



Teacher's Guide for:  
**Puddle Jumpers**

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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Puddle Jumpers  
A Rock-it Science Lesson  
Filmed October 2010

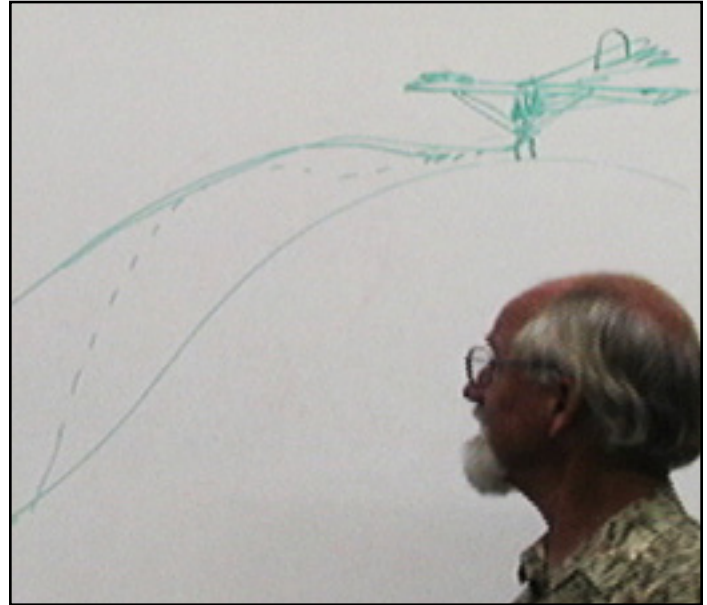
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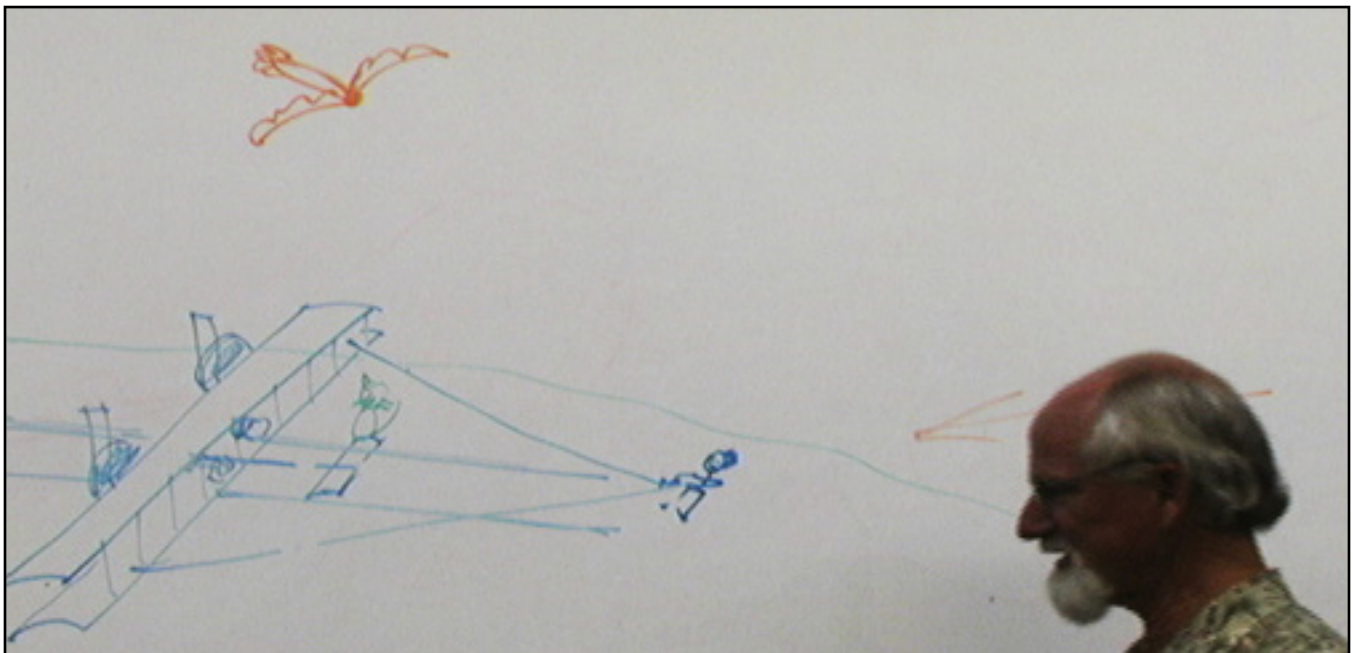
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## Intro Quick Recap:

- A guy named Lily used to run down a big hill behind his house. He tied a thin stick on top of his head that helped him glide as he ran down.
- He experimented with different shaped sticks, like bird wings. They had a tendency to tilt and twist instead of going straight.
- He added a piece on top to help keep it from twisting and tumbling.
- On a windy day, he was able to glide down the hill and land safely. But when he tried it again, the wind stopped suddenly and he fell to his death.
- Lily had written notes about everything he did and sent them to a lot of other people.
- A couple of brothers who had read Lily's notes experimented with flying on a beach called Kitty Hawk.
- They used two wings, one above the other, connected with vertical sticks and pulled by a rope.
- To keep it steady, they added some additional wings. Later, they built a compact gasoline engine and invented propellers.
- Eventually, they built a launch rail and successfully flew.



