Outrageous Ooze

This stuff can’t make up its mind—is it a liquid or a solid?

What do I need?

- newspaper
- measuring cups
- 1 cup of dry cornstarch
- large bowl or pan
- food coloring (if you want)
- 1/2 cup of water

What do I do?

1. Put newspaper down on your counter or table top.
2. Put the cornstarch into the bowl. Add a drop or two of food coloring. (Use whatever colors you like.) Add water slowly, mixing the cornstarch and water with your fingers until all the powder is wet.

3. Keep adding water until the Ooze feels like a liquid when you're mixing it slowly. Then try tapping on the surface with your finger or a spoon. When Ooze is just right, it won't splash—it will feel solid. If you Ooze is too powdery, add a little more water. If it's too wet, add more cornstarch.

4. Play around with your Ooze!

**Wow! I Didn't Know That!**

Ketchup, like Ooze, is a non-Newtonian fluid. Physicists say that the best way to get ketchup to flow is to turn the bottle over and be patient. Smacking the bottom of the bottle actually slows the ketchup down!

- Pick up a handful and squeeze it. Stop squeezing and it will drip through your fingers.
- Rest your fingers on the surface of the Ooze. Let them sink down to the bottom of the bowl. Then try to pull them out fast. **What happens?**
- Take a blob and roll it between your hands to make a ball. Then stop rolling. The Ooze will trickle away between your fingers.
- Put a small plastic toy on the surface. **Does it stay there or does it sink?**
Why does my Ooze act like that?

Your Ooze is made up of tiny, solid particles of cornstarch suspended in water. Chemists call this type of mixture a colloid. As you found out when you experimented with your Ooze, this colloid behaves strangely. When you bang on it with a spoon or quickly squeeze a handful of Ooze, it freezes in place, acting like a solid. The harder you push, the thicker the Ooze becomes. But when you open your hand and let your Ooze ooze, it drips like a liquid. Try to stir the Ooze quickly with a finger, and it will resist your movement. Stir it slowly, and it will flow around your finger easily.

Your finger is applying what a physicist would call a sideways shearing force to the water. In response, the water shears, or moves out of the way. The behavior of Ooze relates to its viscosity, or resistance to flow. Water’s viscosity doesn't change when you apply a shearing force—but the viscosity of your Ooze does.

Back in the 1700s, Isaac Newton identified the properties of an ideal liquid. Water and other liquids that have the properties that Newton identifies are called Newtonian fluids. Your Ooze doesn't act like Newton's ideal fluid. It's a non-Newtonian fluid.

There are many non-Newtonian fluids around. They don't all behave like your Ooze, but each one is weird in its own way. Ketchup, for example, is a non-Newtonian fluid. (The scientific term for this type of non-Newtonian fluid is thixotropic. That comes from the Greek words thixis, which means "the act of handling" and trope, meaning "change").
Most liquids don't act like that. If you stir a cup of water with your finger, the water moves out of the way easily--and it doesn't matter whether you stir it quickly or slowly.

Quicksand is a non-Newtonian fluid that acts more like your Ooze--it gets more viscous when you apply a shearing force. If you ever find yourself sinking in a pool of quicksand (or a vat of cornstarch and water), try swimming toward the shore very slowly. The slower you move, the less the quicksand or cornstarch will resist your movement.