

# LEGO Mindstorms NXT

## The Mayan Adventure



James Floyd Kelly

## **LEGO Mindstorms NXT: The Mayan Adventure**

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# Tomb, Trap, and Trigger

Location: Southwest Guatemala

85 miles SW of Guatemala City

Coordinates: 14° 02' N / 90° 42' W

Weather Conditions: 94 degrees Fahrenheit, Humidity 40%

## Day 2: King Ixtua Tomb Excavation, 4:42 PM

Evan leaned against a large stone at the base of the pyramid and sprayed more insect repellent on his left arm. The smell was horrible, but unlike the sunscreen, at least it worked. Evan wasn't sure which was more burned, his nose or his ears. He couldn't wait to get inside the pyramid and the shade it offered. The pyramid and the base camp were completely covered by the jungle and not visible from above, but the sunlight still managed to find its way through the leaves and branches and heat the air.

"A slight problem here," said Uncle Phillip as he walked away from the large stone entry door to the Mayan tomb. He continued walking across the camp, with his two assistants, Max and Grace, running to keep up.

Evan turned and ran to catch up with his uncle. "What's wrong?" he asked, almost running into two Guatemalan guides carrying a box of excavation equipment.

"Follow me, Evan, and I'll show you," Uncle Phillip replied as they continued walking towards the communications tent.

Dr. Phillip Hicks was the lead excavator for a newly discovered Mayan tomb, deep in the Guatemalan jungle. Evan's uncle was a professor of archaeology and taught at Florida State University, but he jumped at any chance he could find to leave the classroom and do some hands-on research. Two weeks ago Evan's parents had received a call from Uncle Phillip, asking if Evan would like to tag along; his parents had agreed to let him travel with his uncle for a few weeks to finish off his summer vacation. It would also be a nice break from Evan's younger twin brothers, Les and Wes.

As they entered the communications tent, Uncle Phillip threw his FSU cap on a nearby chair. Sitting next to the chair was a large opened chest with numerous books and strange equipment. Uncle Phillip was an expert in Mayan history, and earlier in the day he had shown Evan a picture of a Mayan glyph from one of the books. Uncle Phillip told Evan that the strangely drawn symbol represented King Ixtua. That same symbol was carved in stone above the tomb's entry door, confirming that the Mayan pyramid was the tomb of the ancient Mayan king.

Uncle Phillip began flipping maps on a large table, looking for something. “Where’s the enlargement of the Tupaxu manuscript? That drawing makes sense now,” he said.

One of the assistants, Max, was looking on a small side table. Evan stood quietly, not wanting to interfere. The other assistant, Grace, began to dig through the chest of books.

“Have you ever heard the story of King Ixtua, Evan?” asked Uncle Phillip. He continued to shuffle maps and papers on the table.

Evan shook his head. “No, sir. My history grades aren’t so hot. Sorry.”

“That’s okay,” replied Uncle Phillip. “I didn’t really become interested in history until college. But I think you’ll like this story.”

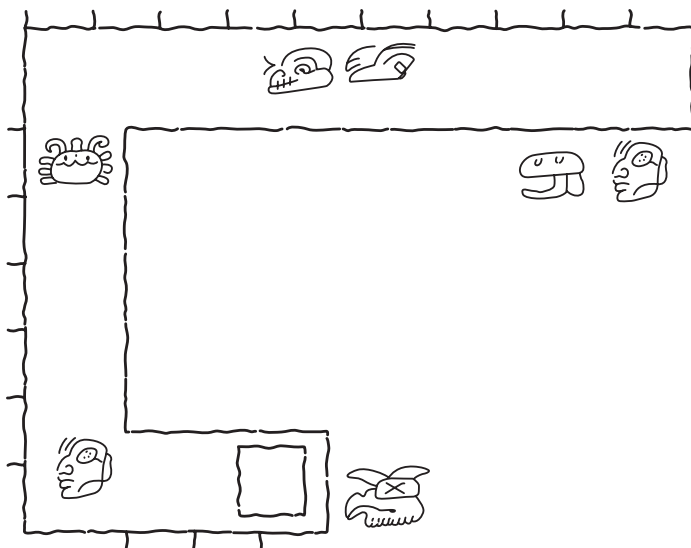
Evan’s last history grade had not been impressive; science and math were more to his liking. But when his uncle had told him that this pyramid was unopened and had been hidden for more than 700 years, Evan couldn’t resist. He had packed his clothes, MP3 player, laptop, and the new robotics kit his parents had given him for his birthday last month, and met his uncle at the airport. If the pyramid turned out to be one big boring rock, he’d have his music and could at least spend some time designing some robots to show his friends when he got home.

