

## Peter Kalmus: The Question of Progress by Richard Whittaker

I met Peter Kalmus at a ServiceSpace gathering in Santa Clara, in the heart of Silicon Valley. All of us had introduced ourselves in a circle and something about the way Peter described his work as a scientist in environmental studies stood out. Immediately I wanted to know more about him and his work and fortunately, he was able to make some time for an interview. We started at the beginning.

Richard Whittaker: So you grew up in Illinois?

Peter Kalmus: Yes, outside of Chicago. I remember in high school, I went for a walk. I was going to a friend's house and I was walking past all these houses; it was the evening, sort of dark. In every house, there were blue flickering lights going in synchrony because everyone was watching the same TV show. It was a quiet night and I was alone, just walking with the sound of the freeway and the blue flickering lights. And what had seemed normal to me my whole life suddenly seemed strange. Even so, I didn't think of some other way of living. This would have been in 1991 so I would have been seventeen.

RW: It's interesting that memory would come to mind. It's a powerful image you're describing.

Peter: Yes. It was kind of formative, I think.

RW: What do you think made it such an important memory?

Peter: That's a good question. There was a feeling of loneliness and alienation, but also a sense of questioning the way we're living. It was kind of waking up a bit, coming out of this sense of everything having to be the way it is. You know? Sometimes it's hard to imagine things being another way because we get so used to them.

RW: How did your interest in science evolve?

Peter: When I was a kid I was good at math and science, and I got a lot of validation. I'd get the good grades and the teachers would like me, so I think I got a little addicted to that feeling of being smart. And my dad had studied chemistry, so I think there was a little pressure from there. But mostly I think I got a little addicted to being perceived as smart by other people. Virtuosity's too strong a word, but maybe I had some fraction of virtuosity. It fed my ego. So that was the negative side of the equation—and then physics, the desire to understand the universe and where we come from, that's the positive side of the equation. I think that my whole life I've been in shock by just being born into this universe. I find it really bizarre, so I have a deep longing to know how it works, to know what's behind all this, sort of to see the

wizard behind the curtain.

RW: Right.

Peter: That's kind of what physics does. Because you can see how matter works, and you can see how space and time works. You can even ask questions about where the universe came from and how everything started; that's cosmology. That really attracted me so I went to college and started thinking about doing astrophysics and addressing these questions of where the universe came from—all the time though, not being aware that this egoic part was driving me as well. The desire to be perceived a certain way was just part of my path. Then I had a kind of meltdown in college. I got really depressed. It was a stressful time. So I took a break. But eventually I went back and got a PhD in physics and started doing astrophysics.

RW: I recognize this wish to know -- what is this all about? And maybe everybody does, in a way.

Peter: Yes. One the most magical things I've done in my life, really, is to get some tiny insight into general relativity and how geometry and gravity interact with each other. So gravity is the attraction of massive objects to each other. And when you have a massive object, or even when you just have a lot of energy in one place, it actually bends spacetime.

Spacetime looks flat to us. The surface of the planet looks flat, too. But if you step back far enough you can see you're actually going on a curved path. Spacetime itself is curved by matter and energy, and then the matter and energy follows these curved paths.

RW: It's hard to wrap your mind around that. I'd think that for many scientists, the wonder of things is a motivating force. I think you were saying something like that, actually.

Peter: Well, there's a miracle to a mathematical equation. It's almost mystical how an equation can capture the essence of the physical world; how math can capture the physical world. For instance, you can use Einstein's equation of General Relativity and potentially go out with a telescope and verify it in the real world. So why is it that these equations can describe the natural world? I don't know.

RW: That's a question that I ponder myself sometimes—the mystery of mathematics and its profound relationship with the physical world.

Peter: Sometimes math even gets ahead of physics. I think this was true with general relativity, with the Riemann curvature. I'm not well-versed in the history of math and science. But there's a mathematical theory that doesn't have a physical counterpart and then its physical counterpart is found. It happened with Einstein's equations. So it's possible to even explore things mathematically, and then use those equations to find out about the physical world. It's amazing. I can't pretend to understand why there's that connection.

RW: Sometimes people talk about music in a related way. Music is just vibrations and the notes of the octave are precise, based on simple numeric relationships.

Peter: Yes. Each octave is a doubling of frequency.

