

# But Why: A Podcast for Curious Kids

## Do skyscrapers scrape the sky?

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**Jane** 00:20

This is But Why: a Podcast for Curious Kids from Vermont Public Radio. I'm Jane Lindholm. On this show, we take your questions about the weird, the wacky and the wonderful, and we find interesting people who can help with some answers. Today, we're going to imagine ourselves in a city. Picture yourself standing on a concrete sidewalk. Can you hear the cars going by some are honking their horn. Some are stopped at stoplights. Maybe there are pigeons on the sidewalk cooing. The sun is out, but you are in the shade. What's blocking the sun? A very, very tall building. Start drawing your eyes from the front door up to the first windows then up to the next floor and up and up. And wow, you really have to stretch your head all the way back to see the top of that building. It looks like it goes all the way to the sky. Straining to see the tippy tippy top, you might be wondering.

**Evie** 01:21

How do buildings get so tall?

**Jane** 01:24

That's six year old Evie from Albany, California. Evie is among the many of you who have sent us questions about very tall buildings. And you want to know both how and also why buildings get so tall. Let's start today with some trivia. Do you know the name of the tallest building in the world? The tallest building in the United States and all of North America is One World Trade Center in New York City. The tallest building in Europe is the Lakhta Center in Russia. The tallest one in Australia is known as Q1 in Queensland. In South America. It's the Grand Tour de Santiago in Chile. Africa has the Carlton Center in South Africa and the tallest building in Asia, the Burj Khalifa is also the tallest building in the entire world. Simon knows that and he sent in this question.

**Simon** 02:14

I am five years old. I live in Chicago in Illinois. And my question is, why is the Burj Khalifa so tall?

**Jane** 02:24

We thought we'd reach out to an expert to find out a little bit more about this record breaking building.

**Isabel** 02:30

My name is Isabel I'm six years old and I live in Dubai. The world's tallest building is in Dubai and it is called Burj Khalifa. Burj means tower in Arabic and Khalifa is the name of the ruler of the UAE. I went to the top of Burj Khalifa with my family, we took a super fast lift to the top. From the top we could see the whole of Dubai. We saw all the building the sea, the islands, boats, and even my favorite park! From

the top of Burj Khalifa people on the ground look like small ants. Can I tell you a secret? Dubai is going to build a tower that will be even taller than the Burj Khalifa. Bye.

**Jane 03:25**

Bye. Thanks, Isabel. That was such a great description of what it's like to stand at the top of the Burj Khalifa. I especially liked imagining what it was like to ride that super fast lift or elevator up. Seems like that's almost like taking an amusement park ride in and of itself. The Burj Khalifa is interesting for a lot of reasons, but one of them is that it's not just a giant rectangle, its shape was inspired by a desert flower called the spider lily. You can't really see the resemblance between the building and the flower if you're just looking at the Burj Khalifa from the ground. But if you were a bird, or a drone flying above the building, and you look down, you'd notice that it's kind of shaped like a capital Y. Or maybe a fidget spinner. And it's wider at the bottom than the top with various towers rising taller in the center, up to a total height of 2,716 feet. That's 828 meters. I don't know about you, but just thinking about that number of feet or meters doesn't really explain to me how tall the building is. So we asked another friend to give us a different way to think about it.

**Janny 04:33**

If you put 450 grownups stacked up on top of each other, that would be the height of the building. I'm Janny Gedeon and I am the president and founder of ArchForKids.

**Jane 04:51**

ArchForKids teaches architecture, engineering and urban planning to kids using real life projects. Janny is an architecture educator. And if you're not familiar with the word architecture, here's how Janny explains it.

**Janny 05:05**

Architecture is the science of designing buildings, as simple as that. Thinking about what the purpose of you know, what is it used for? What do I need this to be? What is the function of a space? So the architect is the one who designs that space.

**Jane 05:26**

There's more to being an architect than just drawing pictures of buildings. Architects have to consider how people will use the building, what kind of materials will be used in making it, how it will look where it's being built, how it will be designed to withstand earthquakes, and wind and rain and sun. A building like the Burj Khalifa, for example, has apartments, a hotel, office space, and a number of observation decks. Janny thinks about this kind of stuff all the time. And as we said, she works with kids. So we thought she'd be a great guide to help us answer your questions about tall buildings, or as we sometimes call them in English skyscrapers.

**Axl 06:04**

I'm Axl. I live in Auburn, Illinois. I'm four. My question is, do skyscrapers scrape skies?

**Jane 06:17**

Axl wants to know, do skyscrapers scrape the sky?

