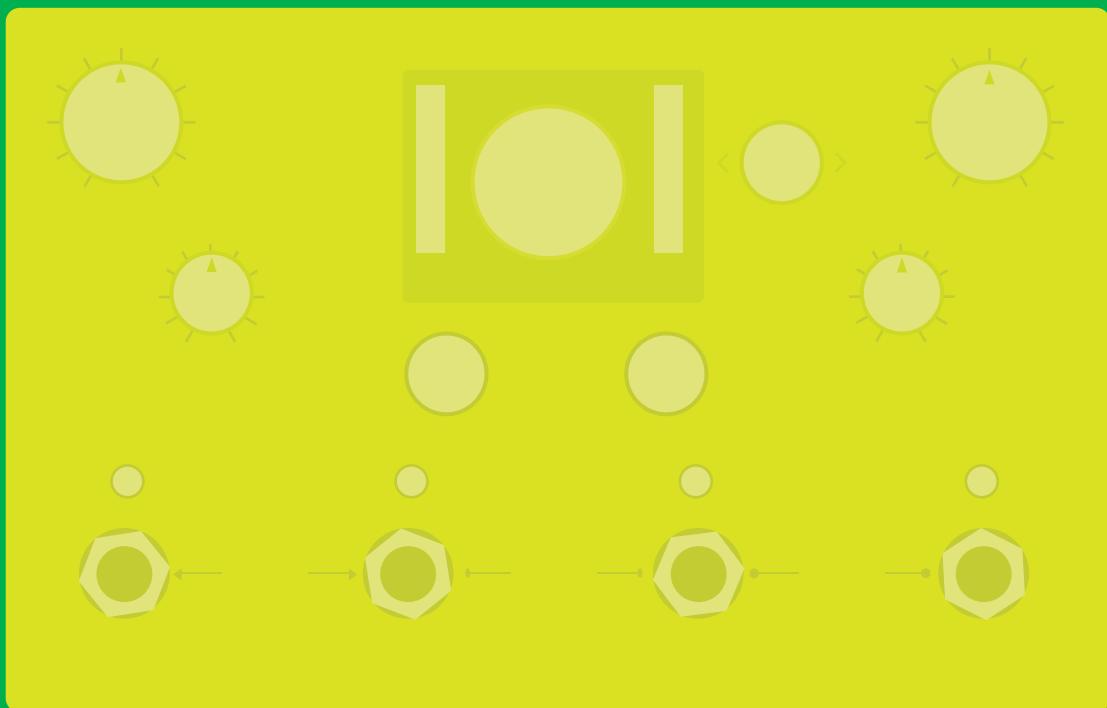


ISSUE 15

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Art Direction/Layout - ELLISON WOLF, EM MASLICH

Circulation/Customer Support - BARBARA JONES-FARADAY

Music Editor - TOM OJENDYK

Shipping and Logistics - EVAN MORROW

Contributing Writers - DAVID BATTINO, EM MASLICH, JASON CZERYK, EVAN MORROW, IAN RAPP, WILLIAM STOKES,
TOM OJENDYK, ALEX VITTM, GRAIG MARKEL, ROBIN RIMBAUD

