The Pop Ups. Stay seated. Three, two, one, ignition. Get ready for an adventure of magnificent proportion.

The Pop Ups. (Singing.) I don't know what you've been told, but we're in a golden age - so many discoveries that are jumping off the page. Wow in the world. Wow in the world. Wow in the world. Wow in the world. Wow in the world. Wow in the world. Wow in the world. Wow in the world.

The Pop Ups. With Guy and Mindy. We're on our way, Houston.

Mindy. Nooooooodles! Get your noodles!

(Soundbite of Reggie cooing.)

Mindy. We've got linguini, cappellini, ravioli, and even those little ones that look like the tiny bow ties! Noodle caboodle, coming through!

Dennis. (Gasp.) The noodle caboodles here! The noodle caboodles here! I want macaroni, no wait, baked ziti, no wait, zamboni! Hey, where are you going?!

Guy. What in the…..?

(Soundbite of noodle caboodle coming to screeching halt.)

Reggie. Coo!

Mindy. Gooooooood morning, Guy Razzy! Can I interest you in some of my famous pastarazzi!?

Reggie. Coo.

Guy. Mindy? Reggie? What have you done with your ice cream truck?

Mindy. Oh...well, isn't it obvious? We…

(Soundbite of running.)

Dennis. Ok, ok. I know what I want now. I'll take a venti sized bowl of lamborghini, hold the terracotta please!

Mindy. Sorry Dennis, but we're all out of lamborghini noodles

Dennis. (Gasps.)

Mindy. Can I interest you in a bowl of... science instead?

Dennis. Hmmm… no.

Guy. Wait...science?

Mindy. Consider this a scientific pasta presentation, inspired by a new-dle scientific study…

Reggie. Coo.

Guy. Are you talking about that new study about flat packed noodles that was just on the cover of the journal, Science Advances?!

Mindy. Yes! You know about it, Guy Raz?

Guy. Oh, I read that one Mindy! Amazing! The way those researchers from Carnegie Mellon, Syracuse, and Zhejiang Universities got together and completely reinvented the way we should be making and packaging pasta!?

Dennis. Well that sounds tortellini awesome!

Mindy. I know, bonkerballs, right?! So in an effort to recreate what these scientists did in their lab, I decided to turn my ice cream truck into the noodle caboodle! Delivering pop up pasta presentations all over town! Ahem. Welcome, everyone, to the noodle caboodle! You're just in time for a delicious demonstration!

Grandma G-Force. Well…okay.

Mindy. Now, please take your seats, and we'll begin the presentation.

Thomas Fingerling. Ooo, is it one of them fancy edible presentations?

Guy. No!

Thomas Fingerling. Well, phooey!

Mindy. But if all goes well, you will get to eat what comes out of it!

Thomas Fingerling. / Grandma G-Force. / Dennis. Yay! / Yippee! / Zi-pa-dee-doo-dah!

(Soundbite of film rolling, music playing.)

Mindy. Our presentation begins in the year 2017, when two scientists and engineers, Lining Yao and Teng Zhang set out to find a way to create materials that were flat or two dimensional that could transform themselves into three dimensional shapes.

Guy. And to give you an example of a three dimensional shape, we'll take this box of pasta…

(Soundbite of pasta rattling.)

Grandma G-Force. Oooooh!

Dennis. Yeah yeah yeah, pasta! That's what I'm talking about!

Thomas Fingerling. Ooh, I just knew this presentation was going to be one of them fancy edible kinds

Guy. Okay. Well, this box is a three dimensional or three "D" shape because it has volume, a top and a bottom, sides, a front, and a back!

(Soundbite of pasta rattling.)

Thomas Fingerling. Hmm, go on...

Guy. And there was a recent peer reviewed scientific study in the journal Science Advances–

(Soundbite of film reel stopping, presentation music halts to end.)

Thomas Fingerling. Wait wait wait, go back to the pasta inside that there three "D" box.

Dennis. Yeah, the pasta!

Guy. Ugh.

Mindy. Anywho...before these scientists could transform two dimensional flat materials into three dimensional shapes, they had to experiment with different kinds of materials!

Guy. Which brings us to Mindy's noodle caboodle!

Mindy. Guy Raz! Hand me that bowl over there in the back.

Guy. Okay.

(Soundbite of bowl clunking.)

Mindy. Reggie?

Reggie. Coo.

Mindy. I'm going to need some semolina flour, some eggs, and some water, stat!

Reggie. Coo, coo.

(Soundbite of pigeon wings flapping.)

Dennis. Oh! I'll go get the hose from my yard!

(Soundbite of Dennis running off.)

Guy. What are we doing, Mindy?

Mindy. What do you think we're doing, Guy Raz?! Here we are, standing in the serving window of my noodle caboodle truck! Eh?

Guy. Uhhh..