“This King Ixtua liked monkeys, you see,” said Uncle Phillip as he continued to search through a smaller pile of maps and papers. “He had numerous spider monkeys that he trained to do tricks. The story tells us that King Ixtua had a pyramid built as his final resting place. To keep out tomb robbers and other unwelcome guests, he had the builders design the pyramid so only someone friendly to his monkeys could gain access to the tomb. A nice legend, huh?”

“Weird,” Evan said, and then laughed. His uncle smiled at him and laughed, too.

“Here it is!” yelled Max, as he pulled a large sheet off the small table and walked over to Uncle Phillip. Evan watched as his uncle carefully placed the sheet in front of his team.

“Two years ago, Evan, one of my old professors found a Mayan manuscript in a sealed jar on a dig and gave it to me. I translated the writing and found it was written by Tupaxu, the king’s pyramid builder. It gave a general description of the location of the pyramid, among other things,” said Uncle Phillip. “Look at this,” said Uncle Phillip, pointing his finger at a strange drawing on the sheet.



**Figure 1-1.** Tunnel drawing

Evan looked at the small drawing. It was surrounded by the strange Mayan writing he had seen on the various ruins in the camp.

Evan shook his head. "What is it?" he asked.

Grace pointed at the strange writing. "It's a drawing of a small tunnel. Your uncle was right about the monkeys, it seems," she said. "That drawing shows us how to unlock the stone entry doorway to the tomb."

Evan still didn't understand, and he frowned. "What are these symbols?" he asked, pointing at the small shapes.

"Measurements," answered his uncle. "These measurements translate to a tunnel entrance roughly eighteen inches high by eighteen inches wide. Too small for a person, but just the right size for a small spider monkey."

"But if you've found the door, why can't you just drill through it or knock it down?" asked Evan.

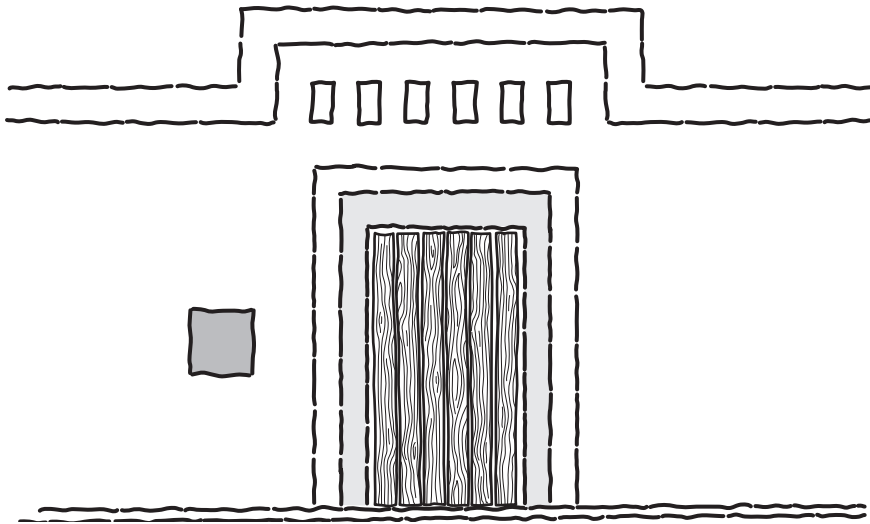
Uncle Phillip shook his head. "First, we don't destroy or damage any ruins. And second, the door has a trap that is disabled by a pressure switch. If the switch isn't pressed, the trap, whatever it is, will go off if we open or tamper with the door. Tupaxu was a very smart designer."

