

While it's debatable whether time moves in a linear fashion, there's no question that Mike Beauchamp's Therevox moves as such. It's a trajectory mirrored in a solo bike trip across Canada that he undertook in 2005, and chronicled in the documentary, *The Cross Canada Project*. Moving from left to right—the way most languages are read, the way most historical timelines are recorded, and the way most musical instruments are pitched from low to high—Beauchamp biked and camped from Vancouver, BC to the Eastern Canadian Seaboard. The trip, while initially intended as an exploration of the limits of cameras and technology, would ultimately prove to be life-altering.

Since releasing the first version of the Therevox, the ET-1, in 2005, Beauchamp has been honing and perfecting his continuous pitch instrument with each new iteration, now up to the ET-5. Whether he's building robots to test the limits of the instrument or, say, throwing one out of the back of a moving car, Beauchamp is relentless in his pursuit of refining the Therevox, his homage to the ondes Martenot, the beloved French instrument created by Maurice Martenot in the 1920s.





therevox



Once I realized that Maurice Martenot had solved that problem in that way, I absolutely fell in love with the instrument.

Waveform: I just watched your movie, *The Cross Canada Project*, and it was really impressive...and entertaining. Why did you want to ride your bike from one side of Canada to the other? It seems like one of those things where you say, "Wouldn't it be cool if...," but you don't actually do it. But you did actually do it.

Mike Beauchamp: A year before I graduated from university in computer science, I had this weird idea of riding my bike across Canada and filming it. I started to get attracted to that as a project because I liked the idea of building the camera system that I was putting on the bicycle, but once it came time for the ride I realized I hadn't ridden my bike to get in shape for the trip.

How did your body handle the lack of preparation? Did that turn out to be a problem?

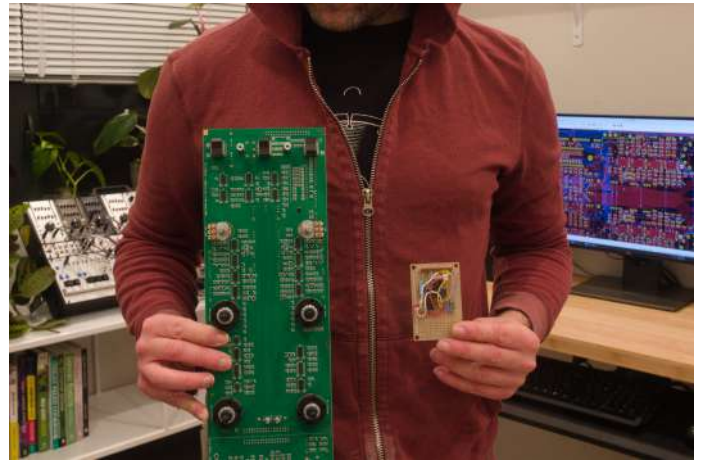
In the first few weeks, I dropped twenty pounds before I was even out of the Rocky Mountains. There were climbs that lasted for days; I'd never seen anything like it. I also wasn't carrying enough

food with me and I was pretty worried, actually, but I got taken in by a large group of cyclists that were on the same route fundraising for something. They had arrangements with churches in every town, and were given huge buffet dinners everywhere they went. I pretended to be with them for a few days and ate as much as I could.

That sounds like some kind of "bike trip life hack!" Did you feel a huge sense of accomplishment once the trip was over?

The trip really changed me in a lot of ways. Biking across that 7000 kilometers or whatever was a really good lesson in the fact that there are projects that can span a really long time to get to the end of, and you're going to hit moments of massive discouragement. Each one of those hurdles is something that you have to jump over to keep going. Also, during the trip I registered on a site called couchsurfing.com to find people to stay with during the trip. Two years after I got back, I got a message on couchsurfing from somebody in Japan looking for someone to hang out with when they were in Canada, and that was Melissa,

Photo Spread: **Mike Beauchamp in his workshop.**
Previous Page: **Mike riding his bike across Canada, 2005.**
This page: **The Therevox ET-5 and ET-1 circuit boards.**
Page 12: **Homemade testing robot.**
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Page 14: **The evolution of the Therevox: 1st prototype, ET-1, ET-3, ET-4.**
Page 15: **The Therevox ET-5.**
All photos provided by Therevox



who is now my partner. So in that regard the trip led me to finding her.