Mindy. Ugh. We're making morphable material known as...pasta dough!

Thomas Fingerling. It's also an edible material.

Grandma G-Force. Glad I'm wearin' a bib.

Reggie. Coo!

Mindy. Guy Raz...First, I'll need you to take that bag of flour and dump it into this bowl.

(Soundbite of flour pouring out.)

Guy. Mindy...this bag of flour weighs more than Grandma G-force. Are you sure you want to use the whole thing?

Mindy. Yes, of course I'm not sure, Guy Raz! Now, dump it in the bowl.

Guy. Okay…

(Soundbite of flour pouring out and coughing.)

Mindy. Next up! The eggs. Uh, where are the eggs?

(Soundbite of rustling and metal clanking.)

Guy. What happened to the eggs? They were just here!

Grandma G-Force. Oh. Let me get them out from under my rump.

Reggie. Coo.

Guy. You were sitting on the eggs?!

Grandma G-Force. Just tryna keep em safe during that smoke storm we just had.

Guy. What?!

Mindy. Aw, Grandma G-Force that was so thoughtful of you!

(Soundbite of eggs cracking into bowl.)

Guy. (Sigh.) What's next, Mindy?

Mindy. Okay so, next, we're going to mix it all up. I attached an airplane propeller to this mixer here…

(Soundbite of clank.)

Mindy. Just put the bowl underneath it…

(Soundbite of clank.)

Mindy. Turn this puppy on…

(Soundbite of engine.)

Mindy. And…

(Soundbite of dough splattering.)

All. Blagghhhhh!! Ahh, Mindy!

Mindy. Well. There! That should do it! We just need to take the dough out of this bowl…

(Soundbite of dough thumping down on a surface.)

Mindy. And we're gonna roll it flat.

Reggie. Coo.

Guy. Oh...do you have a rolling pin Mindy?

Mindy. A rolling pin?! Nah. I'm going to run the dough over with this truck.

Reggie. Coo.

Guy. Oh no.

Grandma G-Force. Already one step ahead a ya Mindy!

(Soundbite of keys jingling and truck engine starting.)

Guy. Where did she get the keys?!

Dennis. I feel unsafe.

Mindy. Quick, Dennis! Take this dough and put it in front of the noodle caboodle!

Dennis. Okay!

(Soundbite of running and panting.)

Grandma G-Force. Hold onto your tater tots, everybody! Grandma G-Force is gonna step on the gas.

(Soundbite of tires screeching.)

All. Whoa! Oof!

Guy. I guess I'll go peel the dough off the road?

(Soundbite truck door opening.)

Mindy. Thanks Guy Razzy! And while you do that, I'll continue with the presentation.

Dennis. And by presentation you mean cooking pasta?

Thomas Fingerling. Yeah! For eating!

Mindy. So typically pasta noodles are made by squeezing dough through a metal pasta die and formed into shape. But like the scientists in this study, we're going to use flat, rolled dough instead.

Guy. I got your road dough Mindy.

(Soundbite of truck door opening and closing.)

Mindy. Oh, thank you, Guy Raz. Smashed and full of gravel...just like my Grandma G-Force used to make!

Grandma G-Force. That's me!

Thomas Fingerling. Showboat.

Mindy. And just like the scientists in the study, we're going to cut this dough into flat shapes like this….circle...square...rectangle…triangle….

(Soundbite of dough getting cut.)

Dennis. Ooh, I want a rhombus! No wait! A parallelogram! No wait! A concave octagon!

Reggie. Coo.

Mindy. Okay now. My partner Guy Raz here, is going to take this fork…

(Soundbite fork clanking.)

Mindy. And gently press into the shapes to make tiny patterned grooves on the surface of the dough.

Guy. Mindy, I'd love to, but I feel like the tires from your noodle truck already did that?

Mindy. Oh! you know what? You're right! Look at that everyone! This dough's got grooves! Now I need everyone to listen carefully, because what I'm about to tell you is very important and very scientific.

Thomas Fingerling. I'm listening.

Mindy. Hey Reg, you wanna get the water boiling on the stove back there?

Reggie. Coo coo coo.

Mindy. So the grooves in this pasta might look like ordinary tire tracks to some of you. But what if I told you that they were the key to some scientastic magic?

Thomas Fingerling. / Grandma G-Force. / Dennis. No way, that doesn't make sense.

Mindy. What if I told you that those grooves could be used to control the shape of these flat pasta noodles!

Thomas Fingerling. / Grandma G-Force. / Dennis. No way, you're pulling my leg!

Guy. Mindy's right! The scientists in this study added their own flat pasta dough into boiling water, and they found that the groove sides expanded and

swelled less than the smooth sides, which led the pasta to morph into three dimensional shapes!

Thomas Fingerling. / Grandma G-Force. / Dennis. Oooooh!!

