But Why: A Podcast for Curious Kids
Why are there so many colors?
October 31, 2025

Jane 00:20
This is But Why: A Podcast for Curious Kids from Vermont Public. I'm Jane Lindholm. On this show, we take questions from curious kids just like you, and we find answers. What's your favorite color? Colors are all around us. When you walk into a room, if you're a sighted person, you might notice that the walls are painted in yellow, gray or white, or off-white, or eggshell white or creamy white. When you pick out your socks in the morning, do you grab a different colored pair depending on your mood? Red, if you're feeling feisty, purple if you're feeling bold? Flowers come in all kinds of striking hues. And if you've ever looked at a female cardinal, you'll see the most beautiful gradations of brown and gold, from her amber colored chest to her soft gray brown back and a tuft of red at the crest of her head. We've gotten lots of questions from you about color, and that's not surprising, because colors really are everywhere.

Eleanor 01:19
My name is Eleanor, and I'm eight years old, and I'm from Georgia. And where do colors come from?

Hannah 01:25
My name is Hannah. I'm from Detroit, Michigan. I'm six years old. Where do colors come from?

Midhaa 01:34
How do we know if we are seeing the same red, yellow or blue? We could be seeing different colors and calling them more red?

Jane 01:34
Let's first talk about what we mean when we say color. Color has a lot to do with light. When light shines on an object, that object absorbs certain wavelengths of light and reflects other ones. The material the object is made out of determines what wavelengths are absorbed and which ones are reflected. Our eyes only see the light that has reflected, or bounced off the object, not the light that is absorbed. And our brain interprets those wavelengths that have bounced off as different colors. For example, let's say you have a nice, ripe strawberry. The strawberry's skin is soaking up blue and green wavelengths and bouncing the red light back to your eyes! So you see that strawberry as red. But how do we know if our brains are all interpreting that red color the same way? Midhaa, who is 11, from Kerala, India, has a question.

Jane 02:08
To tackle this big mystery, we need to understand how we perceive color in the first place. In the back of our eyes, there's a thin layer called the retina, where special nerve cells called photoreceptors help us see. There are two main types of photoreceptors: rods, which work at very low levels of light and help us see different shades of light; and cones, which are primarily what we use to see color. Most people have three types of cone photoreceptors, specialized to detect blue, green or red light. But it's not just our eyes that are important for our ability to see things and identify colors. It's your brain's job to process all these signals your eyes receive. Not only does your brain interpret the signals from your eyes to let you know what colors you're seeing, but it also then associates those colors with feelings and experiences. For this part of the conversation, let's bring in our special guest.

Kassia St. Clair 03:40

I am Kassia St. Clair, and I am a writer.

Jane 03:43
Kassia is the author of a book called The Secret Lives of Color. She's been fascinated by color for a long time. When she was a kid, Kassia's mom was a florist, so she spent a lot of time at the flower shop after school, observing what kinds of colors go together in a bouquet of flowers and what types of flowers are popular for certain occasions. When Kassia became an adult, she decided to learn and write about colors. In fact, she wrote a whole book about them. Kassia's work focuses on the ways we think about colors and how they take on different cultural meanings.

Kassia St. Clair 04:17
The process of how we see color, an awful lot of it takes place in our brains, and that means that even if the architecture of everyone's eyes is roughly similar, what's happening in the brain, kind of behind the scenes can be very, very different and can be really influenced by our own experiences. So for example, imagine if you grew up in a bedroom, and the walls of your bedroom were painted blue, and you loved your bedroom, forever after, you might have really positive associations about the color blue. Now, someone else might feel very differently about blue. They might associate it with a time they got really embarrassed at school and the walls of that room were blue so. So your experience of color will be very different. And the other thing is that not everyone's eyes are the same. Lots of people have something that's called color blindness, or color vision deficiency, and so you might perceive color slightly differently, and that's a lot more common in boys and men than it is in women, because the parts of our DNA which are responsible for our eyesight are encoded in in the part of the DNA that is kind of more present for women than it is for men. And as technology is now emerging to kind of correct color vision, so if you do have color blindness, there are now kind of glasses that you can put on that can allow you to better perceive the colors that you might have naturally struggled with.

Jane 05:46
In my family, we have arguments about the difference between blue and purple, and some things that my daughter and I say that is absolutely purple. It's no question. It's purple, and then my son and his dad will say, Are you kidding? That's blue. There's no way it's purple. It's not even close to purple. It's just blue. And that's all there is to it. And we can sit in our corners and never agree on that, and it's impossible for us to tell, are we seeing different things with our brains, or are we seeing the same color fundamentally, and we just think of it in different categories, and it's always kind of a fun fight for us, because it's just clear how different our brains see things and how differently we interpret things, but we don't know whether it's something physical in our brains or just in the way we think about what category it is.