So you met her because of the trip, indirectly...Are there any highlights or interesting stories from the trip that you can share?

Everyone that took me in through couchsurfing were solid; they fed me and gave me a place to stay. Strangers let me camp in their backyards without hesitation, and people pulled over to give me Gatorade on hot days. I was mostly on my own in a tent somewhere hidden in the woods, but every time I needed help someone was there. I think long distance hikers and bikers call this "trail magic," but I think it just speaks to the fact that humans are mostly pretty awesome to each other when we're face-to-face.

When you were riding on your trip did you think about the design of the Therevox at all? That's a lot of solitary time with nothing to do but iterate on synths and watch out for cars.

We built a testing robot using a salvaged motor from a car seat...and attached it to the robot and...left it on 24 hours a day, seven days a week.

...and bears! I did a bit of sketching, mostly mechanical linkages that could work as exponential converters. In 2010, Melissa and I went on a bicycle trip around the island of Savai'i in Samoa. About halfway in, we both got really ill, near-death experience type shit complete with hallucinations, after eating some barracuda. We were really messed up for days and during that time I sketched out a lot of features that became the ET-4 and ET-5. Little design things, like how the waveform and octave knobs should look and work, but also important synth architecture and workflow. When we got back to New Zealand, the doctors said we likely had Ciguatera, which is a pretty intense neurotoxin.

So some of the design elements were brought about by hallucinatory visions...Is Melissa a business partner in Therevox as well as your life partner? It sounds like you've been through a lot!

She is a big part of Therevox. I'm really engaged in the designing of the circuitry and she is able to see a larger picture and help out

with the aesthetics of the instrument. I'll design something and then take it to her as a second set of eyes. She's better at noticing things like the subtleties of colors, and the rhythm and the spacing of certain things, like how far knobs should be away from each other and how much whitespace things have around them. She's got a really good eye for design and she helps me see from a different perspective.

Why did you make the Therevox?

I was in an indie rock band in the early 2000s and I had a small theremin that I'd run through all my effects pedals and stuff. Once I wanted to play some melodies on it, I realized how hard it was, but also how amazing continuous pitch instruments were. From the unhinged theremin solo in "Whole Lotta Love," to the pedal-steel on Jason Molina's Magnolia Electric Co. that can just tear your heart out, to Jonny Greenwood and Radiohead, I really appreciate the emotion that can be conveyed when you're not limited to twelve predetermined pitches. That ability to slide

between notes, to bend notes, and get everything in between is really special. My friend Patrick McMaster in Montreal sends me rare recordings (of the ondes Martenot) to check out and I'm always amazed that the instrument can sit so well with a traditional orchestra or hold its own in a totally wild experimental piece. I wanted to design something that did that, but had reference keys on it so you could actually point to the pitch. The first prototype that I made used string from some window blinds going right across a hand drawn keyboard with a rubber washer from a garden hose as the finger ring. I put that up on my personal website in 2001 and somebody emailed me and told me it looked like an Electro-Theremin (Ed. - also known as the Tannerin, after inventor Paul Tanner), and so I did a deep dive into that instrument. It's what was used in the Beach Boys "Good Vibrations," and was just an off-the-shelf oscillator with a frequency knob where you're sliding something that has a pointer on it, and you're lining that pointer up with the reference keyboard. In 2004, I made the first one that I actually called the

Therevox and after I put that online, people found it and ordered it. I made six of the ET-1s in 2005 and used the money to do the bicycle trip across Canada. When I came back from the trip I built a single ET-2 using a mechanical linkage to approximate an exponential pitch response, but shortly afterwards I switched to using an electronic exponential converter, so that model never went into production. I did the ET-3 before moving to New Zealand.

What made you want to move there?