**Janny** 06:22

Well, that's a very good question. We say it's scrapes the sky because that's what we can see as far as we can see, but there's really nothing to scrape because you cannot really touch the sky. So no matter how far up you go, you cannot touch it. So when we look, it's our perception of how tall this building is compared to where we are located. Because when we see a tall building, we are really minute really small compared to that building. So when we looking up, we feel that it is touching the sky.

**Jane** 06:53

But you're not like in outer space. If you go to the top of the tallest building?

**Janny** 06:57

Not at all. And you can still breathe, exactly. You're not floating or anything. So it's just the perception.

**Yuma** 07:04

Hi, there. My name is Yuma, and I'm five years old. And I live in El Paso, Texas, and I visit my grandparents in New York City every summer. My question is why are building so tall in the city?

**Jane** 07:22

What's the deal with tall buildings in cities?

**Janny** 07:25

Well, a lot of people want to live in cities, a lot of people want to work and have fun, go to the theater to the movies, and so on. And there's not a lot of space on the ground to build horizontally. So then they have to just like go vertically instead. So then to accommodate all these people who want to come to the city. And so just like the footing of the space that that the building takes is not that big. So therefore you have to go up. And then I mean footing is just like if you imagine you standing up so your foot, your footprint is really your feet, the size of your feet, that's the space that you that you take on the ground. So the same thing with the buildings is just like the little square, the little rectangle that is on the ground that touches the ground, we cannot really elongate it on the horizontal plane. So therefore we have to go up to accommodate more people. And also with Manhattan, the rock that Manhattan is built on is called a schist. And then the schist is such a hard rock. So then when you go deep down to make the foundation of the building, this is a strong rock. So then that allows more buildings to go up because it's stronger, and your foundation is can hold it better.

**Jane** 08:55

Well, that's interesting, too. Because what you're saying is it it really matters what's underneath the soil, if you're going to build any kind of building, right, so you have to think not just about how tall you can build it or how much space you have on the ground, but what's underneath the ground.

**Janny** 09:12

Exactly. Because, because sometimes you can go as far as bedrock, but sometimes you don't because the soil is so tight. So then you can actually bring your foundation down and it will hold it together. But if you can go down to bedrock, that's even better.

**Jane** 09:29

You can't just build a skyscraper wherever you want. There are certain places where the ground underneath makes it easier or harder to build a really tall building. There are also rules that some cities or towns make about how tall a building is allowed to be and where those tall buildings can be within the city or town limits. Another thing to keep in mind is, is there a need for a tall building with lots of space? You might notice that there are lots of tall buildings in New York City where their grandparents live, and maybe they're aren't so many tall buildings in Yuma's town. The town where I live in Vermont is very rural, there aren't many people and there is a lot of land. So there's no need to build tall buildings. So that's another reason why some places have lots of tall buildings and other places don't, it depends a lot on how many people want to fit in a small amount of space. Building up can be the best way to fit more people in. Okay, so let's say you do want to build a skyscraper. What do you actually have to do to get it made?

**Billy** 10:31

Hi, my name is Billy and I am six and a half. And I am from Wilmington, Massachusetts.

**Luca** 10:42

Hi, my name is Luca. I live in San Francisco. And I'd like to know how buildings are made. And I'm six years old.

**Janny** 10:52

Buildings, it's really, it's a complicated process. So first you have, you have to have a need for it. And and there is the owner, which in tall buildings usually is a developer. And they buy the site, and then they hire the architect to do the planning of you know, the layout of that building. It's based on the function, which means that is it going to be a commercial building? Is it going to be a residential building? Is it going to be entertainment? So then all that is is thought through by the architect and then the architect, along with the engineer would think about, okay, would my design actually stand up, what the measurements and then the specifications, or what we do is going to make it stand up. So that's a structural engineer, then the mechanical engineers get a chance to think about where the heating and the cooling is going to happen, then you have the electrical engineer, we think about where the wiring for all that is going to happen. And then when all these are put together, and everybody comes together, you have the contractor who comes in and start building the structure. So architects, engineers, they all have to work together to make that happen. It's a long process. It can take a few years to actually build a building from design to construction.

**Jane** 12:32

That's kind of cool. Because you know, if you're a kid who likes different parts of what it sounds like to build a building, you could get involved at any level, you could be designing it like an architect, or you could if you really like electricity and figuring out how electricity works, you could be figuring out the electrical wiring for a big building, or the plumbing. Maybe you really like toilets.

**Jane** 12:54

Yes, yes. Definitely.