Kassia St. Clair 06:40
It's so mysterious how we, how each person sees color. I love that there's all this, this mystery. I think it makes it such a great topic to study.

Eleanor 06:51
Hi, my name is Abilene. I'm eight years old. I live in Scotts Valley, California. Why are like dogs can't see that many colors, but humans can and why is vision for different animals different?

Susanna 07:06
Hi, but why? My name is Susanna. I live in Arkansas, and I'm 10 years old. Why do dogs see different colors than humans?

Jane 07:13

We said that most people have three types of cones in our retinas that help us detect different colors. Dogs have only two so they see fewer colors than we do. Dogs can't really distinguish red from other colors, but they can see blue and yellow. So if you've ever seen a dog having trouble finding a red ball in a green field, that's probably because the red doesn't stand out against the green grass in their eyes, they all look like kind of the same shades of muddy brown. But then again, my dog can smell and hear things way better than I do, and dogs can see better in the dark than we can. So I guess you win some, you lose some. You know, some animals actually have a much wider range of color reception than dogs, or us, humans. Birds, for example, are known to have four types of cones, those color sensitive receptors in their eyes, where we have three. Butterflies have five, and mantis shrimp have 12 to 16 photoreceptors and can even see infrared and polarized light. It's fun to imagine what the world would look like if you had the ability to see even more colors or more wavelengths of light. The world might look very different. We have more color questions coming up, including, how do colors get their names? And is white a color?

Jane 08:36
This is But Why. I'm Jane Lindholm, and today we're talking with Kassia St. Clair, author of The Secret Lives of Color. She's answering your colorful questions.

Freya 08:47
Hi, I'm Freya. I'm six years old, and how is colors invented?

Parker 08:52
My name is Parker. I'm six years old. I live in Birmingham, Alabama. Who discovered color?

Jane 09:04
Color has kind of always been around. As long as there's been light, there's been color, because color is really how we perceive wavelengths of light that bounce off of other objects. But beyond that, there's also the way we think and talk about color, and humans have found lots of ways to make pigments so we can have different colored toys and clothes and crayons and paints.

Kassia St. Clair 09:27
Colors come from lots of different places. Is it a paint that you have in a tube that you paint a picture with? Or is it a paint that you put on the wall of your house? Or is it a color of a jumper or a pair of trousers? All of those colors will come from slightly different places, and most of the time today, the colors that we use will be made in a factory. There'll be combinations of different kinds of chemicals, substances that scientists work with and put them together in different combinations, and they create something new, but in the olden days, so, you know, maybe 200 years ago and before then, people weren't generally using chemicals to make color, or they sometimes were, but more often, they were using the colors that are found naturally in the world around us, and there are actually quite a lot of those. So there are colors in the soil. So depending on where you live, you might be able to go outside, you might notice that the soil is different colors. The other places where you might find color are in insects. So lots of insects create color, or indeed, snails, sea snails create color.

Alaina 10:44
I'm Elena, and I'm eight years old, and I'm from Alberta, Canada. How many colors are in the world?

Addison 10:51
My name is Addison. I live in Milford, Pennsylvania. How many colors are in the world?

Gigi 10:59

Hi. My name is Gigi. I'm nine years old. I live in Sand Springs, Oklahoma. Why are there so many different colors?

Jane 11:07
There are a couple different ways to think about this question. Scientists say humans can see millions of distinct color gradations with our eyes. But there's also another way of looking at it that has to do with how colors exist in our minds and our cultures, and Kassia says that number is infinite.

Kassia St. Clair 11:26
The truth is that the number of colors that there are is everlasting. We're all over the world, and no matter where you are in the world, you'll be thinking about colors in new ways, and that can change even over the course of your lifetime. So, for example, I'm now 40 years old. When I was growing up, the color avocado green had a really specific meaning. It was seen as really old fashioned and and something a color that had been really fashionable in the 1970s. But now avocado green means something a bit different, because the world has changed slightly. Avocados have become much more associated with really young people with avocado toast, which is something that you may or may not enjoy for your your breakfast or your lunch, and maybe in ten years time, that won't be one of the first things you think about. And that process is happening all the time. We're constantly thinking about colors in new ways.

Alan 12:19
My name is Alan. I am six years old. I live in Brewster, New York. How do colors get their names?