When I met Melissa she had already planned to move there for a year and had a ticket and her work visa all lined up. I was like, "Well, I'm going to have to go with you." I'd finished the ET-3s days before we moved, the timing was really tight on that one. After that, I put a message on the Therevox website saying I was done making instruments. Then, when I was in New Zealand, somebody emailed me and said the instrument kind of looked like an ondes Martenot. I had no idea what an ondes Martenot was and so I did a deep dive into that and realized that that interface was better for controlling a continuous pitch

your finger exactly like you would on a guitar. So you get tactile feedback from the intensity key and the fingerboard, and I think that's super important for playing and connecting with a musical instrument. Later, I was sitting at my computer programmer desk job, still in New Zealand, and I got an email from somebody who's in the band The Besnard Lakes, up in Montreal, saying he wanted an instrument. I really love that band so we decided maybe we should move back to Windsor, Ontario and start the business again, basically because the Besnard Lakes were interested in a Therevox. We thought we'd make a prototype, see what they thought, and kind of go from there. That wound up being the ET-4.

You're now up to the ET-5, so how long was the ET-4 in production?

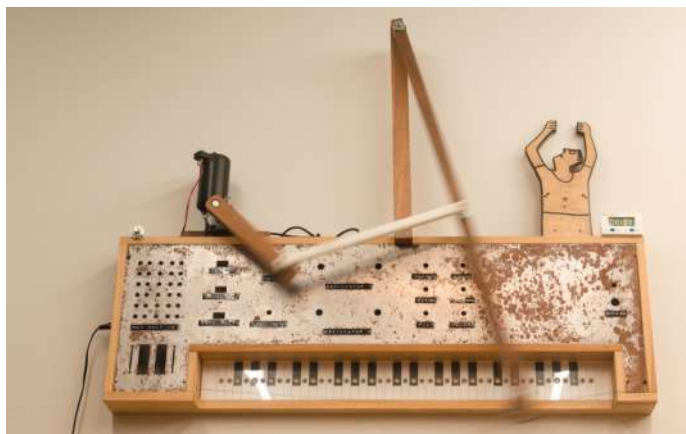
We did the ET-4 for seven years and then I started working on the prototype for the ET-5. That took about three years. It's funny, because the ET-5 looks almost exactly the same as the ET-4 but I first spent a lot of time redesigning the aesthetics for the ET-5. Totally different wood, totally different colors, different

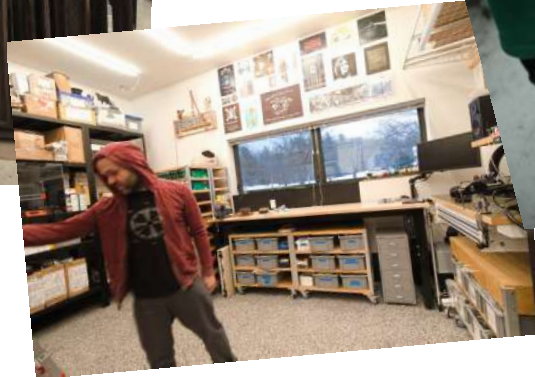


Am I happy with the sound of the oscillators? Do there need to be more waveforms? What filter topology sounds the best?

instrument, especially the amplitude part, because the Electro-Theremin was just a knob that you had to turn for amplitude and the ondes Martenot had a pressure-sensitive intensity key. The thing I love about the intensity key is that it actually moves up and down so you're not just pushing on something that doesn't move; there's muscle memory associated with how far down it goes, but then there's resistance that you get, so the farther down you get the harder it is to push down, and that's really important. You can play it just a little harder to get a bit more volume at any time. That sets it apart from other electronic instruments where it's just whatever volume it is at all times. Once I realized how Maurice Martenot solved these problems, I absolutely fell in love with the instrument. For pitch, you have a ring around your finger and you point to the notes on the reference keyboard that has divots and bumps, so the muscle memory is a lot easier; you just move a finger right to where you want it, land your finger in the divot and then you can get that natural vibrato by wiggling

