

Archimedes' Sandcastle

by Quinn Tyler Jackson

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Mary and her ten year old granddaughter Becky were walking Becky's retriever on the shore in early autumn. The waves washed the shore. From time to time, they would come across a cluster of oysters.

"Do those oysters have pearls?" Becky asked. It was her birthday. She wanted a pearl.

"Probably not," Mary replied. She bent over, picked up a stick, and threw it for the dog to fetch from the shallows.

Some time into the walk, Becky asked her grandmother the Big Question. "Is there a God, grandma?"

"Couldn't tell you," Mary replied. When she saw the disappointment her granddaughter demonstrated at her reticence on the matter, she continued. "But since today is your tenth birthday, I'm going to give you a very important present."

Becky's eyes lit up at this. To Mary, she looked about as happy as Jo chasing after the stick.

"I think you're old enough to be able to understand everything I have to tell you." She picked up another stick, but not to throw for Jo. Instead, she drew an infinity symbol in the sand. "Do you know what that means?" When Becky did not reply, she asked, "Do you know what a symbol is?"

"Like a shape?"

"A shape can be a symbol that is used to mean something else. Jo's name is a symbol. When we want to talk about the dog, we don't have to have her in the room in front of us. We say 'Jo' and we both know who we mean."

Becky smiled as Jo shook off the ocean from his fur and waited for another stick. Becky tossed a clam shell instead and Jo dutifully chased after it as her grandmother went on.

"That symbol there means 'forever and ever.' As in, it never, ever ends. That's infinity."

"I get it," Becky proclaimed. "How could anything be forever and ever?"

"As far as I know," Mary replied, "solid things can't be forever and ever." She opened her arms in a grand sweeping motion, and said, "If you counted all the sand on this beach, it wouldn't be forever and ever. Even if you counted all the sand on all the beaches, you'd eventually stop. Infinity is bigger than that."

After half a minute of thinking, Becky asked, "So is anything infinity?"

“Ideas can be,” her grandmother answered her. “And that’s where it begins.” She used her stick to draw a large A in the sand. “That’s a symbol for all the sand on this beach. Just like ‘Jo’ means the dog.”

Becky nodded.

Mary then drew a large B in the sand beside the A. “That’s the symbol for all the sand on the beach near your house.”

Becky nodded again.

“Is any of the sand on this beach also on your beach?”

“No,” Becky immediately replied.

“Right. So we use this symbol...” She drew the intersection symbol between the A and the B. “... and that means, “Everything that is in A that is also in B.”

“But nothing is,” Becky declared. “Not even one grain of sand.”

Mary drew a null. “And that’s how we show that.”

Jo returned without the clam shell and Becky, instead of throwing something else for her, scratched her head with her salty fingers.

“Let’s just pretend that this beach has infinite sand on it. And your beach, too.”

“But you said it can’t.”

“Let’s just pretend.”

Becky agreed with a nod that she would pretend. Jo sat at her heel.

“Now, is there any grain of sand that both have?”

“No.”

Mary smiled widely. “And if both beaches have infinite sand, what does that mean?”

At first, Becky struggled with the thought.

“It doesn’t matter if there’s one grain on each beach, or infinite grains on each beach – they don’t have even one in common,” Mary finally said.

Becky lit up.

“Now, let’s imagine this. Imagine I took a truck and carried all this sand to your beach.” She brushed away the intersection symbol and replaced it with a union symbol. “All the sand is together. That’s what that symbol means. How many grains of sand are there in all?”

“Twice infinity,” Becky blurted out so excitedly that Jo stood from her heel and had to join in by walking figure eights.

Mary smiled, but it was a mildly correcting smile. The kind of smile she might have smiled had Becky reached into the fridge for a snack she oughtn’t have. This Becky knew meant, “Think again.” So, after a minute, she finally said, “Forever and ever plus forever and ever is still forever and ever.”

“Yes.” Mary was pleased. “And the new beach. It has infinite sand, but is not the same as A or B.”

“Yes,” Becky agreed. “Just like if I paint a piece of paper. It’s not paint, and it’s not the same paper it was.”

“Lovely analogy,” Mary declared.

“And that, Rebecca, is your birthday present.”

A wave flushed over the symbols in the sand, washing it into obscurity. Becky frowned deeply. Jo ran from her side, into the waves, and chased whatever she could find to chase.

When Becky did not seem to understand, Mary said, “Many years ago, on a beach not unlike this one, a very smart man drew symbols in the sand. He thought about many, many things. Because he helped his people keep the Romans from taking their city, he wasn’t very popular with the Romans, and he was killed.”

“That’s not nice.”

“No, it’s not. The point is, being able to figure things out. To think....” Mary tapped her temple with the stick before throwing it for Jo to scramble after. “It’s important enough to save your life, or to get you into trouble.”

“Mom always says, ‘Think before you leap!’” Becky said.

“Just like that. Well, what I showed you about sand. There can’t really be that much sand. There’s always a last grain of sand, somewhere. We don’t know where it is. But,” she added, “up here, where it counts – where you can have thoughts that save you or get you killed like that fellow way back in the past – up here, you can imagine that there are infinite grains of sand.”

Becky nodded enthusiastically.

“And you can reason about all those infinite grains of sand, use symbols like we did, and make sense out of your thoughts. I can talk to you about things in my head. Even things that cannot really exist. And you can figure out what I am trying to say. You can reason through them with me. You can turn a simple beach into anything you want it to be. Even if the waves come along and wash it all away. You can learn tell fool’s gold from real gold; just the way that fellow I told you about who drew in the sand figured out how to do.”

Jo returned with the stick and Becky took it from her and threw it again. As Jo chased yet again after the stick, her face went from frustration to a very bright smile. Mary wasn't sure if she fully understood what she had been saying, but she hoped in her heart that she had, and that she had fully grasped just how important a gift she had been given on her tenth birthday.