Lily's flying wing.

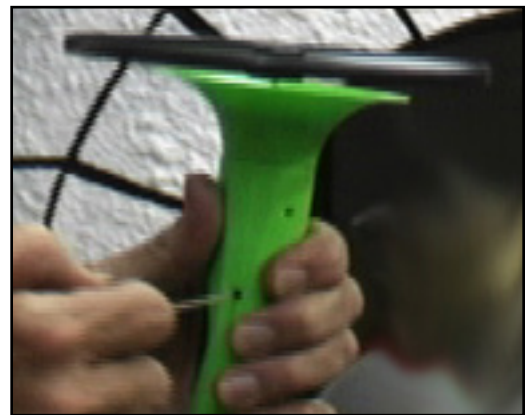


## Experiment Quick Recap: "Puddle Jumpers"

- Students work in groups of two or three. Each group is given various types of helicopter toys to try out, one at a time.
- The first one is a helicopter toy that launches plastic rings from a gun-shaped handle by pulling on a string.
- The second toy launches larger rings.
- The third one is a small motor attached to a 6-volt battery with alligator clips. The motor has an attachment shaped like the end of a screwdriver, and the plastic ring sits on the tip. Students leave one alligator clip unattached from the battery and touch it to the contact when they want to launch the helicopter. After a few minutes, Instructor passes out some other sizes of plastic rings.
- Add another 6-volt battery and attach it with another alligator clip. Place the ring on the motor, then place a plastic cup on top of it to hold it in place until the motor starts to spin. Then pull the cup away, and the ring flies off.
- The last toy is the traditional puddle jumper, a propeller on a stick, which is launched by rubbing it between the hands. Students wear goggles to use this one.



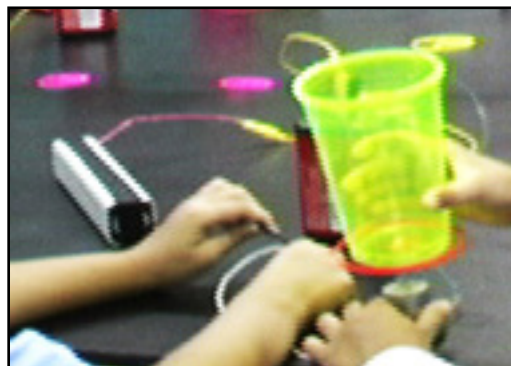
First helicopter toy.



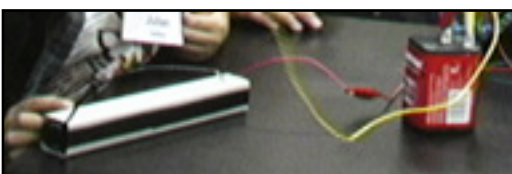
Second helicopter toy.



Third helicopter toy. (Extra battery below.)



Plastic cup on top of third toy.



Puddle Jumper.

## Equipment List: "Puddle Jumpers"

### Items needed for Instructor:

#### Consumables:

- None

#### Other:

- None

### Items needed for Students:

#### Consumables (per student):

- None

#### Other (per group of 2 or 3 students):

- Various helicopter toys, including puddle jumpers
- Battery, 6-volt lantern, 2 per group
- Small motor
- Insulated cables with alligator clips, 24" (3 each)
- Goggles

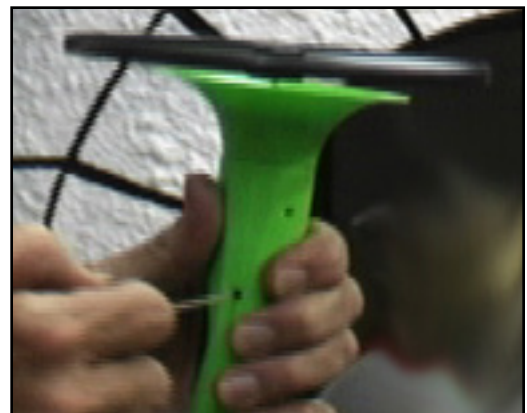
### Prep Work:

- None



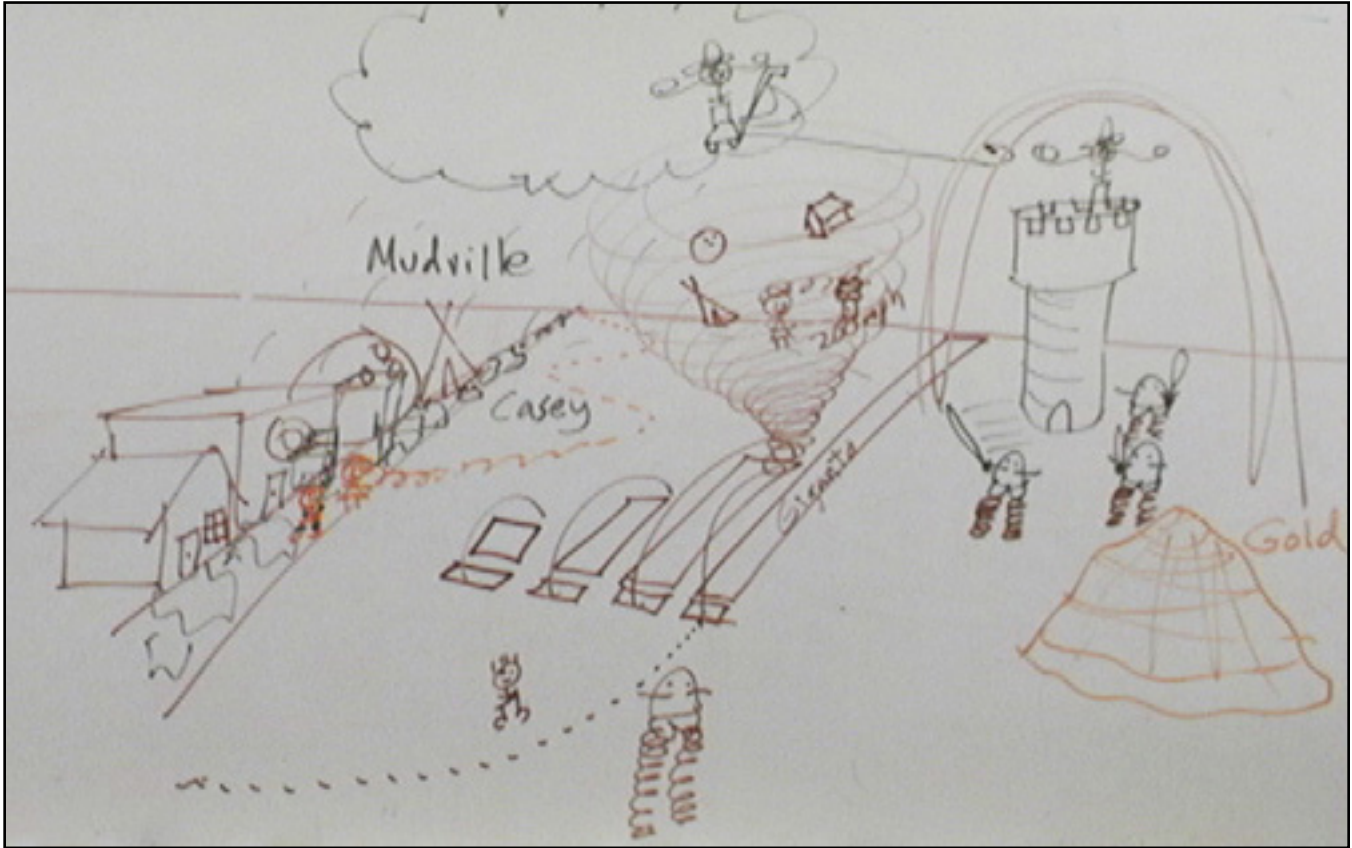
Puddle Jumper.

Other helicopter-type toys.





## Story Recap: "Jack & Jill in Mudville"



### Part 1:

- Jack and Jill lived in a town where everything was made of dirt, called Dirttown.
- Evil Mister Fred roped a cloud and made it rain over Dirttown every day so everything turned to mud, so the people renamed it Mudville.
- People learned to jump over very large puddles, and Jack and Jill could jump while carrying very heavy objects, like a refrigerator or a cast iron stove.
- The minions started hitting rocks into Mudville with their baseball bats, so the people had a baseball game against the minions. The people lost the game, and Evil Mister Fred won all their money.
- Then they decided to have a puddle jumping contest, since Jack and Jill were so good at jumping puddles. They filled puddles with chocolate pudding.
- Evil Mister Fred put springs on the minions' feet so they could jump better, and they started winning.
- Jack and Jill disguised themselves in old clothes and pretended to be unfit for athletics, so Evil Mister Fred bet all his money on the competition.
- As Jill jumped over the last puddle, she started spinning and created a tornado that swept up everything in the town except Jack.

## Story Recap (cont.):

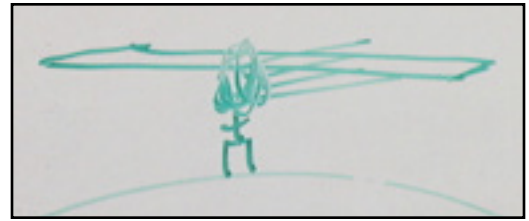


### Ending:

- Jack put a couple of boards on his head, jumped into the air, and started spinning the opposite way that Jill was spinning, so he created an anti-tornado.
- Jack's tornado started to cancel out Jill's, so the buildings started falling out of the sky and returned to their original places.
- When Jack's tornado was in the center of Jill's, it was wobbling so that some places had no wind and others had winds of four hundred miles an hour.
- Evil Mister Fred's castle got tossed out of the tornado at four hundred miles per hour, with him and his minions, and crashed into the Sun.