fonts...a way different look. I got about a year into that and realized that redesigning the aesthetics wasn't the most important thing; it's the inside, the features of the instrument, and the playability and reliability. I was happy with the aesthetic and ergonomics of the ET-4, but everything inside needed to change. I breadboarded every single circuit from scratch. Am I happy with the sound of the oscillators? Do there need to be more waveforms? What filter topology sounds the best? With the ET-4 it was just taking my favorite circuits and putting them all together, and that became the instrument. With the ET-5 I knew that I already had a concise instrument, and it was about designing things that worked together as well as possible. Also, I wanted the ring to feel a lot smoother and in a way that wouldn't move out of alignment with notes. I wanted to use a small string to reduce friction, and you have to design it so that it won't slip so that somebody can play it as aggressively as possible. So that was a complete redesign, and we built a testing robot using a salvaged motor from a car seat. I took an old ET-5 prototype and attached it to the robot and that swung the ring back and forth. I left it on 24 hours a day, seven days a week. It stressed the whole system: the string, the bearings, the potentiometer—everything inside. I wanted to run this stress robot in the shop and see if it came to a point where anything failed. I was worried about the string itself, like what happens if the string rubs against something back and forth a million times? We did the same thing with the intensity keys, and took the same approach with the circuits, the patch panel, the jacks...I didn't want to make something and then find out that all of those new (design elements) only last six months or one year, that there's a problem down the line. The ondes Martenot has a reputation of being a fragile and delicate instrument—there are stories of people trying to fix the instrument hours before going on stage for a big







production. I wanted the Therevox to come with the nuance of how you play it, but not with the fragility. It was one thing when we were making a few, but when we started to get customers that were using them on tour night after night...Somebody's packing this thing, throwing it in a road case, tossing in the back of a truck and going to the next venue, and they're doing that for months at a time and then flying to Europe and doing the same thing there.

There's nothing worse than scrambling to fix some piece of equipment right before a show. How did your testing robot do? How long did you end up running it?

That robot ran in the shop continuously for the better part of a year—over thirty million complete back and forth cycles—testing all of the internal mechanisms for the ring. I was also running a different robot testing three different string materials for abrasion resistance. We finally settled on a string that's the same material that NASA uses in parachutes for reentry, some really high-tech, synthetic stuff. My friend saw the robots tucked away in the shop and was fascinated by them, so I ended up hanging them prominently on the shop walls as kinetic art sculptures.

What changed because of the testing?

We had one bearing that became squeaky so we went back to the bearing manufacturer and made sure that they put the adequate grease in all the bearings. We've done some other fun testing, too. Once we got our custom shipping boxes made, we packaged the instrument every way that we could think of to try to find out what the weak spot might be either in the packaging or the design of the instrument itself, and then drove around in our Subaru. Melissa drove and I would kick the box with the instrument in it out the back and watch it tumble. We'd then open it up, take it apart, and do a bit of an autopsy to see if anything broke or came loose.

That sounds kind of fun. You mentioned the three years of development between the ET-4 and the ET-5. What did you wind up changing in the circuit that made it into the ET-5?

When we were at Knobcon in 2018, some people playing the instrument were wondering what the fingerboard did. On the ET-4, it's just there for tactile reference, but on the ET-5 we made it pressure sensitive and added a new duophonic mode where the second oscillator's pitch can be controlled by pushing down on the keyboard. We also took the old filter and started from scratch, trying pretty much every filter topology. We ended up using a three-pole resonant filter and I absolutely love the sound of it. I also came up with a saturation circuit to kind of emulate how a vacuum tube guitar amp works, so it's not just an overdrive that is overdriving the signal at all times, it only distorts if you play loudly into it above a certain threshold.



If you play harder into a tube amp, it's going to start to distort, but there are other instruments, like string instruments, where if you just dig into it harder the resulting waveform has a different shape to it.

How did you pull that off? Is there a VCA going into the saturation circuit to kind of control the intensity of that?