RW: One of the most mysterious things is how these vibrations in music create an

emotional response. Now what in the heck is going on there?

Peter: Yes. It's mysterious to me, too. I play music and sometimes it's like everything goes right. And performing, like with singing, you can be right there in the moment. I can't even describe it. You're just resonating with the music that's coming out of you, and that music is making you resonate, too. So there is something very profound there that sort of defies analysis, in my opinion.

RW: I agree. Did you say you got your PhD in astrophysics?

Peter: In physics.

RW: So is there an "astro" somewhere that got connected to you?

Peter: Well, when I was in the physics department, my thesis was in astrophysics. I studied gravitational waves, which are ripples in spacetime that propagate at the speed of light. They're basically like very, very tiny deformations in space. So space expands a little bit and then contracts at a given frequency as that ripple propagates out.

RW: It's almost like sound vibrations.

Peter: It's similar to sound waves. Exactly. There's a wide range of frequencies; different astrophysical phenomena can create gravitational waves at different frequencies. But the frequencies we studied were right about in the same range as audible frequencies.

Yes.  
So there was kind of a canonical signal we were considering, or that they're still considering--I left the field--where two neutron stars are in a binary system. They're rotating around each other and losing energy to gravitational waves. It takes energy to make these ripples in spacetime propagate out into the universe. So like any orbiting bodies losing energy, they get closer and closer to each other and they start going faster and faster around each other. At the end they collide, but at the last moment, it sounds like mmmmmmm (hums at a low frequency and then accelerates to a higher one, trailing off). It's like this swooping noise that gets higher in frequency. It's audible.

RW: That's amazing. Sometimes I ponder how we are tuned into little parts of the electromagnetic spectrum. I mean, vision fits into a little range there and there's our hearing, but this spectrum is so much bigger.

Peter: Well, be careful. Now we're talking about three distinct kinds of radiation here, sound, gravitational, and electromagnetic. But our eyes, yes. Our eyes are tuned into a tiny part of the electromagnetic spectrum.

RW: Well science tells us there's a whole lot that we don't directly perceive. It's kind mind boggling, really.

Peter: That makes me think of bees. I actually brought Casa de Paz a little jar of honey from some bees I know back in Los Angeles. I like to think of them as friends, but they probably think of me as a honey thief. Bees see ultraviolet, which we can't see. To bees, flowers look different than they look to us. A particular flower might just look white to us, but to a bee it will have this pattern we can't see in the petals. It stands out to them in the background of images, and they go in there and get their nectar.

RW: That's a good example of how there's much more than we see. Now am I right that you've shifted your focus?

Peter: Yes. To climate physics.

RW: Would you say a little about that shift?

Peter: Okay. About two years ago, I'd been trying to find a university position studying gravitational waves. A year earlier I actually did two job searches and applied to all these universities. I got a couple of interviews but I didn't get any offers so that was a little discouraging. But that's not the real reason I changed. While I was in graduate school I started becoming aware of global warming, and started thinking about it more and more. Someone gave a talk in the physics department - I think it was Jim Hansen from down the street at NASA GISS, but I was so clueless I didn't know who he was - and then Al Gore's movie came out. My reaction was, if that stuff's right, it's a huge deal that this is happening! So I started doing my own research back in graduate school in New York City around 2005 and 2006.

None of the other physics graduate students cared about global warming. We'd go to lunch and I'd try to talk about global warming and these exponential curves, population and depletion curves, that are threatening the food supply. I'd even go on about bison in the high plains. I had this theory that our food system was messed up. I was starting to see all these interconnections between the earth system, global warming, the food system and other things.

My theory was that there used to be prairie grass and bison in the heart of North America, and when the Americans pushed west, they basically killed all of the bison. They started raising corn, right? Now we raise corn; we irrigate corn. We took the prairie out and put in irrigated corn, and we feed that to cows. My theory was that we'd get more meat if we just let prairie be prairie and bison be bison. If you read Lewis and Clark's journal, they talked about bison stretching from one horizon to the other; huge numbers of bison. And if you think about how evolution works, evolution spent tens of millions of years making a system of productivity, prairie and bison, that was perfectly suited to the situation—to the sunlight, to the rain, to that climate. Nature kind of knows what it's doing. Then we came in and wiped it out and replaced it with what we were familiar with from the Old World, which was cows. We wanted those cows; we didn't want the bison. That's what the Indians ate.