Mindy. Tubes! Spirals! Twists! Waves! Ribbons! Ruffles! Pasta plumping and swelling to almost every shape you could dream of!

Thomas Fingerling. Oh, I'd eat all of those.

Grandma G-Force. Tell us more, Mindy.

Mindy. Why tell you more?

Guy. When we can show you more!

Dennis. Ooh! Show me show me show me! Show me!

Reggie. Coo!

Mindy. Everyone into the ice cream truck! I mean, noodle caboodle!

Dennis. What?

Thomas Fingerling. Huh?

Mindy. Get in.

Thomas Fingerling. / Grandma G-Force. / Dennis. Oh Okay. / Well, I suppose.

(Soundbite of doors opening and closing.)

Grandma G-Force. We gonna see something? Oh, I’m gonna eat everything.

Guy. Now what you’ll see here is a large pot of boiling water.

(Soundbite of boiling water.)

Grandma G-Force. Ooh a hot tub! Sign me up.

Guy. Again...This is a large pot of boiling water so we need everyone to stay very still and be very careful around it.

Mindy. And while you're all busy being very careful, I am going to gently add the flat, grooved, pasta shapes to this boiling water...just...like...this…

(Soundbite of pasta dropping into water)

Guy. Careful, careful now, Mindy...

Thomas Fingerling. Ooh.

Dennis. Oh look! something's happening to the little shapes!

Reggie. Coo.

Mindy. What you're seeing here, is that it's taking longer for the water to cook the grooved parts of the pasta shapes than it is the smooth parts.

Grandma G-Force. And they're plumpin' up!

Dennis. And they're curlin' up too!

Guy. Ooh. And that one looks like the Eiffel Tower in Paris!

Grandma G-Force. And this one looks like my large intestine!

(Soundbite of boiling water.)

Dennis. Ew.

Guy. Amazing! Just like the scientists found in their study. The flat pasta dough with grooves is bouncing and swelling to three dimensional shapes!

Mindy. And what's even more wow, is that the researchers found that by carefully planning where they placed the grooves and how they pressed the grooves into the dough, they could control the shapes that the pasta morphed into once it was cooked!

Dennis. This is awesome! I'm only eating magic shapeshifting noodles from now on!

Thomas Fingerling. It’s called pop-up pasta!

Dennis. Oh yeah, that’s right.

Guy. You know Mindy, a box of pasta that comes flat and doesn’t expand or bounce into shape until after it cooks, would probably take up a lot less space than say a big box of twisty fusilli or even macaroni!

Grandma G-Force. Well, finally! A box of noodles that would fit in that Debbie Doll Dream Hut of yours!

Guy. Okay, for the last time, it’s a sustainable, solar powered microhouse, and…

Mindy. But Grandma G-Force is right, Guy Raz! A box of flat to plump pasta would require a lot less packaging and a lot less storage space. In fact, the researchers in this study found that if macaroni noodles were flat to start with, a full box of macaroni would take sixty percent less packaging space!

Guy. Wow! That would be like packing the same amount of pasta in a box twice as small as the boxes we see in grocery stores now!

Mindy. You know it!

Guy. And I’m also guessing that smaller packages of flat packed pasta would lead to a smaller carbon footprint when it came to delivering it to stores and restaurants.

Mindy. Exactoritos! Also, the researchers on this study found that it only takes a short seven minutes to cook. Which means…

Guy. Which means that it would also save energy!

Dennis. (Singing.) Go papa pasta! Savin’ all the energy!

Thomas Fingerling. Ha-chaw!

(Soundbite of knuckles cracking.)

Mindy. And with this discovery, Dr. Yao, Dr. Zhang, and her team may have found a new way to get flat packed pasta to astronauts on the international space station…

(Soundbite of space equipment beeps.)

Mindy. Or disaster sights, or anywhere else that food should take up as little space as possible!

Guy. And I think I read that they're also experimenting with other morphable materials like plastic, and rubber, and fabric and other foods.

Mindy. Exactoritos! And as they experiment more, if they find that grooves can be used to control the shapes of some of these other materials. Well, this could lead to big breakthroughs in the future of soft robotics or more!

Guy. Amazing! Who knew you could pack so much science into such simple pasta?

Grandma G-Force. Mindy...when are we gonna get to eat the little noodles? My tummy's barking!

(Soundbite of stomach grumbling.)

Mindy. Oh! Well, good question, Grandma G-Force! Everyone, dig in! Bon appetit!

(Soundbite of utensils clanking and noodles being slurped.)

All. Mmm / yum.

Dennis. Mmm, the flavor is delicious! But there's a hint of something I just can't quite place.

Thomas Fingerling. Truck tire!

Dennis. Oh right!

Thomas Fingerling. Ooh, that's the stuff!