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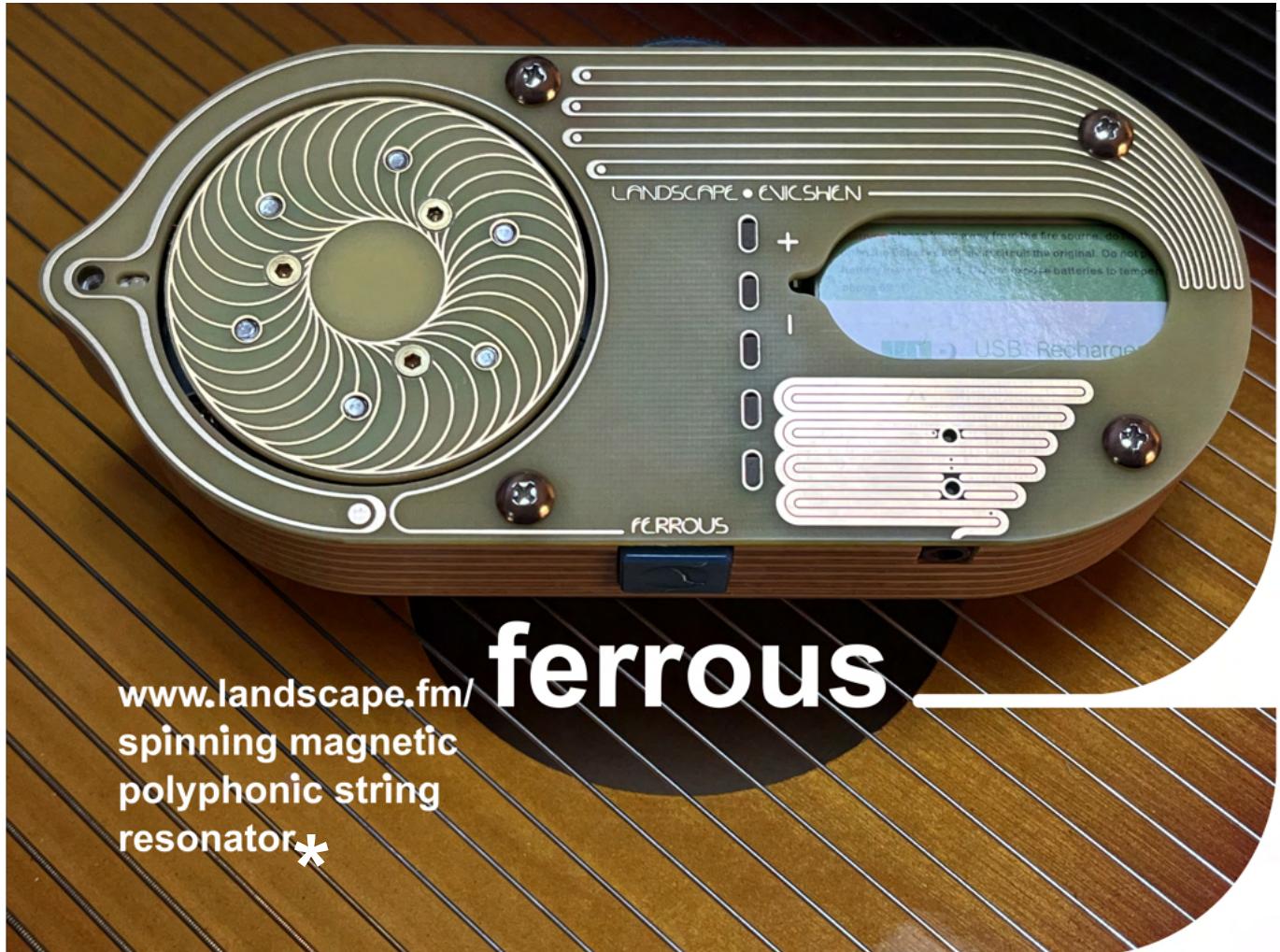
SEATTLE, WA 98119 USA

contact@waveformmagazine.com

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CONTRIBUTORS

DAVID BATTINO'S DIY approach to music began at the Oberlin Conservatory in the days of quadraphonic tape loops. He's the founding editor of *Music & Computers* magazine and co-author of *The Art of Digital Music*. Find him at batmosphere.com

EM MASLICH is an editor, artist, and musician. She plays modified Fender Rhodes, drums, synths, and sings in the band Le Secrétaire. Her artwork explores temporality and impermanence, with a focus on botanical inks and pigments in printmaking and collage. lesecretaire.bandcamp.com/music

JASON CZERYK is an avid synth collector, player, and builder. He designs psychedelic beverage coasters, binge watches "How-To" car repair videos, and does indoor Parkour to stay in shape. He lives near Atlanta with his wife, kids, and his beloved Blue Healer, Sharkskin.

ALEX VITTM is a composer, electronic musician, and drummer. He's worked with Don Buchla, Paul Dresher Ensemble, and Keith McMillan in a multitude of roles ranging from hardware development to product demonstration. He creates ambient music under the name Intervales. alexvittum.com

IAN RAPP likes hiking up Tuckerman's Ravine with his Husky, Sandor, and cooking with fennel. He is a graphic designer and music maker and composes under the name No Reliable Maps.

ELLISON WOLF is into music, words, foraging, cold water swimming, and making pottery. He aspires to be a minimalist.

TOM OJENDYK likes music. He is co-owner of the Seattle, Washington record shop Hex Enduction, and also owns the record label Dirty Knobby. discogs.com/seller/HexEnductionRecords/dirtyknobby.com

EVAN MORROW got his pilot's license before he was twenty five and took up fly fishing right after. His first synth was a Realistic Moog that an ex-girlfriend left behind when they broke up, and he still has it. He's currently trying to combine two of his top hobbies; RC planes and modular, by building a modular that flies. It's proving to be more difficult than he initially thought.