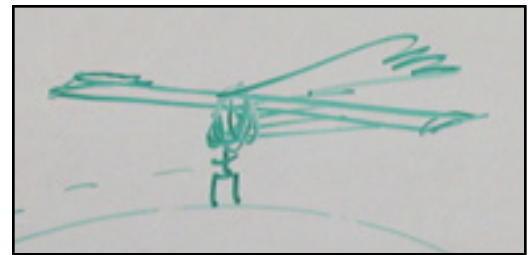
## Transcript: Intro

Once upon a time, there was a guy whose last name was Lily. It's really tough when you're a guy and your last name is Lily. So he had to prove that he was tough. And there was a hill behind his house. So Lily would go to the top of the hill and he'd run down as fast as he could and try not to fall down and go tumble, tumble, tumble, tumble, fumph, fumph, fumph, fumph, fumph down to the bottom. Now one day he had this brilliant idea, and he duct-taped a big stick to the top of his head. It's kind of a thin stick, like that. And he ran down the hill, and the wind caught on the stick, and he glided for awhile. And he thought, "Wow, this is really good!" So he made better sticks. He made sticks that looked like bird wings, like that. And he'd run down the hill that way, and he could glide even further. Every time he'd run down and jump up into the air -- wheeee -- and crash at the bottom. The problem was that this wing thing he put on his head would sometimes tilt this way, sometimes it would tilt that way, and weirdly enough, sometimes it would tilt backwards or forwards. It's really rough when it tilts forwards, because then you do a somersault with this thing stuck on you.



Lily with sticks on his head.

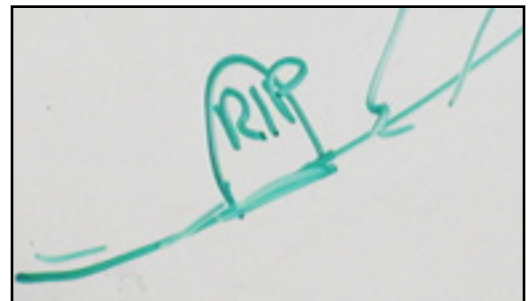
So he put a tail on it. There, now it looks like a bird. It's got a tail. And when he put a tail on it, it didn't tilt backwards or forward so much, it would only tip to the right or the left. He thought, "Okay, I'll put on a little top piece here, and maybe it won't tip to the right or left so much." Well, it still tipped to the right or left, but it didn't turn so badly. And then he had to do some goofy stuff with the back of the wing to kind of control it.



Lily added a tail.

But one day there was a strong steady wind coming. He said, "Yeah, it's a perfect day!" He ran out there, grabbed this thing, got some ropes on it, ran down the hill as fast as he could, jumped in the air and just glided away, hundreds of feet, and was able to land on the ground safely. And he said, "Woo-hoo! This is really good!" and he told his friends all about it.

And then another day came and the wind was almost as good, and he said, "Yeah, I'm going to go flying!" So he ran down the hill, flew into the air, and then the wind stopped. And he thought, "Oh," and went "Aaaaaa" -- crash! And unfortunately, he died, and they buried him. Rest in Peace. But he wrote all about everything he did before he died. He drew pictures of everything that he tried, and he sent these in letters to people all over the place.



Lily crashed.

And there were two guys who got some of the copies of the letters. The Wrong Brothers. Orville and Wilbur. Wilbur's a pig, and Orville is popcorn. And they studied all this stuff, and they said, "Well, we want to do what he did, but we don't want to die." So they decided to go out to a beach where there was always a cat sitting around, and there was a bird flying in the air. And the bird was a hawk. So here's the

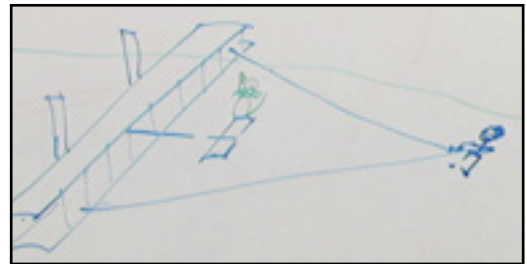
beach, here's the kitty, and then up in the air, here's the hawk. You know what they called the beach? Kittyhawk Beach.

And the wind was blowing this way, let's say. And here's a guy. He's got his feet dug into the sand and he's hanging onto a rope. And the rope is attached to a wing kind of like Lily had. His real name was Otto Lilienthal, by the way. He was a real guy. And they decided to put one wing on top of another wing, with a bunch of sticks between them. And they had this wing that they could fly, and they discovered the same things that he did. You know, it's hard to make it not go up and down and go wham, wham, wham into the sand. It was hard to make it so it didn't go kkrrrr this way or kkrrrr that way, or just go mmmrrrr all different directions.

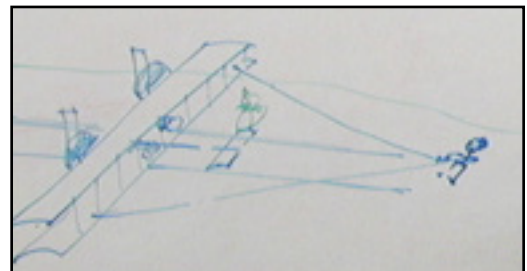
So they added another wing in the front, and they added two wings on the back like that, up-and-down-ways. And then they made it so they could pull on the ropes. Rather than just having just one rope, they made it so they could pull on a couple of ropes and control what this thing was doing. Then they finally got it so they could make it go up and stay up. They could make it go down and stay down. They could make it turn this way, and they could make it turn that way. And everything looked really cool. And they said, "All right! Let's get on it and see if we can fly."