"So you just need to find this pressure switch and press it, right?" asked Evan.

"The first part is easy, Evan," said Uncle Phillip. "We found the pressure switch, but it's in a very bad location. Come on, I'll show you."

## Tunnel Challenge

Evan pointed his flashlight down the tunnel. The bright beam ended about ten feet ahead where the tunnel turned to the left and continued.



**Figure 1-2.** *Tunnel at tomb entry*

"According to the manuscript, the tunnel is about ten feet deep. It then goes left about six feet and then turns left again for another three feet. At the end of the tunnel is a small pressure plate," said Uncle Phillip. "If the pressure plate isn't triggered, we can't get in."

Uncle Philip shook his head. “Unfortunately, the story of the monkeys is also true. I don’t think we have any trained monkeys in our tents. And Evan may be too big to send down the tunnel,” he replied.

Uncle Phillip laughed. "Just kidding, Evan," he said. "We'll find another way."

Uncle Phillip, Grace, and Max talked quietly as they walked back to camp. Evan looked down the small tunnel and shook his head. *If only we had a small trained monkey*, he thought. And then the idea came to him.

*"Wait!"* Evan yelled and then spun to face the others. "I've got it!"

## Evan's Solution

“This is the Mindstorms NXT Intelligent Brick,” he said. “This is the brains of any robot I build with this kit.” Evan handed it to his uncle and continued pulling out various objects. He watched as his uncle turned the Brick over in his hands and examined it closely.

**Figure 1-3.** *Mindstorms NXT Intelligent Brick and other components*

Max and Grace each picked up some of the components and examined them, and Uncle Phillip handed the Brick back to Evan. Evan set the Brick on the table and pointed at the computer screen.

"This software allows me to program the robot to do various tasks. I can tweak the software until I get the robot to do exactly what I want it to do. Pretty cool, isn't it?" he asked.

Uncle Phillip smiled and nodded. "Are you telling me that you can build a small robot with this stuff that can go down that tunnel and trigger the pressure plate?"

Evan smiled. "Yep. And I don't think it will take me that long, either," he replied. He pulled out a small brown notebook from the laptop case and opened it up. He had been playing with the Mindstorms NXT kit for about a month and had plenty of notes and comments written in it.

Max handed his component to Evan and pointed at it. "What does that do?" he asked.

"That's a servo motor. It does a lot of different things, but I use it mainly to give a robot wheels to move. Grace is holding the sound sensor," Evan said, pointing at a small block that Grace was examining.

Uncle Phillip pulled a chair over to the table and sat down with Evan. He looked over all the parts Evan was placing on the table and nodded.

"This might work," Uncle Phillip said. "How much time do you think you'll need?"

"Well, I'll need to do some planning first, mainly to figure out the best parts to use. The actual building and programming will take some time, too. I'm guessing three or four hours," Evan replied.

Max and Grace looked at Professor Hicks, waiting for his decision.

Evan's uncle looked at his watch. "It's almost dinner time, and the sun will be down in a few hours. There's really no point in trying to open the tomb tonight. If you can get the robot working, we'll let you send it down the tunnel tomorrow," he said. "Is there anything else you need, Evan?"

Evan thought for a moment, looking at the robotics kit in front of him and all the components.

"I just need some time to work through my design notebook. I'll start building and programming after dinner," he said. "This'll be fun."

Uncle Phillip smiled at Evan. "All right, this sounds like a good plan," he said, and stood up. "Dinner is in 40 minutes."

Evan watched as Uncle Phillip, Grace, and Max left the tent, and then he took a deep breath. "Time to get started," he said.

*Story continues in Chapter 5 . . .*