**Jane** 12:57

And if you really like to hammer things, you could work on a construction site, you could help build the actual buildings.

**Janny** 13:04

Yes, definitely. There's a there's a part for everyone. Pretty much. Okay.

**Jane** 13:11

But here's the question that we have been waiting to get to, how do they get so tall?

**Janny** 13:16

How do they get so tall? So there is a race for the cities to actually know who what city is going to have the tallest building of all? So there has been a race and then there was a race in America. At one point, we had the Sears Tower in Chicago, that was the tallest. Then we had, we had the Empire State Building that was the tallest then at one point we had the Chrysler Building. So then we had like different races of who's going to be the tallest building, and then we had the World Trade Center. So then it is a race to be taller. And then the same question is, why do we need tall buildings? It's just like the Earth is getting more and more populated. So then people need places to live in places to work. So then the same thing, there is not enough space to actually have shorter buildings. So instead, we have to build high. It's not that we have to build so much taller, but like I say, there is a race who is going to be taller, so then that's pretty much what it is.

**Jane** 14:29

So it's just a competition. It's just adults in a competition?

**Janny** 14:32

It is, because now the Burj Khalifa has a lot of apartments and all a lot of space vacant, because there is not a lot of people like you know, renting or buying. But it's not that we need it to be taller, but it's us human being we have to be in competition with each other.

**Jane** 14:52

So it's all just a big competition to build the highest tallest building. I guess we humans never stopped trying to be the fastest, the biggest, the tallest, we are definitely a competitive species. In just a minute: okay, you've got a tall building, how do you make sure it stays up?

**Jane** 15:15

This is But Why: a Podcast for Curious Kids. I'm Jane Lindholm. We're learning about tall buildings today with Janny Gedeon, founder of ArchForKids, an organization that teaches architecture to kids. We've been talking about how and why tall buildings are built. But there's a lot that goes into making tall buildings stable enough to live and work in. Janny says you can think about how you balance your own body as a good way to think about how tall buildings stay up.

**Janny** 15:45

Usually, I want you to think about you being a person, how do you stand up as a person. So then first you have your feet, so the building has to have feet as well. So then the feet are the foundation of the building that actually go down into the ground, we talked about that earlier that it has to anchor in the ground, so it can be stable. Then you have inside of you as a person, you have a skeleton, which is a set of bones. The building has a skeleton as well. And the skeleton of the building is called a structural frame that is made of different parts horizontally parts, vertical parts. So then you have that and then you have you have the cladding, which is your skin, right? So then you have like, you know, is it made of glass? Is it made of just like, you know, aluminum sheets? So then you have to think about the building as a person. How do you stand up, what makes you, and then there's gravity, gravity is the force that the pull of the Earth, so you don't want to be in outer space like floating, so then gravity has to anchor you down as well. And there are two other forces that sometimes we talk about is the push and the pull. So then the building itself is pushing and pulling that keeps it in equilibrium, which means that it's not going to collapse if it's not provoked, I would say by heavy wind or, or so on. And so then all those, the foundation, the structural frame, the gravity, and then the push and pull forces, keep the building standing up.

**Emma** 17:35

My question is, how does buildings stay up?

**Parent** 17:42

What's your name?

**Emma** 17:44

Emma.

**Parent** 17:44

And how old are you?

**Emma** 17:46

Three.

**Jane** 17:47

Emma wants to know how do building stay up? And you mentioned Janny that, you know, there, there are all of these forces that are taken into account, not just how the building is going to stay up on its own. But sometimes buildings are built in places where there are earthquakes, or you know, in any place, you might get a lot of wind. So how do tall buildings actually stay up?

**Janny** 18:10

In some places, like places with earthquakes, they have designs that the building is like on a rail like so then when the earthquake so it just moves on the at the foundation level. So then that it actually moves, it's not stiff. Just like when buildings, when you building tall buildings, it has to be a little bit flexible, because you have to think about the wind factor and so on. So you don't want it to be too stiff, so it's brittle. So then it's going to collapse. So what you do, like for some reason, when you have tall

buildings, they sway. They sway from if you have motion sickness, you don't want to be on top because sometimes you will feel the swaying.

**Jane 18:54**

So you can actually feel it in a very tall building?

**Janny 18:56**

You can feel it, you can feel it. A lot of them you regulate that swaying a bit, but it is okay for it to sway because you don't want because it's it's steel most of the time, so then you don't want it to be too brittle. And then it will just like snap break. So then you need it to be to be flexible a bit.