So one of them got on it and tried to take off with the other guy holding the rope. Well, they couldn't do it. He was too heavy. So they said, "We need to make one bigger. And we need more power." So they built their own gasoline engine, a really lightweight gasoline engine. And they said, "Now, let's put on propellers." Then they said to themselves, "What are propellers?" because propellers hadn't been invented yet. Of course, Leonardo da Vinci had made propellers, but they may not have known about that.

So they invented some nice propellers and they put those on it, hooked them up to their engine, and then they built a wooden launching rail. And then they let this thing go down this launching rail, and it took off and it actually flew! And the cat said, "Nice going!" And the bird said, "Yeah!" This was the Wright Brothers at Kittyhawk in what? 1903 or something like that? Well, today we're going to try to make some stuff fly, and we're going to do it easy ways and hard ways. But first we need a crazy story.



Experimental wing at Kittyhawk.



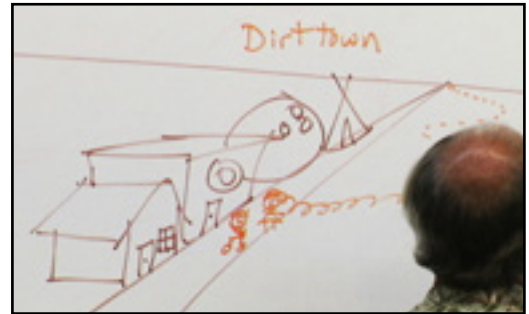
With extra wings, engines, and propellers.



## Story: "Jack & Jill in Mudville"

Once upon a time, there was dirt. There was a whole bunch of dirt. Everywhere you looked, there was dirt everywhere. And somebody decided to build a city out of dirt. So they made a main street out of dirt. And then they made some houses out of dirt. They could make some cars out of dirt. They made windows out of dirt. And they made a store out of dirt. They sell doughnuts, and the doughnuts were made out of dirt.

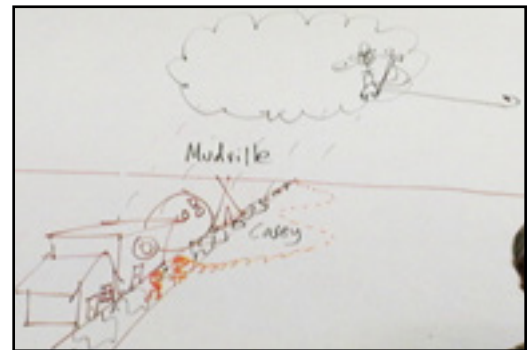
[Students: Eeeeeewww!] Well, if you want to make a doughnut, what do you need? Flour, right? Well, flowers are made out of dirt. [Student: You need a coconut.] And yeah, there was a coconut store made out of dirt, and a tepee made out of dirt. And there were people living there. They didn't mind living there. It was a pretty nice town. It's called Dirttown. And Jack and Jill were visiting there, and they liked the people there, so they decided to hang around for awhile.



Dirttown with coconut and tepee.

And Evil Mister Fred happened to be flying over in his vacuum cleaner one day, and he saw Dirttown. And he said, "Now, there's a nice town. Look at those poor miserable people out there in the dust and the dirt. Life doesn't get any worse than that. And then he saw that they were laughing and playing and dancing. And he said, "What is wrong with those creatures? Are they idiots or what? They like being in the dirt!" And the sun would come out and it would get way too hot, but they didn't mind. They just were happy there.

He said, "Well, I'll show them." So Evil Mister Fred put a rope on his vacuum cleaner with a hook, and he flew off. A little while later, he came back with a cloud, and he left the cloud right over Dirttown and flew away. Well, of course, now it started to rain. And so now they had to rename it Mudville. And the rain made big puddles in the road, it melted a lot of their buildings, and life became cold, wet, and miserable in Mudville. And Mudville had a mayor, his name was Casey. He liked to play baseball. And the people in Mudville said, "Well, even though it's cold and miserable and muddy, we'll make the best of it." So they just rebuilt up their places, they put some straw on the roofs to help keep the rain off, and



Evil Mister Fred hooked a cloud and made it rain on the town, now called Mudville.

sometimes they would need some doughnuts. So they'd go to the doughnut store and buy ten or twenty pounds of doughnuts. They'd need some coconuts, so they'd buy fifty or sixty pounds of coconuts. And they might need some other stuff, and they'd carry all this stuff home. Well, they'd come to a big old puddle, and if you were carrying this heavy stuff and walked into the puddle, you'd sink into the puddle until it was right up to your eyes. So they didn't walk through puddles, they jumped over the puddles.

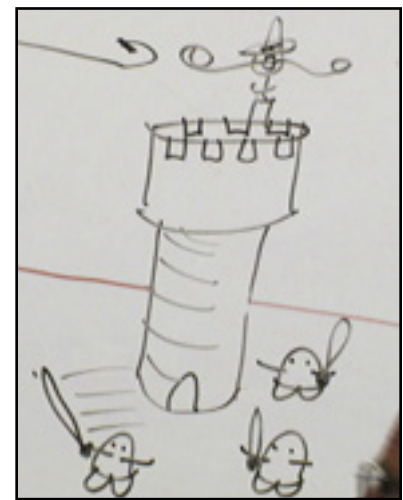
Now, if you're carrying a lot of heavy stuff and you jump over a puddle, it takes a lot of strength. But if you do this day after day after day, the people got really strong legs and arms from carrying stuff. And Jack and Jill were also doing this. They practiced carrying things. In fact, they were a little bit crazy about it. They put weights on their ankles and their wrists, and on top of their heads, and jumped over