WILLIAM STOKES is a writer and musician in the three-piece avant-psych band Voka Gentle. He's written on music and music technology for *The Guardian*, *Sound On Sound*, *The Financial Times* and more. You can find his music at vokagentle.com

ROBIN RIMBAUD (Scanner) is a composer and artist, whose work traverses the experimental terrain between sound, space and image. His work connects a bewilderingly diverse array of genres from design to architecture, contemporary dance to film. More at scannerdot.com

Graig Markel is a multi-instrumentalist, producer, and electronic instrument designer in Seattle, Washington. He owns and operates Recovery Effects and Devices, the Recovery Room recording studio, and records music under the moniker The Animals at Night. His music can be found at theanimalsatnight.com and his instruments at recoveryeffects.com.





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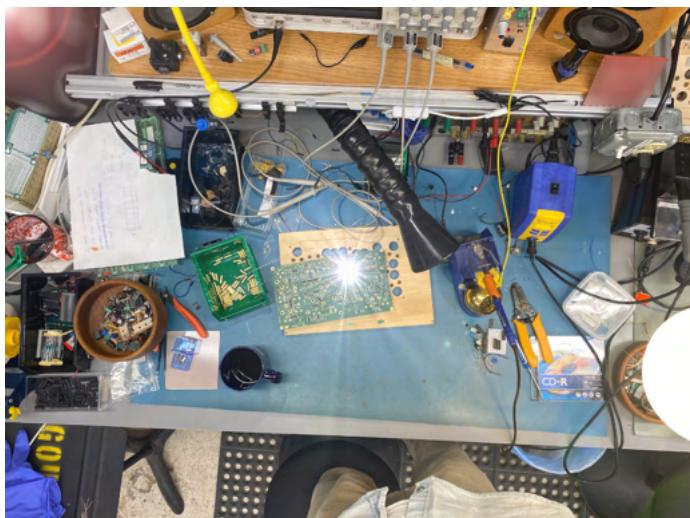




Lorre Mill

Finding complexities in the simple or small is an art all to itself. Think Agnes Martin, with her meditative line work, or Edward Wilson and his study of ants, or even Greg Maddux, the Hall of Fame baseball pitcher, who had average speed but impeccable placement. Sometimes, as in the case of Wilson, it's finding a space where you can explore subtle movement and find hidden patterns. Sometimes, like Maddux, it's figuring out a way outside of your physical limitations to dominate. Other times, like Martin, it's just following a line of passion to see where it leads you.

Lorre Mill's Will Schorre follows that sort of line. Based in Maryland, Schorre makes instruments with intentionality in mind in order to find complexity in simple systems, to have access to a circuit all the way down to the chip pins, to be involved in every aspect of building. It takes dedication to find the deeper meanings and big possibilities in things that seem so simple, to dive deep, to create beauty, and to find interesting systems within.



Waveform: You're from Texas, but you live in Baltimore. How did you find your way there?

Lorre Mill: I went to art school here. I have family that lives nearby, and I had been to this area to visit them, and my older sister was going to school here. Moving from the place where you grew up is kind of a jarring thing no matter what, but it felt like a pretty easy transition, all things considered. I immediately started making friends and seeing the value of what was happening here. It's teeming with art and music. Baltimore's a really great place to have space and time to pursue things in the way you want to, and be around other people that are doing things in their own way, with their own art or music. It's a great place.

Something about highlighting the interactions between those simple elements and how much can come from that is an exciting thing for me.

Do you feel part of a community in Baltimore?

Yeah, definitely. There is a really strong experimental music community here, regular shows at the Red Room, and there's an annual multi-channel music series, Diffusion Festival, run by my friends Obie and Martin that I always look forward to. I definitely take a lot of inspiration from being around folks in the scene here. The kinds of spaces where shows happen has changed quite a bit since I've lived here, though. There used to be more warehouse spaces and DIY venues, but those spaces are largely gone or are no longer able to be used for events. Even with the spaces changing or going away, there's still a really great community.

What was the medium that you studied in school?

Technically, I studied sculpture, and I worked a lot in digital fabrication techniques. I was using computers, working with CNC machines and 3D printers...that kind of stuff.

What did you think you'd do with an art degree? Did you have any ideas when you started?

That's the whole thing when you go to art school; it's like, "What am I going to do (for a living)?" Maybe if you go into a situation expecting that you're not going to be able to get a job, you overcompensate and figure out how to make something work.

Were you creative growing up?