RW: It's one example of what some people could call our hubris—that we can make it work the way we want it to. What you've just described suggests how sadly mistaken we can be.

Peter: I call that the myth of progress. We pride ourselves on not being superstitious anymore, right? Because we've got science and technology; we've come out of the Dark Ages and we're mastering nature; we're making a better life for ourselves. It's what we tell ourselves. But we've replaced what we thought of as superstition with a new superstition, which is the myth of progress.

We think our technology can solve any problem. We think that if we destroy this planet, we can go on spaceships and populate some other planet, which we can't. That's not in the cards for the foreseeable future. We think that if the planet gets too warm, we can do geo-engineering, mess with the system and keep controlling it.

We think we can control the food system by turning natural gas into nitrogen fertilizer and diverting water from vast distances, and growing whatever we want wherever we want, and changing the species, you know, genetically modifying the species so that they can

make higher yields. But we're seeing signs of collapse everywhere you look. The system's straining at the seams, and it's possible that we've already gone too far, like Wile E. Coyote already gone off the edge of the cliff and now in thin air not having fallen yet.

RW: Yes

Peter: It frightens me that we've created this system that lacks diversity and resilience, this system of monocultures that's propped up by fossil fuels, pesticides and chemical fertilizers—and by other resources that aren't renewable, like the soil and the groundwater. It's really a system in crisis, I think. I feel like that's a minority opinion still, but I'm sticking to it.

Let me go back, though, to the question of how I switched to climate science. So this awareness of climate change was growing and the more I learned, the more I realized it was a serious problem and found myself thinking about it. I couldn't justify doing astrophysics any longer. It was like sort of like fiddling while Rome burned, so finally I made the switch.

RW: So, specifically, what did you switch into?

Peter: I got a job as a postdoc working on clouds, cloud physics, and how the clouds interact with the climate. I studied low clouds off the coast of California; stratocumulus clouds mostly, and how those stratocumulus clouds transitioned into cumulus clouds as you move towards Hawaii. These low clouds reflect a lot of sunlight and keep the planet cooler. If these low clouds decreased by just a few percent, the planet would get much warmer. So we're wondering how these low clouds are going to change as the planet continues to warm, and we still don't really know how they're going to change.

There are a lot of questions about clouds, and the response of clouds, to a warming planet and whether the way the clouds change is going to enhance global warming or it's going to put the brakes on global warming. It's one of the biggest questions in a climate science. There's a lot of uncertainty in what's going to happen to the planet in the coming decades—which centers on the clouds, because we don't understand the clouds well enough.

RW: That's really interesting. Speaking of the myth of progress, there's another factor. We've got this myth that we can figure it out, and in fact, if there's money to be made, we will figure it out. You know, that kind of faith.

Peter: Faith in the market, yes.

RW: Financial pressure keeps industrial farming in place, and there's the pressure the corporations put on the society through advertising and whatnot. It's not just certain kinds of attitudes about progress and how we can fix things, but there's also the pressure from vested interests to keep cranking out hamburgers, and this sort of thing. This is also a factor, wouldn't you say?

Peter: Yeah, absolutely. Corporations, I think, at some level, are incarnations of our deepest desires. There's one thing we want more than other things, which is money. We want money because we're afraid, I think. We know that we're going to die, but we tend to avoid looking at that; we sweep that under the rug. We're so attached to our bodies and we're so afraid. We feel that accumulating more money can give us security, and I think that's false. But that's what we, as animals,

do when we're afraid. We try to accumulate and hold on, and we're afraid that somebody's going to take it away.

I think that this wanting, this deep mental habit we have, which comes out of fear maybe created these corporations. The corporations were originally created to solve problems that one person couldn't solve by him or herself. right? We wanted railroads to bring all those buffalo skins back, or to bring the minerals back—to extract wealth from the western part of our country basically. The system of capitalism feeds that desire for wealth, which is why we have all this advertising, too.

The corporations were designed to solve these problems, but they're built to make a profit; that's their legal purpose. Making money for the shareholders is built into the legal charter of these corporations. There was a lot of money around with the successful ones and the managers start to scratch their heads and ask how can we make more money? Right? And there are regulations, like we can't do this or that to the environment. Or there's some tax we have to pay. So how do we get rid of that regulation, or how can we reduce that tax?

