so much gold there that the entire town glowed. Evil Mister Fred decided he was going to tunnel under the bank, so he had his gopher go down there. And their GPS system didn't work underground, so he pops up -- oops! Missed the bank. Goes back down again, pops up somewhere else -- oops! Hit a swimming pool.

So Evil Mister Fred couldn't get the bank. And he said, "Ar-rrgh!" Can't see underground, can't tell where he's going, life is hard. So he said, "I know. I'm smart. I'll make it so they GIVE me their money." So he said, "Gophers, start digging all over the place." And the gophers went and dug everywhere. And he said, "But don't dig in Moneyville." And so they dug everywhere else. Well, as the gophers were digging, they tunnelled on this level, and then on this level, and on this level, and they were digging hundreds and hundreds of feet underground.

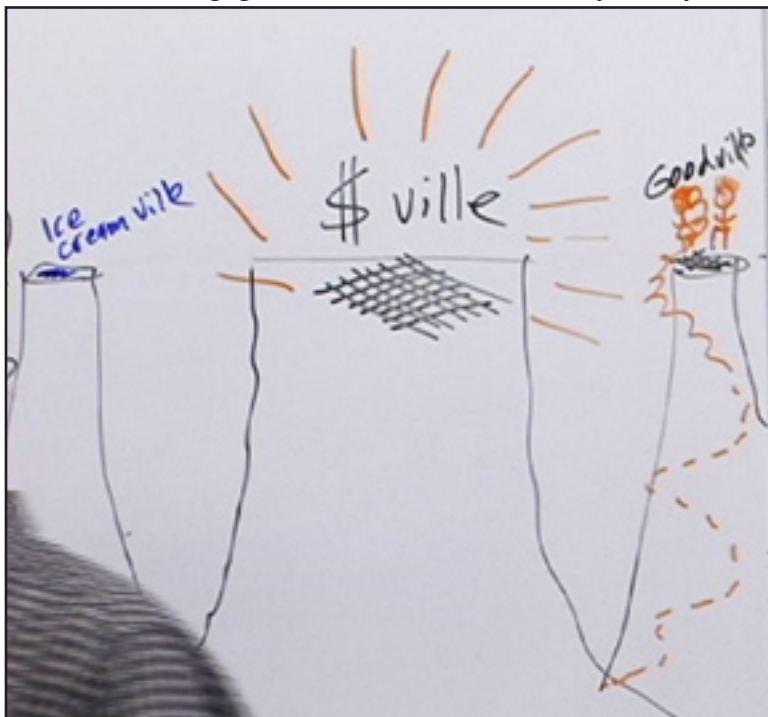
Pretty soon, when the gophers had dug down maybe a thousand feet, Evil Mister Fred said, "Minions! Go out, have a good time. Jump up and down. Hit the ground with your baseball bats. I don't care. Have a good time." And the minions said, "Really? We can do this? Run around and hit each other and anything?" Evil Mister Fred said, "Yeah, go for it."

So the minions all ran around here jumping up and down hitting each other. Well, the ground under them was all riddled with holes. And pretty soon, everything started to collapse -- badoom, badoom, badoom, badoom, badoom -- down and down and down and down. And now all of Moneyville is on a huge cliff, and Evil Mister Fred's place is on a cliff, too. And the earth is no longer flat. There's another cliff here, and -- [Student: Put Goodville on a cliff.] Goodville can be on a cliff out here. [Student: There should be an IceCreamville.] There can be IceCreamville here. [Student: And VIP ville -- Very Important People ville.] And VIPville.

All of these cities are trapped on top of huge cliffs. Evil Mister Fred has all his gophers down there, and he says, "My, oh my.



The gophers dug miles of tunnels, and the minions jumped up and down on them.



The cities were trapped on top of tall cliffs.

Don't you guys look like you're in a precarious position. Why, if whatever made that collapse was to dig further under your city -- oh dear, oh dear, your entire city would collapse into the chasm, and you'll all die. But never fear! Those gophers won't dig there, unless I happen to tell them to. And of course, I can be convinced to not tell them to, if you give me just a little bit of money." And the people said, "Oh boy. We don't have much choice. We've got to pay Evil Mister Fred so his gophers don't make our city collapse into the chasm of death."