I was always really interested in art; I just loved drawing and it was encouraged by my folks. They're in the arts, both architects, so there's art in the family. My grandparents were both creative people, too. My grandfather was a photographer and my grandmother made paintings and wood carvings. My great uncle Charles was a painter, and I grew up in his former studio/house with my family. I think being in that studio space was really inspiring to me as a teen.

When did you start playing music?

I played bass for some years in a garage band kind of thing. At some point, I was playing around with synths on the computer and got into building circuits. I was interested in music and was playing with stuff like free software or Reason. A friend of mine got a Future Retro XS which got me into the idea of hardware, realizing that there was a whole history of electronic music outside of the computer.

When you were in art school were you thinking you wanted to be an instrument designer and start a company? When did you decide to start Lorre Mill?

Before I went to school for art, I was building some synth kits and I built a little modular system for myself. Then, when I was studying sculpture, I was still toying with building kits and studying schematics, and trying to learn as much as I could on

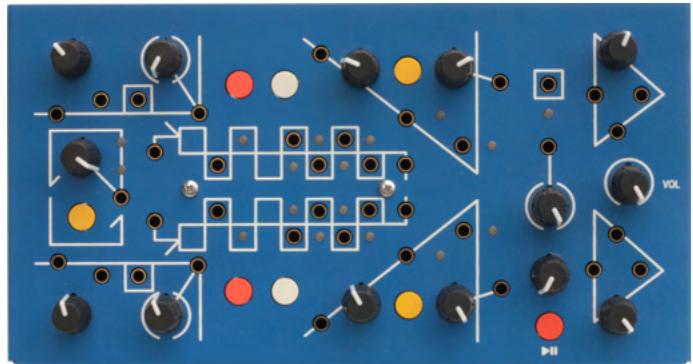
my own. Right around the time I was finishing art school, I was thinking about coming up with a design...I wanted to make something that I had imagined. I started trying to do that around 2015, and in 2017, I started selling the first version of the Double Knot. I put a video on YouTube, had a link to a PayPal button on my website and started from there.

What was the thought process? Did you go through a bunch of different ideas and incarnations to get to that first version?

Yeah, there were a lot of prototype boards, a bunch of iterations over the course of a couple of years. I was thinking about the simplest possible synth voice, of just an oscillator and a VCA, and the simplest possible envelope generator you could have, trying to make a system that would allow you to get more than you might expect out of such a simple voice. Then I added a simple shift register sequencer, and realized that if there were two of them, they could interact and work together.

Why the focus on it being simple? Why not put more features in it right from the start?

Photo Spread: Will Schorre at Rocks State Park, MD.
 Previous Page: Overhead shot of Schorre's desk.
 This page: Lorre Mill Double Knot.
 Page 12: Lorre Mill Float Glass.
 Page 13: Lorre Mill Comb Room.
 Page 14: Lorre Mill Keyed Mosstone.
 All photos provided by Lorre Mill



...if I'm going to use a library of code that does something, I want to know what's involved.

Something about highlighting the interactions between those simple elements and how much can come from that is an exciting thing for me. Something that's super simple on the face of it, but when you start working with it, you realize that there's this whole other relationship that these simple elements can have, this whole other sound.

I love the idea of really diving in with something simple and coming up with something complex. It forces you as a musician and artist to give a lot of thought to something, or even just spend the time experimenting. I love hearing about ways to use an instrument that the designer never thought of. It's a cool unexpected collaboration of sorts.

Right. I think limitations like that can be powerful. This simple tool set can hold so much if you're only faced with just that. Something I think about and appreciate is spending a lot of time with something and living with it, letting new things happen.

The first version of the Double Knot came out in 2017, and two years later, the second version was released. Now you're on the third version. Do you implement changes because of user feedback, or do you just see how you could kind of make it a little different or do component updates?

It was a mix of things that I heard from people who were using the Double Knot and just continuing to think about that simple system that you could get more out of, and wanting to try other things. Between version one and two, I added a few things, like inputs to the VCAs that are in the voice so you could patch it in different ways, and also made it a little wider.

From instrument to instrument, each Lorre Mill device has a different aesthetic, a different layout. Do you have an overall design philosophy that you adhere to?

I do feel like there's maybe a different sort of design program involved, a different direction. With the Double Knot, I was looking at it, trying to figure out a layout that made sense for all the components. I'm always trying to lay everything out from the inside out, starting with the inside of something and then working on it a little bit. Then I think about it from the other perspective, like, "How would this read? How could it make sense

if you're not thinking about the guts of something?" I go back and forth between coming at it from the inside, and then from the front panel, how it might be presented from the outside. But something like the shift register sequencer (on the Double Knot), that's a little bit of a Lunetta thing, bringing the chip out to the panel from inside the device, having it be a direct line to the face of it...it seemed like a satisfying thing, a through line.

