



# A magnetic tale

When I was very young, one of my favorite toys was Woolly Willy. For those who haven't been introduced, Woolly Willy is a cartoon drawing of a face that is mounted on cardboard and covered with a plastic window. Between the plastic and the cardboard is a small space, where tiny iron bits freely move around. It also comes with a magnetic "wand" that can be used to move the iron filings to give Willy's clean-shaven face new features such as a beard or hair.

The encased iron filings mesmerized me. These iron flecks would awaken as the magnetic wand drew near to them and would flare out like quills on a porcupine; and then the iron bits would sleep like a gray cloud on the cardboard when the wand was lifted away. That is how I understood it when I was too young to comprehend magnetism.

I eventually became a materials science professor developing new types of solders (that is, low-melting point metal alloys) and finding ways to strengthen them. Strengthening solder can be likened to the consistency of cake. Compared to a pound cake, a fruitcake is harder to cut because of all the stuff in it. The same goes for solder. By putting stuff in it, in this case small particles, it is strengthened.

In an effort to make solder stronger, one of my students added iron filings to it. He noticed something. When he moved a big magnet over the new solder, he could pick it up. He didn't think it was anything important, so he kept this to himself.

One day at the end of a research group meeting, he took a quarter-sized puck of metal out of his pocket and a magnet, and waved the magnet above it. In an instant, the puck snapped up to the magnet, and he said, "This seemed kind of neat."

I was immediately transported back to memories of Woolly Willy, and I wondered if we could change the shape of the solder when it was molten. We ran into the laboratory with the enthusiasm of seven-year-old children, melted the solder, hovered a magnet over it, and were astonished. We found a magnetic solder that could make three-dimensional shapes by the waving of a magnetic wand.

After the crescendo of presentations, publications, and patents for this special solder waned, I wondered, who made Woolly Willy? I did some research and found a name: James Reese Herzog. I decided to find Herzog and thank him for the hours of entertainment in my childhood and, more importantly, to thank him for the inspiration his toy gave me for my invention as an adult.

One cold December evening in my office, as I was mustering up the energy to trek home, I typed in the name of Herzog's company. I found out he had sold it, so I contacted the company that bought it. They replied the next day and said Herzog wasn't doing interviews. In my disbelief that an inventor would not want to talk about his invention, I sent an email to the Chamber of Commerce of the town Herzog lived in with the hopes of connecting. I wasn't expecting much. It felt like my search was actually over, and this was my last effort before I moved on.

A week later, I received a polite email in my inbox. It was from James Reese Herzog! Herzog said that he received a note from one place that was sent to another that was sent to him. I was amazed that my email reached him at all, but I was even more thrilled that he responded. We set up a time to chat. At long last, I would speak to Woolly Willy's inventor.

Herzog was fun and knowledgeable and rattled off things I never knew: Woolly Willy was rated one of the top toys in the world, had reached all seven continents, and got a mention in space. (Woolly Willy gets around.)

So I asked, "How did you discover Woolly Willy?"

"I was grinding magnets into a shape at my father's company and noticed something," he said. "The dust could be moved with a magnet."

In a light bulb moment over 60 years ago, it dawned on him that this would be a great toy if there were a face below it to "draw" on. This was the birth of Woolly Willy, rated one of the best toys of the Baby Boomer generation.

But, it almost didn't happen. In the 1950s, inventors did not go through the route of writing a business plan or outsourcing the manufacturing of parts or kick-starting their ideas. Back then, inventors built it themselves. And, if they wanted to sell it, they needed to contact a chain store to buy it. Names like Woolworth's and other five-and-dime stores might be a distant memory for many now, but they were the 1950s equivalent to Walmart.

When Herzog tried to sell his new toy to stores, everyone declined. The only buyer who accepted them only took them so he could prove that they would not sell. Within 48 hours, all of the Woolly Willy toys sold, and they were the first of the 100 million units that would eventually be bought by children all over the world.

I am personally glad the buyer was mistaken. He should have known that magnets have a powerful force that attracts both iron filings and the imagination of children.

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