So they start talking to the politicians. The politicians need to reach a lot of people and get the word out in their campaigns. That takes money. So the corporations and the rich people that run the corporations get together creating a positive feedback loop, which I think is actually hiding in free-market capitalism. It's kind of built into free market capitalism. But it's basically an unstable system.

It's like if you're an aeronautical engineer designing a plane, you can make a plane that's stable, that will actually fly itself even if the pilot takes his hands and feet off the controls; the plane will just stay stable, flying straight. Or you can get something like some of the fighter jets; they are unstable systems, but they're more maneuverable. But with an unstable system, you have to control it or it will crash.

I think that we have these regulations in place to try to control this intrinsically unstable system. But these corporations have gotten so large, especially over the last 30 years, and I think people kind of stopped paying attention, stopped controlling the unstable system. Maybe that's too simplistic, but during that period the corporations, along with the politicians, have kind of merged into one entity. And a lot of the corporate chiefs became the politicians, and a lot of the politicians became the corporate chiefs.

They used the legal system as a tool to dismantle regulations and lower taxes, and further accumulate wealth. And the more wealthy these corporations get, the more they control and manipulate the legal system. And they don't have to break laws; it's all perfectly legal, but they get to extract this wealth.

Then NAFTA came along and globalization happened. The corporations became multinational corporations, so there's even less regulation because they can always go to whatever country where the regulations are favorable—and they change regulations in those countries. There's no international oversight, so they get bigger and bigger and they basically own the political systems now.

It's like one system, which you can call a corporatocracy. So whenever there's a problem, like global warming that can get in the way of the profits of some of these corporations, the fossil fuel corporations and the banks, they use their money and power to preserve the status quo. So it's very hard to take action on global warming. First we have to dismantle this corporatocracy, and it's still getting stronger every day. It's not getting weaker yet.

RW: Yes. It's an alarming picture.

Peter: Yes. Does that make sense?

RW: Yes. I mean, sadly, it makes sense. I'm reminded of what Reverend Heng Sure was talking about the other night, how the practice of mindfulness is beginning to be

embraced by some corporations, under the idea that it would create a more effective workforce. But as this practice is embraced is there hope that some people will wake up a little bit inside of the machine? Will some of them begin to see that their long-term interests require them to change their ways, you know?

Peter: I certainly think that dealing with this constant wanting we have, and the fear we have in dealing with that inside our own minds, that it's the ultimate solution. But it's very hard to predict how fast these kinds of ideas can propagate in the general population. Learning how to wake up also takes a lot of work.

I think there's this misconception in Western culture that wanting things is a solution. It's actually a form of suffering. I wouldn't be surprised if most people thought that wanting things, and then having those cravings satisfied, is happiness. So they're constantly chasing after these sensual things, and maybe for some amount of time after a craving is gratified, a person feels relief from this deeper suffering. But then it comes back again. It's actually stronger because the cycle of wanting and gratification is a habit, and now the habit has gotten a little more ingrained.

That's why even when people get all this money it's not enough; they might get a collection of sports cars. Then they get one giant mansion, and that's not enough. So they get a summer home. Then they get a summer home in France. It just keeps going. Then they start buying politicians and buying ideologies and changing the whole fabric of Western culture. But that's still not enough. So space tourism is coming along. The craving never ends. It's infinite.

Even the people who do make this connection, I think a lot of them don't understand that it takes a lot of work to start to change this. It's like practicing the piano. They think they'll suddenly be enlightened. Right? Maybe people don't think this way, but certainly for a lot of my life, before I actually started meditating, I had this sense that enlightenment was this kind of mystical thing that was out of my power to obtain, but that through some kind of grace, some kind of mystical process that I don't understand, maybe suddenly it could happen. In fact, what I found out about meditation and about dealing with this habit is that it takes a lot of practice, like becoming a concert pianist. You practice it every day, and there's nothing mystical about it. But I don't see these 7.2 billion people all starting to do that. But I think we should absolutely be doing that because that's the path that will make us come out of our suffering and make us be happier. Maybe it can happen fast. Maybe it will take hundreds of years, or maybe thousands of years. I don't think anyone can predict. But maybe, ultimately, it will catch on.