To sort of play the chip?

Exactly. You're playing the chip, and it's very direct in that way.

Have you ever tried to design a synth this way and it came to be that the chip wasn't that interesting?

Absolutely. Some chips don't provide an especially interesting or useful function on their own and they need to be combined or built into a larger circuit. Also, sometimes it seems like a good idea to provide some control that makes sense or is convenient at the circuit level without adapting it specifically for human interaction, but often that kind of control is clunky and hard to get used to so it's too much to ask of the user.

I noticed you're not offering the Keyed Mosstone right now. Do you have a set production schedule? How do you handle that aspect of the business?

I worked on that design in 2018 and I was selling it for a while, and I came to a point where I was like, "Okay, do I reorder boards and continue manufacturing this, or should I discontinue it?" At the time, I wanted to focus on other things, and I also wanted to redesign it, so I stopped selling it. I'm working on redesigning it right now. I think it'll probably be pretty different.

The idea of a discontinued product changing form is interesting. You could make a new version or rename it, but the evolution of something, keeping the lineage, can be an important aspect in an instrument's statement, too.

Yeah, in respect to the Double Knot, it didn't make sense to call it something else, because those iterations are the same idea; I didn't change the layout, except for peripheral stuff. Iteration is a really interesting thing. Playing with what makes it through from one version to the next, and what gets left out.

What were some of the important things you learned in the two years between version 1 and 2 of the Double Knot?

I was learning so much as I went, and I also made some basic interface adjustments. For one thing, 5mm buttons are too small for something essential to the interface, 9mm should be the minimum diameter for a button you're going to be pressing all the time. I learned quite a bit about design for manufacturing as well. Working with customers has turned out to be pretty good and seamless, and I'm grateful for that.

Two of your instruments, Float Glass and Comb Room...do you think of those more as pedals or desktop devices?

Pretty much pedals; the only thing that's missing from them is a foot switch. With both of those, I was thinking a lot about making something that could act like an effects unit, but using them in feedback systems. Like what happens if you make certain points in a pedal available to patching? What would I want in a pedal if I'm using it with synths? What would be useful in a mostly end-of-chain idea? You're going to plug the output of your thing into this effect, but then maybe you can pull stuff from the effect and put it back into your synth, or take controls from your synth and have it effect this end-of-chain. It's been fun working with effects; I feel like it's a whole new layer of stuff.

Right, because you've been working on the voices for so long. Did you enjoy the process of working on the pedals?

Definitely. With the pedals, like the Comb Room circuit, I was thinking about how to lay it out, and came to the idea of not using a graphical or geometrical layout, and just doing everything with text. It's not a spatial layout where it's like, "this feeds into this"; you just get the words. I was drawing block diagrams and trying to figure out how to lay out the controls in a way that would mimic that—or not—and I ended up deciding to just do all words to see what that was like.

Do you feel that kind of lends itself more to random

You're not given graphical cues, you're just given the word cues. How are you going to use those?



experimentation, rather than if you see something in a linear fashion?

It's a different kind of suggestion as to its use. You're not given graphical cues, you're just given the word cues. How are you going to use those?

True, like how will one interpret the text cues? I like that the flow is open to interpretation, it's somewhat fluid. Have people commented on the fact that they look so different from your previous devices?

Not that I've known. If I post a video on YouTube, I'll read the comments, and if I get an email from somebody, I'll correspond with them, but I'm not on forums or anything.

I suppose if you don't frequent the forums, you just don't really know, unless you're told, or if somebody directly reaches out. I like direct communication with customers, where you can have a conversation instead of just comments back and forth. You can build a relationship that way on a basic human level.

Absolutely. If somebody feels strongly enough about something to email you, it feels really important. If somebody's in a chat room and says something, maybe offhand, that's just kind of like, "Oh, this is what I thought"; it's a different kind of thing. Then again, maybe the more gut reaction, saying something on a forum really clear and direct, might be the really true feedback; it's more casual. It's not like somebody felt so strongly about it that they needed to go write a direct email. It's kind of like listening in on friends talking about it.

You only have three things in your shop for sale right now: the two pedals and the Double Knot. Is that plenty to keep you busy on a daily basis? What do your days normally consist of?