Yeah, exactly. We also added two controls underneath the left side whose function is defined through the new patch panel, so the user can decide what these two controls should do. Adding the patch panel meant that people could get creative with signal flow or control assignments, but it also meant that all of the circuits inside the ET-5 had to have voltage control, so that was also part of the redesign. We even redesigned the spring reverb so it sounded fuller. Sometimes I play the ET-5 where the signal is 100% wet so you're only hearing what comes through the reverb tank and I wanted all of the bass and as much



The model seven was when they went to transistors, and I've played a few of those before but I'd never played the vacuum tube version. So me, Patrick McMaster and Daniel Áñez—two friends from the Synthesizer Society of Montreal—went to admire this instrument and we also had the chance to play it. The week after, I messaged Jean and asked if I could show up with my oscilloscope and some test equipment to take some measurements. It was a once in a lifetime opportunity to play this instrument that might be the only perfectly working version of it that isn't behind glass in a museum.

What do you think about playing it?

It felt familiar, but I was also nervous playing a priceless instrument. With the ET-4 and ET-5 I made sure the spacing between every note was the exact same as the original ondes Martenot, so the scale length was exactly the same. We did a lot of research on exactly how the intensity keys feel on the ET-5 to get that to be similar to the ondes

I would kick the box with the instrument in it out the back and watch it tumble.

as the treble as possible coming through. We also added a feature that alters the filter's frequency cutoff depending on where the ring is, so the filter opens up as the pitches get higher—or does the opposite—so the low notes are really bright and the high notes are really mellow. That's exactly how the tube ondes Martenot sounded, you'd see the timbre change in relation to pitch.

So it's basically like keyboard tracking... I guess you'd call that ring tracking! You talked about how digging into a tube amp is when a signal can start to distort and I know that working tube models of the ondes Martenot are hard to come by. Have you ever played one to see if it reacts this way?

Yes, my friend Jean Landry lives about an hour from here and I met him when I was designing the Ondes VCO, our Eurorack module. He used to be a repair tech in Montreal, keeping the ondes Martenots at the Conservatoire in running order. They had four or five of them and a few stopped working so he reversed engineered the ondes Martenot and developed new drop-in replacement circuit boards for them because the parts that blew up are no longer made, and you can't get them anymore. He's a really knowledgeable guy and he was one of the reasons Melissa and I moved to Quebec. We came up here and he showed us around the area and we loved it, so the idea of moving somewhere and knowing somebody close by made moving much easier. A while back he emailed me about a woman who was selling an original vacuum tube ondes Martenot, the model six.

Martenot as well, so that also felt really familiar. The strangest thing was that I'm used to playing the ET-5, which has two oscillators and two intensity keys, so I'm always doing something that requires both oscillators; either one oscillator is a drone note, they're complementary in pitch, or they're different timbres and I'm switching between them. But the ondes is just a single oscillator and one intensity key so it felt limited. Still, it felt totally smooth and the tone was magnificent. It was a real privilege.

What kind of information were you able to gather from your testing to help you with the Therevox?

I wanted to see what the waveforms coming out of it looked like, and they actually change in relation to amplitude. I think that's because the output section is also a tube amplifier so as your volumes are getting louder, you're saturating these waveforms and they're changing, compressing, and other harmonics are coming up. You get this tone that changes in proportion to amplitude, but also in proportion to pitch. Even though it's set to the same setting, as you go up or down in pitch, new harmonics show up, which was something we added to the ET-5 with the saturation circuit.

There's so much that you're talking about in designing the Therevox, from circuit design, to communicating with parts manufacturers, to the aesthetic considerations, not to mention the actual manufacturing of the instrument, building robots to test it... that's a lot of skill sets you need to inhabit.

You've been making these for around twenty years now—which seems incredible, and constantly refining the design along the way. What was the circuitry of the early models like when you first started out?

The first Therevox's circuit board was about one and a half inches by one and a half inches with a single chip on it. It was right off the datasheet, but it did just what it needed to do. It was hand-wired on perfboard. This was way before I learned how to design circuit boards. One of the things I like doing when I'm designing is to (gather) all of the options possible, and to choose the best one. So something like a potentiometer, I order every single one available, design a process to test it, and choose the best one. We use a one hundred dollar potentiometer that's specced for as many rotations as possible and we've never had one of those fail. It's been like this even when we're designing the aesthetics. What is it going to be made out of? Show me all of the available woods, show me every knob...I have a box full of every knob that every manufacturer makes...hundreds of knobs.

What were some of the early challenges with building this instrument when you started? What was your engineering level?