RW: You must have run into Buddhism. Is that a safe guess?

Peter: I'm not a Buddhist, but the practice I follow was taught by the Buddha. To me, it's just a practice; it's just a way of being happy.

RW: It sounds like you've been practicing for a while. How did you run into this, if you're willing to share that?

Peter: My wife and I started meditating around 2002. I think we both independently found out around the same time about this -- I guess you could call it an organization where you can go and meditate for ten days, and it's completely free, and supported by donations.

RW: You're talking about Vipassana?

Peter: Yes.

RW: Goenka?

Peter: Yes. The Goenka tradition of Vipassana, exactly. So I've been searching my whole life. I grew up with Catholicism. I read a little essay that Goenka had written about the breath, and about anger, how anger arises. And how we go through our lives without ever looking at how our minds work, and how our minds and bodies interact. It made so much sense to me -- examining how the mind works and where the suffering comes from. I mentioned that when I was in college I got depressed. That was a great suffering and a sense of being out of control, the mind kind of going off the rails. So naturally, I started wondering, where does all this suffering inside me come from? It seemed very natural to just sit down and have a look. It seemed exactly like what I was doing in science. You have some question. How do neutron stars work? And you can address that question by looking, by examining. Or let's say something breaks and you want to fix it. You look at it. Right?

RW: Right.

Peter: You can't just randomly start hitting something with a screwdriver and expect it to get fixed. You have to examine it and find out where the broken part is, and exactly how it broke, and what you need to do to fix it. You can do the same thing with your mind. Your suffering is kind of like your mind being broken. But if you don't ever look at it, how can you possibly expect to fix it? Just by random luck?

So that made a lot of sense to me. It wasn't a tradition where the priests said do this and do that otherwise you'll go to hell, an authoritarian thing you have to take on faith. That's a little bit simplistic maybe, but that was sort of my experience as a kid in church.

I don't want to say religion is bad for everyone, but in my experience something was missing there. So I went to this 10-day meditation course, and the more I meditated, the more I learned, and the more sense it made.

RW: That's great.

Peter: My wife and I went to that first course together. I guess you could say we were skeptical. And we made a pact: if you decide it's a strange cult, you can sneak over to the men's side and we'll leave together, and I'll do the same. But by the end of the course, we were both amazed by how wonderful we felt, how peaceful we felt, and how happy we felt. We both did a lot of work. It was ten days of just constant meditating. So we had a chance to really start breaking some of those bad mental habits, that blind reacting to wanting. And so we decided to keep exploring this.

RW: One of the things that comes up for me listening to you, is the question of what is enough?

Peter: You mean in terms of stuff?

RW: I think it can be expanded into just about any area, I guess. But certainly, in terms of stuff.

Peter: So whenever you think that you don't have enough, like there's something that you think you need right now, then your mind is in the future. You feel like there's something missing from this moment, and that's a kind of suffering. But if you can make this little shift, you can start to see that everything around us—like



this cup of tea, or this air that we breathe, or just the fact that we can have this conversation, or see a plant growing or the taste of the delicious beans and chard and avocado I just ate—you see that we’re swimming in miracles. All of the bad stuff that happens comes from not recognizing this and by wanting more stuff for one’s self and by being afraid of other people, feeling separate and seeing them in opposition. If someone starts running after you with a stick you’re going to get scared; that’s going to make you feel separated and you’re going to want to get a bigger stick. So it’s this positive feedback that leads to militaries, it leads to hoarding of wealth and all of this fear. But it takes such a little shift, because what I’m saying is literally true.

Any scientist who studies the properties of water will think that water is a miracle. But we drink a glass of water and we wish it were Coca-Cola. We don’t appreciate the water while we’re drinking it. This wanting is kind of what gets in the way of seeing all the miracles we’re swimming in. When we see these ordinary miracles life becomes so wonderful.

RW: That’s beautiful. Water is one of those miracles I’ve been moved by. Do you have any deep memories connected with water?

Peter: When I was a college kid, I had this summer job in New Mexico and there were all these mountain streams. And sometimes there were these mountain pools. They were as cold as heck and it’s such a joyful thing if you’re alone to strip down and jump into one of these mountain streams.

RW: Oh, yes. That is a deep experience.