the puddles. And pretty soon Jack and Jill could jump over the biggest puddles, a thirty-foot-long puddle. They could run and jump over it carrying some of these weights. And the people in town said, "Whoa, you guys are good!?" And Jack and Jill said, "Ah, but we're going to keep working. We want to get better." So they did. They worked and worked and worked and worked until one day Jill was able to jump over the giant puddle, the thirty-footer, carrying a refrigerator on her head. [Student: *Did it have pizza in it?*] Yeah, and it had pizza in it. And Jack said, "Whoa, that was really good! I want to try that." But Jack used a cast iron stove, and he made it. And everybody in town said, "Woo-hoo! You guys are good!"



Jack with weights on wrists and ankles.

Well, Evil Mister Fred wasn't content just watching from up above. He decided to build a castle nearby just to show off. Every day he'd bring a cloud to keep Mudville muddy, but he let his castle stay dry. And his minions were out there. His castle is made out of stone. The minions are out there with their baseball bats, and they've learned to hit rocks with a baseball bat. Throw a rock in the air and whack! -- they could hit these rocks. And so they were launching rocks at the people in Mudville -- whack! Here's more minions hitting rocks, and they're hitting each other. That's just the way they are. And let's put Evil Mister Fred up here. And Evil Mister Fred said, "You know, we ought to have a contest with those guys. Let's have a baseball game. My minions are so good at hitting stuff, we'll beat them playing baseball."



Minions with baseball bats.

So he ran over there and talked to Casey. And he said, "Casey, let's have a baseball game." And so they had a baseball game. And Casey got to bat and was struck out, and they lost the game. And then Evil Mister Fred won from the town of Mudville one million dollars in gold. So he had this big pile of gold. And people in Mudville were really sad about this because they lost a million bucks. Yeah, and the gold was made out of dirt. And the people in Mudville said, "We've got to win that back. Jack and Jill, what are we going to do to win that money back?" Jack and Jill said, "Well, I don't know." And then Casey said, "Wait a minute. You guys are good at jumping. Let's have a contest. A puddle jumping contest."



Pile of gold.

So they ordered about ten tons of pudding, chocolate pudding, and they dug holes in the ground, and they put pudding in the holes. And then they put boards next to each hole. There was a small hole, and a medium length hole, and a long hole. And they were going to challenge Evil Mister Fred's minions to a puddle jumping contest. This is perfect because minions have no legs. They've got big feet. They're just stubs. And they made the giganto puddle that was eight hundred feet long, like that.

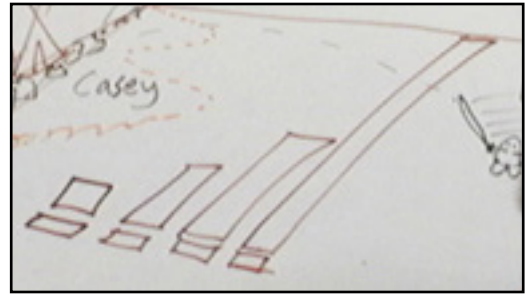
And Evil Mister Fred couldn't turn down a bet. And they said, "Come on, we'll have a contest. Whoever jumps over the longest puddle wins all the money." And Evil Mister Fred said, "I'll take it! We'll beat your guys!"

And so Evil Mister Fred said, "All right, I've got to cheat here." So he called the Acme Store of Everything, and he ordered springs, and he glued springs to his minions' feet. And then he had the minions practice bouncing around like kangaroos -- boing, boing, boing -- and they crashed and burned and hit everything. Well, after awhile, the minions could bounce clear over -- boing -- Evil Mister Fred's castle, like that. And Jack and Jill said, "Uh, oh. Those guys can really bounce."

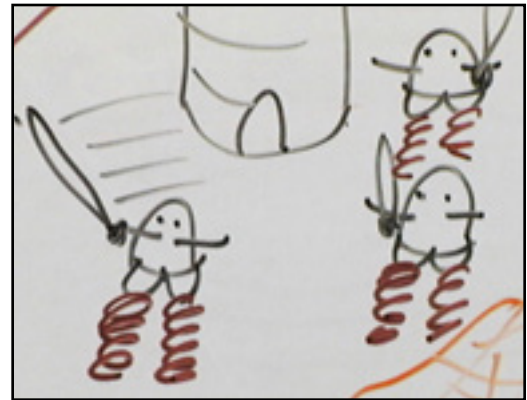
Well, the day of the contest came, and they had the minions bounce over the first puddle -- boink -- and won easily. And then they did the medium-size puddle -- boink! Again, the minions beat the people of Mudville. And boink! -- they won in that one, too. And everybody in Mudville said, "Uh, oh. We're going to lose." Then Casey said, "Jack and Jill, you're our only hope. You're our strongest jumpers. Go put on some old torn-up clothes with holes in them and all kinds of nasty-looking stuff on them, black out some of your teeth with wax, mess up your hair really good, and then come back out."