In the early instruments like the ET-1, the hardest thing was getting the note spacing to be completely even. You need an exponential conversion from your control voltage to match the exponential nature of musical instrument pitches. That wasn't something that was known to me back then. Some guy heard that I was building these instruments and left a few books at my house. It was all the printouts of the *Electronotes* series, which I

I'm always hesitant to get somebody else to do something because I want to be the person that's building these instruments; I love doing it.

had never heard of before, and also a copy of Horowitz and Hill's, *The Art of Electronics*. I didn't realize that those were such huge missing pieces that I needed. I'd always loved synthesizers, but I never thought what I was building was a synthesizer, I thought it was just an electronic instrument. Delving into all of those printouts were solutions to all of the problems I was facing with the Therevox—they had all been solved before. That was one of those weird moments where somebody just came out of the woodwork and gave me something that helped me for twenty years onward. I don't know how long it would have taken me to find those resources or to think I even needed those on my own. I wish I could remember this person's name because he definitely changed my life with those books.

It's all out there, it's just having the exposure. Were there any circuits, or any features that were hard or tricky to develop?

Getting the response curve of the intensity keys to feel natural. You've pushed the key 50% down and you've also used 50% of your force to push it down—that's a physical thing. There's also circuitry for the response curve of that, a curve that's neither linear nor exponential, sort of in-between in certain sections.

That took a long time to get working to where it felt transparent, where you didn't even think about it. And then to put a spring reverb unit inside of an instrument with all of the interference and everything as well, that's always a little tricky to do. We ordered reverb tanks from every known manufacturer, inspected them for build quality, banged them around...

In terms of design, I totally understand most of the design elements, they make sense to me, but how did you figure out how you wanted the velocity keys to work? I would think that'd be hard to get right.

Yeah, the original ondes Martenot had a leather bag with some powder inside and as you push those two things together there's an anode and a cathode that get closer and the powder becomes conductive. There was also a cork in the powder for some squishing. It's a whole complicated thing and each musician had their own special recipe of what should be in this bag because some of them preferred it to be looser and some of them preferred it to be tauter, and also, they wore down over time so their characteristics would change over time as well.

That is as archaic sounding as it gets. It might as well have some mice in there turning a wheel or something.

I'm a pretty avid researcher on the ondes Martenot, and I have volumes of translated books and translated academic papers that were done in French and I've done research on the exact displacement and force required for that. With the ET-5 I had the ondes Martenot specifications in mind, but I tweaked it to see what felt the best. The process of doing that, to adjust every

parameter and make notes on what feels good and what doesn't feel good, informs the physical design of it, and that's informing the electronics as well.

What you're describing, I would think to design it like some kind of key, where you'd have a hinge at the top, and you'd have spring that would give physical resistance, but I understand that a spring's resistance might remain too constant for the level of precision and control that you might want. I would never think of using a bag filled with powder.

Ok, but how long is that key from the hinge? That dictates the angle that it bends down. How stiff is that hinge? Is that hinge wanting to return itself to its original position? And how fast does it want to do that? Is there damping, like does it return quietly? And where does the physical resistance come from when you push it down?

There are so many considerations for every feature, every aspect of the design for an instrument like this. You talked about using wood for the enclosures. Was woodworking another skill that you had to learn, or did you have experience with it beforehand?

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I had some experience before, building things like desks and speaker cabinets. The ET-3s were made out of wood that just came from a big box store, but once the business became my full time job we started doing prototypes where we were staining this cheap wood so it would look like walnut. But there's a truth to the instrument... Melissa wanted to know what was stopping us from using real walnut? It's not much more expensive when you buy nice hardwood from a sawmill, and that's when it comes almost right out of the tree. But it's wavy, it's not guaranteed to be straight, and it's in no particular dimension, so the problem is that you then have to turn it into a perfectly dimensioned board. I didn't know how to do that at the time, and I didn't know what tools were involved, but a friend took me to his shop and ran through the whole process and showed me how to do it. With woodworking you need your own tools, and you need to learn how to fix and adjust them so they're accurate to get them to work properly. I started with a lot of vintage machinery, so those tools all needed to be cleaned and restored before I could even use them. So there are three or four levels of learning until you're actually ready to turn a board into a properly dimensioned piece of wood. When I do it, I'm doing wood for an entire batch of instruments that I'm going to do for that next year or a year and a half, so I'm just in woodworking mode for three months. You put some music on and then you get to use all these tools that you know that you've adjusted to run as smoothly as possible. I love that part.

