Host: Robert Frederick
Walking in the forest, I feel so at ease. But it's not just because my dog is with me, though I'm sure that helps. No, there's always been something appealing to me — something peaceful — about being in a forest. The Japanese have a name for it — *shinrinyoku* — forest bathing — and the physiological effects of forest bathing — walking through a forest — are real: lower blood pressure, lower concentrations of stress hormones, lower pulse rate compared to walking in city environments. But why? Could it be beauty?

Speaker: James Schrillo
Beauty is whoosh whoosh whoosh whoosh! If you can picture that…. That's beauty. That's what we're really tuned to.

Host: Robert Frederick
On this episode of The Conjectural, experiencing beauty — in forests, in clouds, in fractals — and on how seeing natural things in the outside world may be what's affecting how you feel in your inner world. I'm Robert Frederick.

I'll be the first to admit, when I first saw a Jackson Pollack painting, I didn't think much of it. If you're not familiar with the work, search for it on the Internet and you'll see pictures of swirls and lines of paint and splotches. Pollock applied paint to his canvases by putting the canvases on the floor, and standing or kneeling on them in order to spreading the paint about — and not necessarily using even a brush — in splotches and swirls, or as James Schrillo, a psychology professor, at Wake Forest University puts it.

Interviewee: James Schrillo
Whoosh whoosh whoosh whoosh! If you can picture that, or…

Interviewer: Robert Frederick
Painting whirls and dots and spreading…

Speaker: James Schrillo
Swirls, and what looks like "shmear." And he said 'That's beauty — that's what we're really tuned to.'

Host: Robert Frederick
And when an art teacher persuaded me that I really must take a look at and study Pollack's paintings, I finally figured out to stop evaluating them based on what they looked like and start paying attention to how I felt when I looked at them. It was like being in a forest. Wow! How does that work?

Some scientists have described what we see in a Pollack painting as *fractal*, but that's a term that is being used in multiple ways. The more familiar way the term *fractal* is used is to describe things that are self-similar — like the leaves on a fern that are the same shape as you go along the fern but they get smaller and smaller towards the tip. Under this definition of fractal, Pollack's paintings somehow mimic the natural, the organic. Except when I look at a Pollack painting — I don't see fractals but just splotches of color that don't look at all organic to me.

So what's going on that a Pollack painting can make you feel at peace in the same way that you might feel when you are forest bathing? This is where James Schrillo's work comes in. He studies how our eyes signal what is going on in our brains.

Interviewer: Robert Frederick
I wanted to ask you, there was a study that came out and it was a correlation study — a crazy correlation study — between the number of trees, and this has to do with your fractal work,

Interviewee: James Schrillo
Oh, Okay.

Interviewer: Robert Frederick
the number of trees in Toronto, on a street, on every street —

Interviewee: James Schrillo
Okay, so it is a fractal-type study.

Interviewer: Robert Frederick
—- and then the healthiness of the people who lived on those streets.

Interviewee: James Schrillo
I don't know that study.

Interviewer: Robert Frederick
Okay, but I wanted to ask you because they found that if there were 10 more trees on a street than the average, then the people were healthier, and they controlled for everything from, you know, their socioeconomic status to their age…

Interviewee: James Schrillo
Oh, neat.

Interviewer: Robert Frederick
…to everything like that. Right.

Interviewee: James Schrillo
Well, that's cool.

Interviewer: Robert Frederick
And I wondered whether or not, because of the work that you've done with the fractal stuff, is if you could tell me a story that would make sense of a study, but with the fractal — like you see fractals when you look at trees, your eyes…

Interviewee: James Schrillo
Sure, they should make fractal patterns. When looking at trees they should, because trees are thought to be fractal, they should make fractal patterns. So it should differentiate, the trees—looking at the trees—versus the other part, where you're looking at houses and pavements, et cetera — so that should be true. And there is another study where a man a while back looked at the fractal pattern of heartbeats. Do you know this study?

Interviewer: Robert Frederick
Umm hmm.

Interviewee: James Schrillo
Okay, good. Then that would be the relationships. Apparently healthy heartbeats are fractal-like; unhealthy heartbeats are non-fractal-like.