So Jack and Jill did. They looked like hunchbacks. They were drooling, they were going, "Is this good?" And Casey said, "Yeah, that's perfect." And then he said, "Okay, Evil Mister Fred, we're ready for Giganto. And Evil Mister Fred said, "Well, where's your contestants?" And Evil Mister Fred had his best minion in there standing on his springs. And Casey said, "All right, Jack and Jill, come out!" So Jack and Jill came out, limping and gimping and drooling. And Evil Mister Fred saw them and he said, "Those are your contestants? They can't even walk! I'll triple my bet! Three million bucks. If your guys beat my guys, I'll pay you three million dollars."

And Jack and Jill said, "All right. This is cool." And Jill got selected to jump first. So Jill hunched way back, ran as fast as she could, and just before she planted her foot on the board to take off over Giganto, she said, "You know, I've been taking ballet lessons. It would be nice to do a nice pirouette through the air as I go." So when she jumped, she started to spin through the air. And as she spun -- boing -- her hair created a gigantic tornado. And here's Jill in there, and the air's spinning around her, the hair's spinning around her, two hundred miles an hour. And the tornado took on a life of its own. It started to spin like crazy, and it sucked all the pudding out of Giganto. And then it sucked up the other puddles, and then



Puddles for the contest.



Minions on springs.



Jill's tornado with everything in it.

it went through and it sucked up the tepee and the coconut and the doughnut shop and the houses. It sucked up everything on the land, and it sucked up Evil Mister Fred and all the minions, until everything was gone except Jack. Let's put Jack down here. And everybody was up in the tornado spinning around, screaming for their lives. And there's a tepee in there, and Evil Mister Fred's castle was in there. And Jack said, "Oh, no! We've got to do something! This is terrible! Everything is up there, way up in the sky, and they're all going to die." If you were Jack, 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 . . ."

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## Experiment: "Puddle Jumpers"

So, the first experiment is easy. We have regular toys that you get at the 99-cent store. And these have helicopters on them, and the idea is to make the helicopter fly and see how high you can make it fly. Now, being that these are 99 cents, they usually last about two classes. So don't pull too hard, because if you keep pulling after it goes that far, you end up with a string in one hand and a toy gun in the other hand. We'll see how high those go. And then we're going to compare these to another variety that we have. These aren't the Kid Killers. The Kid Killers are last. And these guys, you can pull them and see if they fly, and see how high those go.

So, we're going to use just those two varieties, and you're going to trade with each other to see how they work. Try to not fly them that way [*toward shelves*], because once they go that way, we usually never see them again until two or three years later when we pull a box off the shelf and say, "Oh, lookit there -- helicopters." Try to fly them this way [*towards the whiteboard*], and they'll bounce off the wall and come back down.

And of course, we always go by the Evil Mister Mac's Rules of Unfairness. If you want a certain one, you don't get it. If you don't want it, then you have to use it.

We're going to start off with these guys. There are three helicopters and a gun in each one, and there are a few more over there that might still work. So you guys share those [*gives one to each group of two students*]. You get extra points if you hurt yourself.

Once you launch the helichopper, try to go find it. [*Students take turns launching the small plastic helicopters for a few minutes. Then the Instructor passes out toys that use larger helicopters, and students launch these for a few minutes.*]

Let's see, let's get a box to put all this stuff in. If it flies, or looks like a thing that makes things fly, put it in there. Now, look around. If you see a helicopter stuck in somebody's hair, take it out.

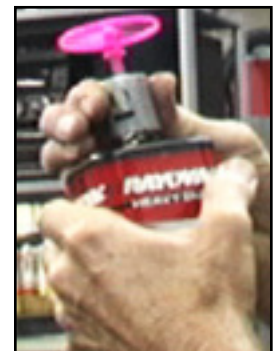
Now we're going to use some silver things. This is a silver thing. [*Student: A Kid Killer?*] No, Kid Killer's last. It's got a spinny pink thing on top with a tip that looks like a screwdriver, and it's got two gold-colored nubbies on the bottom. Yeah, it's electric. If we touch it to the pigtales on this box, it makes noise. [*Touches motor to 6-volt battery so it spins.*] Now, this is not a drill. Because some kids turn it on and then they try to drill into the table, which breaks off the flat end on it, so it doesn't work anymore. Now, I might want to put something on it, because



First helicopter toy.



Second helicopter toy.

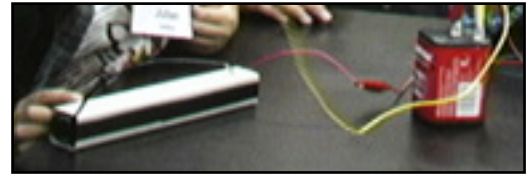


Motor & 6-volt battery.

it spins, and it's fun to put things on things that spin. *[Places a small helicopter on the pink tip.]* So it fits onto that thing, and I can put this on it *[touches motor to battery]*, and there you have a spinning hat. It looks like a hat, but it doesn't come off. If I go like that *[jerks motor slightly]*, it does come off.