I saw that you guys have special cases for the Therevox. Did you design those as well? Did you throw them out of the back of the Subaru, too, for testing? (laughs)

With the ET-4 we designed a case that was

a really nice, aluminum, tweed and wood, and I was making those myself. That was a really hard process, a lot of cutting, gluing, and riveting, and it got to the point where, since I was making these cases, I was cutting into time I could be making the instruments. I'm always hesitant to get somebody else to do something because I want to be the person that's building these instruments; I love doing it. But I didn't love building cases, so for the ET-5 we found some people in Quebec that could build a case to our specifications, because we're pretty picky about every little detail.

I'm noticing a certain thoroughness of thought and processes here. (laughs)

I might come across as somebody that does a good amount of planning, and maybe I do with the Therevox, but with other stuff in life...we go somewhere and I don't even know where we're staying. But Melissa, she's one of those...she's a spreadsheet person. If we go on a trip, she's got a spreadsheet that's got the details of our flights, lists of all the cool things that we can do in certain areas...She runs a hospital laboratory in Vermont, and she brings that lab tech attention to detail. It's something that I try to aspire to when I'm in my electronics laboratory. I try to treat it the same way that she might in her medical lab.

I know you mainly build these by yourself. When you do a new batch of instruments do you have an order, steps that you go through? Do you ever look at it like, "Here is the next year and a half of my life all lined up in synth building steps!" Sometimes I find planning in that way absolutely necessary, and other times a bit hard to stomach.

I would have thought by now I'd have this giant checklist for starting a batch with exactly what I need to do in order, and then I'd just go about doing it in that exact order, but there are only some things that need to be done in a certain order. There are a lot of days where I can just say, "Today I want to solder." If I'm getting into a real groove with soldering, then I might be soldering for the next three weeks until I want to go do something else. With the woodworking, the whole shop turns into a woodshop so once that gets started that just keeps going all the way to the finishing

of the instruments. But that actual task, I can slot into whenever I actually feel like it. And then there are some days where I'm just not feeling it. I don't give myself scheduled weekends, so I'll work until I can. That might be eight days in a row, but it might just be one day because I don't feel like it, I just want to go mountain biking because it's gorgeous outside.

You could take some time off and ride across Canada again, but from east to west! You said that you recently relocated to just outside of Montreal. Was it difficult to move the business?

The space is about half the size of what the old shop was, so it took a lot of drawing everything out on the computer and digitally moving every piece of equipment around until we got to a layout that worked in the small space. My last shop was an old welding shop that was abandoned when we got it so there were big puddles of water on the ground. That space was how I learned to do electrical, how to put up lights, and how to put in walls.

How did you learn to do all of that?

I ran a business for six years repairing tube amps and somebody brought me an Ampeg bass amp, which had caught on fire. It was like a 300 watt amp and had six huge tubes in it. This was when I had just got the first shop and I still needed to learn how to do the electrical work, and he was an electrician so I told him, "I'm going to try to fix your bass amp, which has been burnt to a crisp, if you teach me how to do electrical in the shop." So he showed me how to wire a panel, and lights and stuff, and I ended up diving into this amplifier where I had to replace every trace on the circuit board that was burnt off with hand bent wire to get it to work again.

That's a lot of serendipity. What were you repairing for that business?

It was mostly vacuum tube guitar amps, but once you're known as the guy that repairs things, people are coming to you with pedals, keyboards, synthesizers... Every one is a cool learning experience so you don't want to say no to them, and you end up digging into almost anything people bring you. You learn a lot by taking things apart and also seeing how a lot of things fail. That's why I loved running the

repair business. Everything was coming to me and I could see what the designers could have done better.

I saw that your new shop is near an apple orchard, a river and a bike trail.