So we'll put Jack and Jill over here. Now suppose you were in charge of saving the world from Evil Mister Fred, and you're in Goodville, trapped on the top of this tall, tall cliff. What would you do?

Imagination and Brainstorming Time

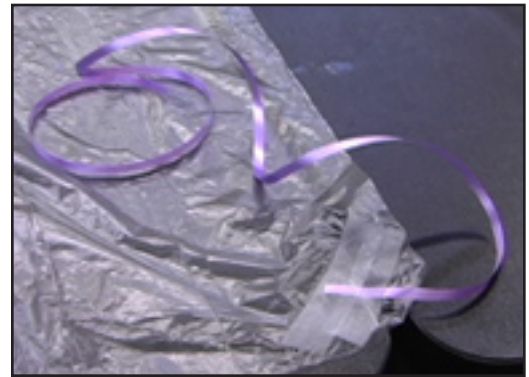
[01:13:39;07] *[Students make suggestions]* (THERE ARE NO WRONG ANSWERS! Whatever they say, you should reply: "That's a good idea," "They might do that," etc. After brainstorming, proceed with the experiments, then finish the story.)

Okay, we'll leave this "To be Continued . . ."

Experiment: "Parachutes"

[01:18:36;28] Well, we have a very simple experiment. For the experiment, you just need a bag *[holds up a clear garbage bag]*. Now, there's a fancy way to do it and a lazy way to do it. You have a choice of the fancy way or the lazy way. The lazy way is, you spread the bag on the table like that and say, "There. I'm done." And you're going to tape a piece of ribbon to each corner. You ever seen Bambi on ice? Bambi starts to walk on ice, and all four legs go *[spreads arms out wide]* like that. So this *[holds a piece of ribbon]* is a Bambi leg. Stick some tape on a Bambi leg, and you smack it. And judging from the other classes, I would put on a second piece of tape. And you put one on each corner, until you have Bambi all taped down. That's the simple way. That makes a parachute, but since this is a bag, there is an opening. So you have to tape the opening closed in a couple of places, just so it doesn't open up when you're using it.

The fancy way is, you take the bag, and you find a pair of dull sticky scissors, and you turn one bag into two parachutes. *[Student: Why?]* Because it makes a thinner and more reliable parachute. You have to cut on three sides. If you find where the opening is, you don't have to cut on that side. If you want to, you can cut on the opening side. If you've got to do this to make the scissors work *[makes repeated small cutting motions]*, trade them for another pair. If you get them to a certain spot, even on a dull pair of scissors, somewhere along its opening between there and there is a spot that's still sharp. *[Holds scissors partway open and slices along the edge of the bag, then repeats on the other two closed sides.]* And then you do the Bambi thing with this. You give one of the pieces to your neighbor and you keep one, and do the Bambi thing. *[Student: Why do you want it thinner?]* Usually thinner floats longer. When we're done with all of that, then I'll show you how to turn it into the parachute. *[Instructor passes out plastic bags, ribbon,*



Put two pieces of tape on the ribbon.



If you cut the edges off the bag, you can make two thinner parachutes from one bag.

and scissors, and students do their cutting and taping. Then Instructor makes a "KickMe" by putting 15 milliliters of water in a balloon and knotting the opening.]

If you're not busy taping something, you should be busy taping something. If you're done taping something, come get a KickMe and tie him to the bottom. Let me show you how you do the KickMe part. You grab your parachute by the middle, pick it up so it looks like a jellyfish, test the strings to see if they fall off. And you put a loop in the string. There's his head, see? There's his hair, there's his nose. Stick the balloon in the nose, right through there [pulls it tight]. And you test it by going like this [holds the balloon and swings the parachute around]. And you've got a parachute. [Instructor makes more KickMes, and students bring their parachutes up to get one attached.] If you bring your parachute all wadded up, it's hard for me to get it straightened out. Pick it up by the center so all the legs are the same length. [While Instructor is busy putting balloons onto parachutes, the students whose parachutes are already finished test them by swinging them around or tossing them into the air. Then the Instructor takes everyone outside.]