**Patrick 19:18**

My name is Patrick. And I'm four years old. And I'm from Sydney Australia. And my question is how buildings stay up and why are they square?

**Jane 19:37**

They're not all square, but a lot of them are and a lot of tall buildings are square or rectangular. Why?

**Janny 19:45**

Well, yes, not all of them are they come in various shapes, but the square shape or the rectangular shape is the easiest to build. You find materials that are readily available so you don't have to custom make them so it becomes a cheaper way of building.

**Willa 20:01**

Hi, my name is Willa and I live in Norwich, Vermont. How do they make buildings taller than cranes.

**Janny 20:08**

I guess it's more technology or anything. It's just like for the Burj Khalifa in Dubai, I think that they just they found a way to actually get it, get it, you know by pulling it with pulleys and then get it to a to a certain stage of you know the height and then pull it back up. But as you can see the buildings get smaller and smaller as they go up.

**Jane 20:31**

Like narrower and narrower?

**Janny 20:33**

Narrower and narrower when they get closer to scraping the sky. So then then it makes it easier for for them to bring things up.

**Jane 20:44**

Yeah, so you can use levers and pulleys to pull material from the bottom all the way to the top. And then sometimes, I think it's amazing to see, but sometimes when you see a tall building being built, they actually put cranes on the top of the building as the top of the buildings. Yeah, that's amazing. Yes. So you know, when we've talked about all of these things that go into making tall buildings from the

architect who designs it, to the contractors who work on it to the city, or town or property owner, who's determining what can be built on that property, to the people actually pounding the hammers, all of those people are adults generally. So why did you want to start something that helps get kids interested in architecture, when, you know, kids can't, can't do the building of the buildings right now. And that's frustrating. So why why kids in architecture.

**Janny 21:36**

They can't do it now but they can be exposed to it. It just opens their mind to see that I can do something that real professionals actually can do. And then what we do, we do the math of it, because a lot of times kids don't see the relevance between what they are learning at school, and what is in real life. So when we come in, we make them understand that you don't see what you're doing right now has an effect. But it will have an effect because these grownups who are doing this right now were kids too, and look at them now.

**Jane 22:14**

All right, are you so do you want to work even harder on math and engineering and art in school, so maybe you can build buildings when you get older. Janny says there are some fun activities that you can do now to get a feel for what it takes to build a tall building. And all you need is paper. Janney does an experiment with kids. And there are three things she tries to make sure everyone thinks about as they build their structures.

**Janny 22:38**

Tallest, strong and stable, those are the three parameters. So strong means that you are you can hold something, it has to be able to hold something. Stable means that if I push it to the side, it's going to withstand that lateral load that I'm putting on it. So it has to be tall, it has to be strong, and it has to be stable. So those are the three things that they have to think about. So just with paper, they can use newspapers, or just regular paper, just roll it up and then tape it and then put it together and build a structure.

**Jane 23:14**

Maybe you can do this with some friends or family and see who can build the strongest, tallest and most stable tower. Janny says you can build strong, tall, stable paper towers without any sticks or internal structures, maybe just a nice cardboard base for the bottom. And here's a hint for how to think about stability as you build up.

**Janny 23:34**

Think about, usually I'd say when it's stable, think about if you playing sports, and then you're standing on the field or the court, you don't stand with your feet together, you stand like you put your feet apart, then what shape do your legs make with the floor? It makes a triangle. So think about that triangle is the most stable shape. So when you are building, think about how you're going to be bracing your structure with a triangle so then it can be stable.

**Jane 24:05**

Good luck with your towers. Send us a picture if you build one of any kind, maybe you want to use Lego or rocks or sticks to build a building. Or maybe you just want to draw your idea for a new skyscraper or wide building on a piece of paper. Thanks to Janny Gedeon, she's the founder of ArchForKids. We have a link to her website in our show notes and on our website, [ButWhyKids.org](http://ButWhyKids.org)? Now if you have a question about anything, send it to us. Start by thinking of what you want to learn more about, then have an adult grab a smartphone and use one of the free memo function or audio apps to record you asking it. Then your adult can send the file to [questions@butwhykids.org](mailto:questions@butwhykids.org). We love to hear from you. But we can't answer every question we get as much as we wish we could. Do you know we've gotten more than 10,000 questions from you since we started. That's amazing. No, it's also amazing. Melody has listened to and logged every single one of them. But Why is produced by Melody Bodette, and me, Jane Lindholm at Vermont Public Radio. We're distributed by PRX. Our theme music is by Luke Reynolds. We'll be back in two weeks with an all new episode. Until then, stay curious.