Peter: So take another element—fire. Last year, I took my son, he was seven, and there was this guy teaching a wilderness course. One of the things he taught us was how to make fire with two sticks. We used a bow. You have to find the right kind of stick as a spindle, and you have to find the right kind of wood as the base. Then you cut a little notch and you rub this little hole. You spin the stick fast until you get a little glowing ember. You have some tinder ready, like a bunch of really dry grass. Then you carefully transfer that ember into the tinder and then very gently bring it up to your mouth and blow until it ignites. The feeling of succeeding in making fire with two sticks—that’s another thing I cannot put into words. It was such a satisfying thing at a primal level. A lot of the deepest truths come out as clichés, right? Like the best things in life are free. The best things in life don’t require money—you know, making somebody smile, making somebody laugh, or jumping in one of those cold streams. You just feel so alive.

RW: This is so beautiful. I’m wondering what it would mean, as a climate scientist, to get in touch this way with these primal realities: earth, air, fire, and water?

Peter: That’s interesting. I never really thought of it that way, but that’s kind of how I’ve started to structure my life. Back to the basics. A few years ago I started really getting into gardening, and you can’t grow plants without understanding soil. When I started I planted seeds just in the soil that was there. I live in Altadena, which is outside of Los Angeles. The soil at my house is mostly clay and doesn’t have a lot of nutrients in it. I planted my seeds and they grew into miniature plants. I didn’t know why they were a third the size of normal vegetables. So I started learning about soil and appreciating it, loving the way it smells and the way it feels in your fingers. I started learning about compost and seeing soil as life, as like living things and being happy when I take a handful of soil and there are worms in it, because in the beginning, there weren’t worms in my yard.

So let's talk about our place in the biosphere for a while. Sitting here and talking we can start to be aware of what that means to be sitting here and talking—to be aware that we're enjoying this house and this comfortable couch and the light—the photons streaming from that light. You can start thinking about how the electricity is generated that makes those photons. And how the generation of that electricity creates carbon dioxide, which is causing the planet to warm, and how the warming planet is putting stress on the biosphere, and causing a biodiversity loss. And having all of these effects that are going to ripple, possibly for millions of years, because it takes several million years after a mass extinction for biodiversity to return back to its normal level.

You can start to think how every little thing we do connects with other beings on the planet, connects with other people, and how it also impacts ourselves. How, if we act in a certain way, it can make us happy and peaceful, and if we act in another way it can make us suffer. So you start to eat in a certain way. If you're eating meat, you can ask where did that meat come from? How was that animal raised? You've started to examine everything that you do. When you get into your car and you turn the key and it burns gasoline or diesel, that's an interaction with global warming. If you can afford a Nissan Leaf, you get in and you turn that Nissan Leaf on, you're running off of the electrons in the batteries. That's also a conversation with climate change because you decided to buy that Leaf so that you don't have to emit those gases, but then there's a whole production system that created that Leaf. You're also perpetuating the system of technology. We have this faith in technology, but maybe instead of more stuff and more technology, we have to start backing down and being happy with less.

Eating is an important way to connect to the biosphere. When you take a bite of food, of course you digest it and it comes out poop that goes into fresh water, right? Of course, in California there's a big drought. Then you flush that down and you can ask yourself, where does that poopy water go? How is it processed and what do they do with the solids that remain? Does it all go into the ocean? Do they put it on a farm field?

If they put it on a farm field, are there pharmaceuticals mixed in there that get taken up by the crops and then people eat those? Or, if you're healthy and you don't need to take those drugs, you can do some research and learn how to compost it, and after two years you have perfectly safe soil that's packed with nutrients.

I'm fortunate to have a little bit of space, like a tenth of an acre and I've got like 20 fruit trees. So when I eat a piece of fruit, sometimes I think about the tree and how it just gives the fruit to us freely. It doesn't expect anything in return, but what it got in return, until we started flushing everything away to the sewage treatment plant, was our poop. That's what it wanted from us, basically. And that's how beautiful nature is. It's so easy for us to get that, and we don't have to think about it. We don't have to make a sacrifice. We just do what's natural and that's giving back to the soil, and the process is closed.

But through our hubris, we've taken these closed cycles and we've cut them and turned them into these linear things because you can extract profit from linear processes more easily. So I think naturally, if you start to examine the relationship that you have with the land through food, and through fuel, and through your daily actions, then for me, at least, it just naturally happens that I want to start to close some of these cycles again. I find that very satisfying.