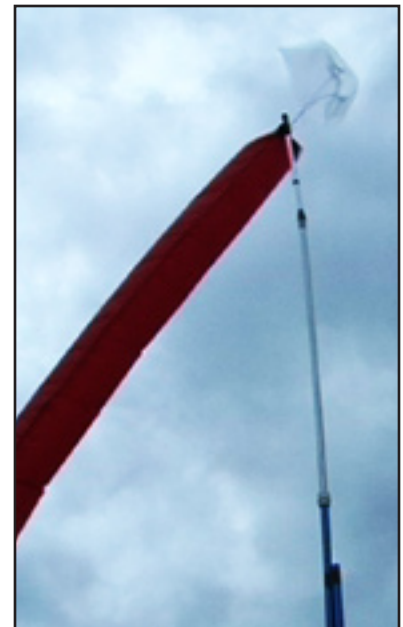
Tying balloon onto ribbons.



Inserting parachute into tube.

[Outside, the parachute apparatus consists of a large tube-shaped "dancing balloon" about 20 feet tall, with a hard cardboard tube attached at the bottom. The cardboard tube is attached to a vertical board, which is in turn clamped onto a stepladder secured to a rolling platform with bungee cords. Directly under the opening of the tube is a powerful fan, sitting in a plastic milk crate, blowing

air up into the tube. There is about a 1-foot gap between the fan and the tube. The Instructor holds a long pole, which is attached to the top of the dancing balloon. This keeps it pointing almost straight up instead of flapping around the usual way. One at a time, students insert their parachutes into the bottom of the tube, and the fan blows them out the top of the balloon. They sail across the parking lot, and the students retrieve them when they land. (On the day this was filmed, a storm was approaching and it was very windy. In order to control the balloon, the Instructor had to move the platform close to the building to cut down on the wind.) Students get to launch their parachutes as often as time allows.]



Parachute emerges at top.

End of Story

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

[01:50:59;03] So Evil Mister Fred tells the people they have to give him their money so that he wouldn't have his gophers make the cities go toppling down into the chasm. So Jack and Jill had to figure out what to do. Well, Jill can talk to animals. She's related to Tarzan. And Jack can't talk to animals. So Jack is going for the practical solution. Jack says, "Jill, we need to borrow a little bit of your hair. It grows infinitely fast. You'll never miss it." And Jill says, "Ohhh, cut me a break. What are you going to do?" And Jack cut off a few hundred miles of hair and had everybody in the city of Goodville start making parachutes by weaving together Jill's hair. And they make these really thin super airproof parachutes. And they were a lot bigger than he thought. In fact, they were several miles across. He said, "Well, since they turned out so big, we could put a whole bunch of people on there, and if Evil Mister Fred's gophers eat through our long long tower here, we'll all be safe." In fact, they put some sticks underneath the city, tied them to the parachute, and next thing you know, the whole city got ripped up off the ground and is flying through the air because the wind came up. So now Jack and Jill have this city up in the air. Evil Mister Fred said, "Hey! That's not fair! I want one of those."



Goodville's Parachute

And the next thing, he saw Moneyville with its own parachute, and it was up in the air. And then IceCreamville and VIPville. And the wind just keeps making these updrafts, and everybody up there is saying, "Yay! Thank you, Mister Fred! That was great! Have a good time!"

And Evil Mister Fred's down on the ground. And Jill is saying to the gophers, "Uh, gophers, guys -- there's a tower over there. Go eat that." And the gophers, a hundred of them, went over there and went chomp, chomp, chomp, chomp, chomp, chomp, until they got to the castle. And then used their jackhammers to make big cracks in the castle. Then Evil Mister Fred's entire tower went err -- *[starts tilting sideways]* err -- err -- crash! Down into the deepest pit anybody had ever seen. And they all lived happily ever, except Evil Mister Fred.

End of Lesson