

The Lollipop Hypothesis Transcript

COMMERCIAL	<p>Mr. Owl, how many licks does it take to get to the Tootsie Roll center of a Tootsie Pop?</p> <p>A good question.</p>
LUKE GROSKIN	<p>Since childhood we've all pondered is deeply philosophical question. How many licks does it take to get to the center of a Tootsie Pop? And now even mathematicians have sought to solve this childhood mystery.</p>
LEIF RISTROPH	<p>The original inspiration for the study was not to look at candy itself, but to look at the fluid dynamics of dissolving. So it was a little more boring of a motivation. And then later we realized it would be fun to think about what it means to eat or consume candy.</p>
GROSKIN	<p>It turns out that studying lollipops dissolving applies to rivers eroding landscapes and pills dissolving in the body. To learn more about these vanishing acts, Ristroph, along with Jinzi Mac Huang, and Nicholas Moore designed experiments to see how the fluid moved around the suckers. But they couldn't use just any lollipops. It had to be mathematically perfect candy.</p>
RISTROPH	<p>If you buy a lollipop from the store and you look at it, there's actually giant air bubbles all in it, and this is a little troublesome if you're, like, an obsessive compulsive mathematician, right? Because you're trying to look at the change in shape, and then suddenly this big divot appears in your candy because there's an air bubble in there. So we tried that, and after a little bit of frustration we decided we were going to make our own candy. And we make it in a way that ensures there's no bubbles inside of it.</p>
GROSKIN	<p>The team created differently shaped lollipops so they could watch how each disappeared.</p>
RISTROPH	<p>As mathematicians we like perfectly symmetric and beautiful shapes.</p>
GROSKIN	<p>Each candy was suspended in a 40-gallon tank it creates a uniform flow of water over the sugary suckers.</p>
RISTROPH	<p>It's a two-part problem. That's what makes it fun. You got the solid object, and then you have the fluid, and they actually influence one another. The solid object makes the fluid kind of bend around it. But then the fluid actually changes the shape of the solid object.</p>
GROSKIN	<p>But they wanted to be able to see how the clear water moves around the lollipops.</p>

RISTROPH	A big part of our lab is to make these invisible flows visible. And so we have lots of tricks to do this.
GROSKIN	Like lasers.
RISTROPH	You can take little glass particles, throw it into the water, and it'll spread all throughout. The light from the laser sheet scatters off the particles. So what you see basically, is a bunch of little lines that represent how the fluid is flowing around the body.
GROSKIN	Then they watched while the shapes eroded into sugar sculptures.
RISTROPH	Michelangelo said in every piece of rock there's sort of a sculpture that's inside of it, and his job as a sculptor is to reveal that. And in our study it's sort of like inside of each piece of candy is this final shape, and the fluid basically reveals that. What we found is, regardless of the body you start with, whether it's a sphere, whether it's a square, whether it's a cylinder, it eventually makes this nice curve, polished, beautiful round front that's facing into the flow. That's the commonality. Now, the dirty truth is there is also a backside to the body. And we almost understand nothing about it.
GROSKIN	But what about that epic question?
COMMERCIAL	How licks does it take to get to the Tootsie Roll center of a Tootsie Pop? [CRUNCH] The world may never know.
GROSKIN	Actually, we do know.
RISTROPH	You can view licking a lollipop as basically washing a fluid over the lollipop at that speed.
GROSKIN	Using a fairly complicated formula, they arrived at a golden number.
RISTROPH	A thousand licks to get to the center of a lollipop.
GROSKIN	But that's a fairly rough estimate, since the applied mathematics lab can't incorporate your tongue and saliva measurements into the equation.
RISTROPH	I would be very excited to have people actually test that number.
GROSKIN	So would we. Take the Science Friday Lollipop Challenge to find out how many licks it takes for you. All it takes is some time, a lollipop, and a tongue.