Kassia St. Clair 12:31
So there's kind of two processes that happen. There's a kind of official process, by which I mean a company, for example, a company that makes paint for your house or paint for your car might create a new color, and then they'll sit in an office and they'll think about how best to name it. So for example, if a nail polish company is creating a new red polish at Christmas time, they would probably want the name to indicate the redness of the color. But they probably also want a name that is suggestive of Christmas, and so they might call it Santa's Cape, for example, but the exact same color, if it's being released in May or June, and this might have a very different name. All of a sudden, it might be Apple Red or something like that. But you also, again, have this kind of more open process by which people, ordinary people, aren't negotiating the names themselves. And so a really good example of this is the color Scarlet, which is a bright shade of red. Now, Scarlet actually, initially wasn't the name of a color. It was the name of a type of cloth, a really beautiful, very fine, very luxurious, very soft woolen cloth. And it made sense, when you were producing such a wonderful cloth, to dye it the most expensive color. No one wants to buy the most beautiful cloth in the world and have it a color that is really unfashionable, and the color that was most fashionable and expensive at the time when Scarlet was the most beautiful cloth, was a bright red. And over time, the color that this cloth was always dyed borrowed the name for the type of cloth. And so Scarlet went from being a type of cloth to a type of red.

Jane 14:20
So it would almost be as if cotton was a name for a color, or polyester was a name of a color that we all identify.

Kassia St. Clair 14:29
Exactly.

Jane 14:30

What about the colors that are seen as just sort of your basic colors of the rainbow? How do we get names for things like red, orange, blue, yellow?

Kassia St. Clair 14:42
In English and in a lot of other languages, you have kind of around about the same number of colors that we all agree are the kind of basic colors, red, green, blue. But that isn't the case for all languages. So not all languages agree on what is a basic color. So some languages only have three basic color terms. They will divide the entire spectrum of all the colors in the rainbow into just three. They'll have light colors, dark colors and red. Other languages and other countries have, you know, divide the rainbow up differently. So for example, in Russia and in the Russian language, blue isn't one color, it's divided into two. There's light blue and there's dark blue, siniy and goluboy. And in Korea, they divide green up into two, regular green and kind of yellowy green. And lots of languages have added or or gotten rid of colors over time. So if you were to go to Japan around about 100 years ago, they would have the same word for both blue and green. They now have separate words, but that's pretty recent. So yeah, the answer is that those basic color terms depend on what your culture and what your language believe is a basic color, and not all languages agree.

Jane 16:08
Think about that for a second. If you live in a place with a language that differentiates between green and blue, you might walk outside and say, hey, that car is green and that other car is blue. But if you speak a language that sees green and blue as one color, your brain will think, look, there are two blue cars in slightly different shades!

Charlie 16:29
My name is Charlie. I'm six years old. I'm from Long Beach, California. Is white a color or not?

Kassia St. Clair 16:39
So that's a really good question, and there is a way that a physicist might answer it, and then there's the way an everyday person would answer it. And a physicist would tell you that white and black are not really colors, they're more expressions of light. So if you've got the full spectrum of visible light, you will perceive that as white. And if you've got none of it, you will perceive that thing as black. But for ordinary people, we go into a shop and we pick white paint, we pick a black pair of jeans, and so we experience white and black as colors. Those are useful color groups, and they are as valid a color as blue or green. But they're not, these things aren't perfectly white in the way that a physicist is thinking of, as an expression of light, or perfectly black, the absence of light, but they are in the category. They are a type of black. They are a type of white. But it's very, very difficult to experience pure white or pure dark. There's a substance that was created a few years ago called vantablack, and that substance absorbs 99.965% of the visible spectrum. So what this looked like is, it's really uncanny. Essentially, you could no longer see any depth in an object that's coated with the substance. And what do I mean by that? So I was shown vantablack on a piece of crumpled up aluminum or aluminum foil. So ordinarily, when you see a piece of foil, you can see that it has, it's got different textures. It's been scrumpled up a little bit. Different areas of the foil reflect light in different ways. And so you know that that object is 3D, you know it's got bits that are further away from you and closer towards you. But when you coat that same piece of foil with vantablack, which absorbs 99.965% of the light, all you can see is a flat, black space. You know that that is a piece of crumpled foil, but you are no longer able to see any definition in the foil at all. It just looks flat. And so a round ball looks the same as a circle. And a car wouldn't like a car. It would just look like an outline of a car. So it reduces our ability to perceive depth.

Jane 19:10

I want to play a prank on my family now. I want to paint all of my chairs vantablack and then say, go sit down. And they'd be like but there's nothing to sit on. Because it just it wouldn't, it would look like the shape of an outline of a chair, but it wouldn't look like... I wouldn't be able to see that there is a flat place for me to sit and a place for me to put my back. It just looks like one solid...

Kassia St. Clair 19:31
Like a blob. Yeah,

Jane 19:33
that's very cool.

Kassia St. Clair 19:34
Very cool.

Jane 19:35
We've learned a lot today about how our eyes and brains work together to interpret color and how different people and cultures and languages think about colors differently. Let's end with this question from Noah.

Noah 19:48
I live in South Salem, New York, and I'm 10 years old. Why do colors make you feel different emotions?