Now, if you don't want to have to hold it here and try to match it onto those, we have alligators. And if you squeeze their heads, their mouth opens and closes. If you squeeze sideways, it hurts their ears. And you can put the alligators on the motor *[attaches alligator clips to motor wires and attaches only one alligator clip to a battery terminal]*, and now you've got this handy-dandy switch. You can touch the alligator on there *[touches unconnected alligator clip to the remaining battery terminal]* and it goes like that *[jerks motor and helicopter flies off.]* And the idea is to make this thing fly as high as you can with what you have. After awhile, we'll be handing out different ones of these *[helicopters]*, and we'll just see how high we can make them go. So you're going to stay in the same groups and we're going to pass out batteries and wires and motors and propellers, so you guys can try stuff out. *[Students assemble the parts and try out the small helicopters. After a few minutes, Instructor passes out some additional helicopters in different sizes.]* Can you make it so that it doesn't fly?

*[After a few more minutes]* You know what you're supposed to say now? You're supposed to say, "More power!" Okay, to get more power, you need one more alligator and another batch of batteries. Just so you don't spend all day working this, I'll tell you you need to make it a circle. You put one battery there, and you look for red. Red is always positive. Go from positive to negative, positive to motor (which is positive), to here. And now, twelve volts instead of six. And it makes a big circle. If your wires make smoke, you say to yourself, "Oh, my wires are making smoke. That means they are really hot, so maybe I'd better take the wire off."



Extra battery connected.

So in this case, you're going to put on your propeller, spin it up, and just so you don't get your fingers tangled in things, we're going to give you a plastic cup. And the idea is to have one member of your group hold the battery and the propeller and the cup like that. And then the other member touches that to the wire. *[Uses cup to hold propeller in place while it spins up, then pulls cup away and propeller takes off.]* And see if you can touch the ceiling. It can be done. *[Students add second battery and launch propellers with cups for a few minutes.]* Try not to break the tip off. Don't push too hard.

*[Student: It's just staying there.]* Well, reverse the wires. Is the wind blowing up or down? You're blowing the wind up. Now it's a fan. You're just making it so it blows the air the opposite way.

*[After several minutes]* Time's up! Everybody disconnect your wires and go search for helicopters. Look all over the place for helicopters, and put all the helicopters in the helicopter box. Put the batteries on the battery cart.



Plastic cup on top of helicopter.

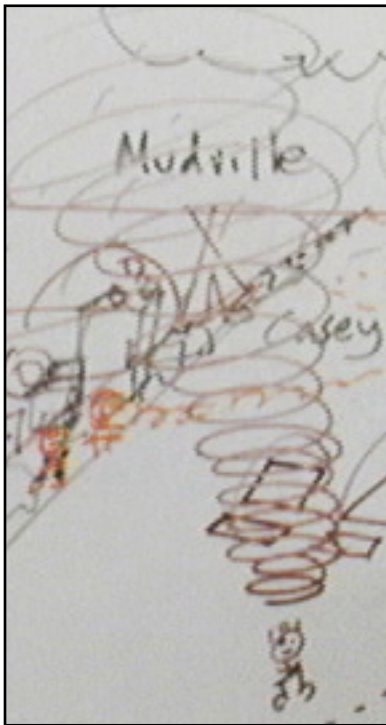
Now we're going to get the Kid Killers. For Kid Killers you need goggles. When we pass these out, just rub them in your hands and keep rubbing them in your hands. When you get tired of rubbing them in your hands, then let go and see what they do. *[Students put on goggles and fool around with Kid Killers (propellers on sticks) for a few minutes, then put them away.]* Isn't that a cool toy? Anybody bleeding?



Kid Killer (Puddle Jumper).

## End of Story

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

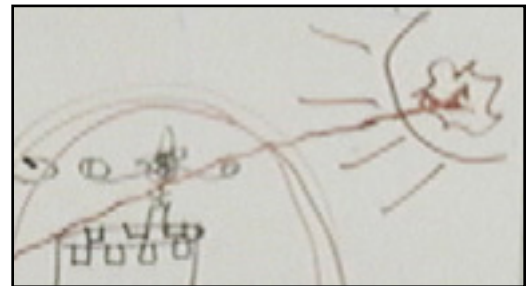


Jack's reverse tornado.

So Jack is the only one left. Jill has sucked up everything with this incredible tornado. And Jack says, "I know what I'm going to do. I'm going to jump up into the air, and I'm going to spin the other way." So Jack grabbed a couple of the boards that were still stuck in the ground, held one in each hand, went as fast as he could, jumped into the air, and started spinning in the other direction and created an anti-tornado. Jack's plan is to steer his tornado into Jill's tornado and cancel the winds. Will this work? *[Students: No. Yes.]* Well, first when he comes closer to Jill's tornado, his wind is going this way, her wind is going that way, and they cancel out, and things start to fall out of the sky. The doughnut shop landed exactly where it was before. And so did the coconut and the tepee and the house. Even the mud puddles landed where they were before, and the pudding went right where it was supposed to go. And the boards landed where they were supposed to go. *[Student: What about Evil Mister Fred's castle?]* It didn't land where it was supposed to go.

And then when Jack's tornado got right into the center of Jill's tornado and was wobbling this way and that, in some places it made no wind, and in other places it made wind of four

hundred miles an hour. And Evil Mister Fred's castle got tossed out at four hundred miles an hour, with Evil Mister Fred on it, and minions in it. And it went zzzhhooooo and crashed on the Sun. There. Brown Sun, made of dirt. And they all lived happily ever after, except Evil Mister Fred.



Evil Mister Fred shot into the Sun.

## End of Lesson

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