RW: You mean restore the cycles?

Peter: Yes. I made up a word for that. I call that "be-cycling" because it goes deeper than recycling. Recycling is an attempt to close some of these processes, but it doesn't involve me. So if I drink something from a bottle and throw it into the recycling bin, and then some truck comes and takes it away—that's sort of corporatized and it

doesn't involve me being aware. In fact, it lets me be less aware because maybe I feel less guilty.

For example if I'm an environmentalist and I'm worried about the state of the environment, then I'm recycling, I'm "doing my part." But that's a superficial action. But if we operate off of guilt, we need these ways of keeping our guilt in check, right? And recycling is one of them. Then we can just keep going and we don't need to examine things at a deeper level.

That's how I think of recycling. It's still kind of throwing something away, and this "away" is a nebulous thing, this vague place "Away"—with a capital A. We don't know where the stuff we discard goes. But if we take things back and become personal with these processes, then that's be-cycling. That's being awake; being a certain way.

RW: It's about being--and to be?

Peter: Yeah, to be.

RW: That's really nice.

Peter: It's made me happier, because my actions are more aligned with my principles. It's also caused me to emit a lot less CO2. It's about simple things like getting on a bicycle; it just makes me so happy getting on a bicycle. That's how I get my exercise, too. It keeps me healthy, and I feel happy not being closed in a car and feeling empowered that it's my own body that's getting me there.

RW: You know "being" is a word we have, but it doesn't really mean much to us. We have very few associations with that word. We use the word "being" in a casual way like, "You're being impatient." But that's not how you're using that word in be-cycling. It's about being, as the state of existing or dwelling here. We don't have good ways of talking about this. But when you say you love bicycling, well, your body is engaged, you're at a speed where you're still more in touch with your environment, and you're functioning more as a complete human being, meaning you're actually being rather than just living in your head, which is where most of our living takes place today in this culture.

Peter: You said that much better than I did. I think that was beautiful.

RW: Well, I'm fascinated that the idea of being has appeared in this conversation, and we have very few ways of actually even talking about it. You can say well, "to be or not to be." Yes. But there's much more to it than this simple either/or. We take so much for granted: air, water, light, living. There's so much more very close at hand, as you are saying. We're kind of asleep in this way.

Peter: Yes. If someone's concerned about global warming and they want to do something to help, to make a difference, all they need to do is turn off the television and get on a bicycle. I mean, maybe if you need to get something from the hardware store, go get something from the hardware store on your bicycle—and just ride around the neighborhood and feel happy. I think we need to stop feeling guilty about how we interact with the environment. It's our birthright to be happy. Again, I don't know how to make it more simple, but to eat good food and to be part of that process of producing the food—it's so joyful. To get on that bicycle is joyful; to make music with people, to know the names of your neighbors, to give your neighbor a gift.

Sometimes, I'll save some fruit from getting thrown away from the supermarket or

something and I'll turn it into jam. Because I'm too lazy to boil it and sterilize it, I'll have all this jam, way more than I can eat, so I give it away to everyone. It makes me so happy and it costs me nothing, because it takes half an hour to make a big batch of jam.

I've gotten to a point now that I don't really know why everyone wants to have a lot of money. I do know someone who doesn't use money anymore. That's a deep practice, and he's gone very deep with it. It's not my path yet. I have two little boys and I'm trying to do climate science. I'm expected to dress in a certain way, to be available through e-mail, and so forth. But I think he really enjoys not using money. He's found it to be very liberating, and I think that's probably the right choice of words because he described his moment of giving up money as a feeling of freedom and profound peace when he finally set down his last \$30.

RW: Wow. Where are you today, as a practicing climate scientist?

Peter: Well, the climate system, the air system, is ridiculously complicated. There's biology and chemistry, and there's physics. There are beautiful, turbulent, calm conditions. The sun is part of the game. The water is part of the game. There are forests. You can think about how water and ice are attracted to tiny particles in the atmosphere, and how that can form clouds. You can work with satellites. It's a huge system. You can work with some of the most intricate computer models that humans have ever made. I mean, there's just this vast playground of science. I still find it a little bit overwhelming, because you have to narrow down so much. I want to know the big picture about climate science, and that's hard.