Host: Robert Frederick
And this is the other definition of fractal — the term Mandelbrot coined and described perhaps best in his book published in 1982 titled "Fractals and the Geometry of Nature." Fractals aren't just self-similar shapes that get ever smaller, though that is one way of using the term *fractal*, but patterns that get repeated at smaller scales — but the patterns don't just have to be patterns in space, they can also be patterns in time.

Interviewer: Robert Frederick
There is the sense that looking at trees and at clouds and things like that make you more calm, or put you in a better state of mind or mood….

Interviewee: James Schrillo
Well, it's actually not more calm, it fractal— it should be fractal like, and fractal-like patterns are actually irregular patterns, they're not the most calm if you remember the heartbeat study.

Host: Robert Frederick
Indeed, regarding patterns in time, cardiologists and statisticians have known for a couple of decades now that if your heart is healthy, plotting its real-time resting heart rate over time isn't steady at, say, 60 beats a second. A healthy heart rate doesn't display a nice sine wave, either. It also isn't spiky. Instead, it's fractal. So, for example, over thirty minutes, even though you're resting the whole time, your heart rate might go up for a whole minute to around 90 beats per minute, or it could hover minute-by-minute between 50 and 60 beats per minute. It might sink down to 45 and then hover at 70 and 80 beats a minute for a few minutes. It doesn't appear to your eye to be a pattern at all. Instead, a graph of it might look like a mountain range or a coast line. They're fractal, too.

Interviewee: James Schrillo
If you look at this room, virtually everything is a geometric structure. But if you look at Nature, it doesn't look at all like this room.

Host: Robert Frederick
And when you look at something natural, or fractal — including computer-generated fractal patterns that are designed to mimic nature — Schrillo and his colleagues have found that your eyes — your pupils — get bigger and smaller over time in a fractal pattern, too.

Interviewer: Robert Frederick
So we, when our eyes are resting or moving or darting about in fractal patterns as we see trees or clouds or Jackson Pollack paintings…

Interviewee: James Schrillo
That is appealing. That's the state that we prefer.

Host: Robert Frederick
In other words, that's what we've been seeing — what all animals have been seeing — throughout all our evolution. And just looking at the signs, streets, houses, buildings — all the stuff we've constructed out of straight lines — that may be what's stressing us out. So it could be that returning to Nature calms us back down with what we're seeing — Nature's fractals — which have been shown to cause our eyes — not only our pupils to dilate in and out in fractal patterns over time — but looking at Nature's fractals have been shown to cause our eyes to move about in fractal patterns. Could that, in turn, be causing our hearts also to beat in fractal patterns, too? I mean, this show is called The Conjectural, right? But is that Schrillo's conjecture, too. I asked him about it.

Interviewer: Robert Frederick
So is there, is there some tie between pupil-dilation fractal rates and healthy heartbeat fractal rates, or is it more…

Interviewee: James Schrillo
That is an unknown that I would very much would like to look at, so that would be the tie between the other research — an interesting piece in and of itself — and potentially the lifespan.

Interviewer: Robert Frederick
So have you done the study then where, when the pupil is in a fractal pattern, have you asked people how they're feeling?

Interviewee: James Schrillo
So that's another question to ask…. You could like to jump to the conclusion, but as a scientist, I'm not supposed to do that, so I don't know.

Interviewer: Robert Frederick
Just so we're on the same page, what is the conclusion that you would jump to…. You're shaking your head.

Interviewee: James Schrillo
I'm shaking my head no, that I won't make a conclusion where I don't have evidence. So that's what you're going to get. What I can't do here, or I could do if I had infinite time in my day—you want to look at the relationship of where the eye is looking, what the pupil size is, and what the rating is for each time that your eye jumps from a bright spot to a dark spot to a bright spot to a dark spot. I've got all that data — too many data points for me to try to get a program for to slosh all that data into one. But it's a do-able—for someone who wants to—someone's got a very ambitious graduate student is what you need.

Host: Robert Frederick
James Schrillo is a psychology professor at Wake Forest University.

Interviewer: Robert Frederick
Okay.

Interviewee: James Schrillo
Okay.

Interviewer: Robert Frederick
Well, thank you very much

Interviewee: James Schrillo
Thank you. I really thank you. I appreciate being able to talk about my work.

Host: Robert Frederick
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