Yeah, we're pretty lucky. There's some mountain bike trails just on the other side of the border in Vermont so I've been checking those out. All around this area of Quebec, almost all the roads are dirt or gravel roads, and I've been really enjoying those on my bicycle.

I'm a bit of an apple fiend, specifically local and hard to find or older non-grocery store varieties. How are the apples in the orchard near you?

There are seven apple trees behind the shop and every time I walk by I pluck an apple and eat it as I walk. It's so satisfying to do. They might not even be good apples, but in that moment they're amazing.

It's so much more than just the apple. The experience of connecting to the land from the ground up...It's an interesting parallel, picking an apple and eating it from your own backyard, to your process of building a new Therevox almost all by yourself, a lot of it from the ground up.

There's definitely something to it. I don't even know how to describe it, but it's probably baked into our primitive brain to do something like that, to pick a fruit right from a tree and then eat it. But so is making things out of wood. And so is making music, right?

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Symmetry is very appealing to me, and for several modules I've made, there are two channels, so starting with symmetry as the

core of the UI/UX design seems right. Then it's a matter of deliberately moving things out of symmetry that make sense to be that way. But even if the module is not a dual-channel thing, there are still symmetry planes that can be drawn between it and an adjacent module, for example. I'm trying to think about the flow of connecting these things together and the convenience of getting to the patch points that will get used a lot.

Is there anything special about your aesthetic, specifically the yellow knobs?

For me, it's always been about laying out functions so that they are logical, aesthetically pleasing, and so that there's enough room to use the module. I'm a really big fan of classic designs from the 50s, 60s, and 70s, and think that plays into the way I design things. There are a lot of timeless design cues which can be found by looking back at mid-century houses, furniture, and electronics. I like the idea of things lasting and being timeless. We live in such a throw-away culture that I like to try and fight against that by making modules that I hope people will use and enjoy for many decades. As far as knob colors, there is a very general grouping scheme where groups like an oscillator's fine and coarse knob get gray knobs, and the FM or CV attenuators are yellow. The actual color choices come from a simple kind of design school where you choose a base scheme and one accent color, and this can apply when designing a webpage, for example, but it also works for physical products. In my case, black and light gray are the base, and yellow is the accent color and that becomes the palette that constrains the design and ties the look and feel of the product line together.

What is the manufacturing of your modules like? Is it all done in-house?

Right now I'm still bringing in populated PCBs and doing hand assembly and calibration in my little shop behind our house. I'm getting to the point where I need more shelves and space to keep all the parts I have to buy in bulk. I'm also getting to a point where I would like to have more time for new module R&D rather than building products, so this is something I'll have to eventually figure out, but for now it's working OK. I did start training my

wife, Christen, how to solder properly so that she can help me do a larger run of modules if need be.

What is your process for a new module? What's your criteria?

If it's something that interests me and I think has some unique differences from something that's already on the market and could be useful, then I'll try and make it. Sometimes it hits better than others. With SE1, my all-analog envelope with sliders, I kind of stepped back and took a fundamental thing and started messing with the envelope. I wanted to do CV control and be able to change the shape for the attack, decay, and release independently, taking something that exists, and packaging it in my own way and adding something a little different than what's already out there...It's very hard to come up with anything 100% new. It's like music: There are no more original ideas, right? There's only twelve notes.

At least for a Western music scale. That's kind of a depressing thought, in a way. How do you not get bogged down by it? How do you fight through it to still try and bring originality into something you think is already played out, that's been done many times before?

You're rehashing something at some point, but that's okay. It's a circle. Something even slightly new is still new...

What do you think about that idea in terms of drumming? Do you feel like your mindset in that way has changed as you play drums longer? I used to look at bands and musical artists—artists in general—and I would try to glean something that I could use for my own music or art. I don't really do that anymore and I don't know how I feel about that change. Have I grown into myself? Am I jaded? Less passionate? I don't know.

I totally agree with you. In my experience that becomes less important and you get a more holistic view of things. Just because you put a new pedal in your rig or put on new strings really doesn't matter to the overall effect, it's the music that's being created. All of those things have changed over the years, and the same with making modules too. Sometimes I see a new