So over the last two years of being a climate scientist, I've learned that there's not such a thing as a "climate scientist." The category doesn't exist. You can be an atmospheric scientist studying clouds. You can be an oceanologist. You can be someone who studies the ice. You can be somebody who studies vegetation, and how the vegetation interacts with the atmosphere; there are so many sub-disciplines. I'm in awe, I guess, by learning how everything is so interconnected. Everywhere I turn in climate science, I just see more interconnection, and more intricacy and more beauty. It's just such a beautiful system.

RW: Yes. Gosh. I want to go back to water, this miraculous liquid that's part of almost all of life. It's not only just this amazing liquid, but then it's a liquid that, holy mackerel, it becomes a solid. And not only that, it becomes a gas. And it cycles through these changes just the right ways to make life function. Well, come on, that's just magic!

Peter: It has this magical property that when it's a solid, it's less dense than when it's a liquid. So that means the ice floats, which means that lakes and oceans don't freeze solid. Right? Which means that life is possible. So it's pretty wonderful.

RW: To the degree I've been able to look at it, it's just mind-boggling.

Peter: It is. And you know, scientists are just people who like to explore, who like to figure out how things work. But I think that in our society, we have this distinction between scientists and non-scientists. I mean, scientists work really hard and through all the hard work they know a lot. But they don't know everything, and they're still people. I used to say, "I'm a scientist," you know. And that was the egoic part of being a scientist. The myth of progress, at some level, maybe kind of lionizes scientists, but we're just people.

RW: That's a nice thing to be reminded of. I talked to a woman who is interested in water, Betsy Damon. I met her thanks to Sam Bower, who you know. She's not a scientist, but she has studied a lot about water. She described the water molecule to me as being the most flexible molecule. Do you have any insight along those lines as a physicist about the water molecule?

Peter: Yes. So I think it all comes down to the hydrogen bond. I'm not a chemist, but water's a dipole because of the electron structure of the oxygen and hydrogen and the way they bond together. That kind of means that water's a magnet, and that allows it to be an excellent solvent. It can electromagnetically attach to other things that you might want to dissolve into it, and that ability to be this excellent solvent is what allows all of the chemistry in our bodies to happen. The story of our bodies, and the story of our evolution that brought all of the life on this planet, the biosphere, the creation of this wild diversity of forms—that whole story was written on water. It relied on water.

RW: And then, sunlight.

Peter: Yes. We're back to the elements again.

RW: Not too long ago, I had this direct impression that all the things that are growing here, the life here, is because of the energy coming from the sun. I mean, to actually take that in is mind-boggling.

Peter: That's right.

RW: We're talking about energy that travels ninety three million miles through space, and that's what's causing all this life.

Peter: Yes. It's so hard to put that kind of realization into words. It's so interesting that these truths, that are intellectually obvious thanks to science, can contain the most profound spirituality—if you actually are able to experience the truth, instead of just hearing it like, “Yeah, water, sunlight. Yeah, sure. I learned about that in high school.” Or the fact that we all are made out of matter—just the same as this floor or the dirt, and the same as a cat. We're all made out of these atoms and molecules that have been recycled. Talk about be-cycling! They've been be-cycled through the eons. They've come from other stellar systems and have been brought here; then they turn into this planet.

Then there's the process of recycling of matter; the matter comes into one form, and that form falls down (we say die) and goes into the soil and things eat it and then those things come up. And it's all the same atoms and the same molecules. Then those things go down and come up again in other forms. This has happened over billions of years and every time the cycle happens, it changes and new forms arise. And all of this is made out of the same molecules.

If that's not a connection, I don't know what is! We're made out of the same stuff. We are the universe. We're just matter, and this matter that we are is having this conversation; it's thinking these thoughts, and being able to connect. That's the universe being aware, the universe exploring itself through forms, exploring itself through our thoughts and exploring itself through our realizations.

You know, nothing I've just said could be contested by any scientist. Right?—that these collections of molecules are having this conversation. It's so profoundly obvious! Intellectually, it's just a vacuous statement, but when you experience it, you can never harm another being. You can't hurt anyone, because you don't

even see them as someone else, you know? But I don't think it's possible to put that kind of realization into words, really. You just have to experience it.