Kassia St. Clair 19:54
So what you've got going on is you've got the way that a kind of the broadest culture feel about a color. So this is information that we pick up from the world around us. So that includes adverts that we see, the language that we're speaking with, and so on and so forth. So you have really broad generalizations, like red is often associated with action, so things like anger or stop or, you know, really kind of words that need to be obeyed immediately, ideas that need to be obeyed immediately, things that are sudden. And we kind of take this understanding into our experience of the word red. You then might have more specific things. You might have something in your own city. You might have like the metro. All the metro stations use red signage, and so that will probably make you think of transport, even if you're not immediately aware that that is part of your understanding of the color red. It will inform your understanding of it. And then you have, like, what I call the throw on the, on the sofa. You then have the kind of your own personal experience of it. How, how did you grow up? Did you have toys that were this particular color when you were growing up? Was it your parents' favorite color? Is it your favorite color? Did you choose to name your dog Scarlet, for example? And all these things will act together in our experience of how we feel about a color. But you also have other things going on, possibly, and this is where it becomes really difficult, because there is some evidence, and lots of people believe that certain colors make all humans feel a certain way, just because that's how we're hard wired to behave. So lots of people believe that red, again, to take the red example, makes us gives us kind of a jolt of energy and makes us more aggressive, makes us more angry, makes us more passionate. The problem is, is that it's absolutely impossible to test for this in a in a scientific way, because you cannot remove a human being from everything, from their culture, and so you can't really completely unpick what it is that's ingrained in all humans and what it is that we grow up with and that we understand from living in the world around us.

Jane 22:21
Right, because sometimes you'll hear people say, if you want to create a calming environment for anybody who's going to come into that room, you should paint the room yellow or blue. I can't even remember which ones, but what you're saying is we don't know if that's because everybody's brain

thinks of that color as a calming color, or if it's because we think it's calming, because that's what we've grown up with, and that's what our culture has told us. There's no way to figure that out scientifically yet, at any rate.

Kassia St. Clair 22:51
Yet.

Jane 22:51
Is there any other story about color that you think just blow everyone's mind?

Kassia St. Clair 22:57
Yeah, so I think a lot of people think of pink as being quite a girly color and blue as being quite a boyish color. But if you go back a hundred years, actually, people thought of it completely the opposite way around. People thought about pink as being a color for boys and blue as being a color for girls. And if you look at the way that they talked about blue and pink, then they said that pink was more decided, it was more masculine, it was kind of more aggressive, and blue was more gentle and feminine. And I've seen that in my own lifetime. So my father, he was born in 1925 and when he was growing up, blue was the more was the more feminine color, and pink was the more masculine color. And he and his partner, Gilly, they had kind of essentially matching walking sticks. One was blue and one was pink, and my dad's one was the pink one, and Gilly's one was the blue one. And that seemed entirely natural and normal to them. And I find it really funny that in just in a relatively short period of time, in just 100 years in the span of one life, that meaning and understanding has completely switched around. And I think it's really interesting to imagine, if we all grow up to 100, what color meanings would have completely shifted over in our lifetime. Will green, you know, now, I think people think people think of green as being like kind of a natural color, and to do with nature, maybe that won't be the case in a hundred years time. Maybe we'll think of something else. Or maybe when we think of yellow, we won't immediately think of sunshine, we'll think of something else. We just don't know yet. And again, this is why I love the subject of color.

Jane 24:38
And honestly, at this point, if you like pink or blue or green or yellow or whatever color you can like whatever color you want!

Kassia St. Clair 24:45
Absolutely. Colors are for everyone. And these meanings that we attach to them, that sometimes seem so rigid and like rules, they are going to change. They do change. We can see them changing. And so even if something seems like a really hard and fast rule, something that definitely should be obeyed, just remember the example of pink and blue. They feel a certain way now, but that wasn't always the case, and it may not always be the case in the future. Who knows? In ten years time, twenty years time, this may have all changed.

Jane 25:14
Thanks to Kassia St. Clair, author of The Secret Lives of Color, for helping us think about the universe of color and how much it's tied to the way we think about the world around us. Do you have a favorite color? We'd love to know and how that color makes you feel. Send us a video, and we'll pop it up on our Instagram and YouTube pages. As always, if you have a question about anything, have an adult record. You asking it on a smartphone using an app like voice memos, then have your adult email the file to questions@butwhykids.org. Our show is produced by Melody Bodette, Sarah Baik and me, Jane Lindholm at Vermont Public and distributed by PRX. Our video producer is Joey Palumbo, and our theme music is by Luke Reynolds. If you like our show, please have your adults help you give us a

thumbs up or a review on whatever podcast platform you use. It helps other kids and families find us. We'll be back in two weeks with an all new episode. Until then, stay curious!