I generally do a batch of a given product when I get a restock order from a dealer and build more than I need to have some in stock myself. In between building and testing orders, I'm

working on new designs and prototyping them. All of that does keep me pretty busy.

How do you see the future of Lorre Mill five, ten, fifteen years from now?

I think about that a lot. I think about what kind of growth I want for this project. This is kind of a business, right? But it's also kind of a craft. I have a relationship with it that's kind of this personal, creative output...a craft kind of thing. Sometimes I think about it that way, and sometimes I think about it like a business. If I think about it like a business, I'm like, "Well, I should try to grow in a certain kind of way." And if I think about it like a craft, I'm like, "It's okay to grow the depth of the craft while staying at a certain scale commercially." I go back and forth about those

different ways of thinking about what I'm doing, so what I aim for is a little of both. But I try not to rush, or think about it solely in a "must grow" kind of way.

So you don't feel any pressure to ramp up production, grow sales, or anything like that?

I do, but I want to be really sure about it. I don't feel immense pressure to release something new, and six months from then have another new release date or something like that. I'm trying to push things forward in terms of designing something and getting the ideas that I have closer to production, but I'm not planning things out in that way.

Do you have any new products in the pipeline?

I'm working in parallel on a bunch of things and I don't know what's going to happen first. I think there's probably another

To really have it set in your mind that, like, "Oh, that's not me," and then it is you. That transition is an amazing one.

pedal that is going to be put out this year sometime, and I'm working on the Mosstone iteration as well, but I don't know when that's going to happen.

There's a saying for business that if you're not growing, you're dying. I understand where it comes from and the logic behind it, but I also think that means that when your business can no longer increase the space it's taking up, then it's failing, and that seems dangerous and shortsighted. It's always seemed like a bad way to view a business, and maybe more of a fear that someone or something is going to come in when you're in a vulnerable position and take you out or take over your market share or something. It could just mean somebody with more money behind them, enough to wait you out, which is something that happens all the time with big businesses.

That mindset seems prevalent. I really feel like working in this kind of industry or this kind of space, it's possible to not think that way, and I like that. I want it to be possible, to occupy some space that's slow, steady growth. It's not for the sole purpose of growth, it's to feed the thing that's growing.

Slow and steady... You talked about taking time just to think about the Double Knot, and when you're describing thinking about a circuit like that, it sounds so luxurious to be able to just sit and ponder, to iterate, to daydream, and having both the time and headspace to do so.

Yes, it is luxurious, and I feel like it is kind of rarefied, too. I try to make time to think about things in that way because I want what I share to come from that kind of place. As much as I can, I balance the need to produce work with carefully developing new stuff. It's a particular kind of a privilege to do that, though there are trade-offs that make that possible.

What trade-offs come to mind?

Well, I'm not living in New York. (laughs) Maybe this is a little bit of a diversion from the topic that we're talking about, but in my mind, big cities like New York or LA can force a certain kind of growth. If you're in those places and you're in this kind of craft and doing this kind of work, there might be more of a prevalent mentality that has to do with pushing yourself to grow commercially. Hanging out in a small-to-medium-sized city with lower cost of living, I think can provide the possibility to work a little more methodically and think about some other things.

Saying that, and using the Double Knot as an example, do you see yourself years down the road, working on something like version seven of it, where it's just kind of small changes in increments? Or maybe version seven will be a full featured polyphonic synth with a keyboard, the opposite of what it started out as.

Possibly. I do feel like there's a certain point, though, where it's

like, all right, maybe do something else. Maybe it'll change, maybe the name of the device will change, and it will start fresh from that version, whatever kind of jumping off point. I think about the evolution happening in that way. I don't have a super clear long-term plan but I love doing this work. It's so satisfying to be making these things and sharing them with people. I want to keep doing it, so I'm going to keep figuring it out as I go.

Which part do you find the most satisfying, the building or the thinking and designing?

I like both. I really love conceptualizing and designing things, and I also like the process of figuring out how to make those concepts make sense in the context of a physical product.

Do you do everything yourself?

My friend Pat (Patamari) helps me solder and we do production stuff together. If there's a lot to do, I work with him, but I'm involved in the whole process and I like it all; it's really satisfying.



There are points though, where I could maybe use my time better by designing something, but I still do enjoy hand soldering, continuing to be involved in the production. I feel like it's an important input back into the design process. Being involved in the production, you know more about the full life cycle of a product, and that can feed back into the beginning stages.

What about shipping, customer service, emails...

Assembly, testing, packing...The whole thing. (laughs) I love it all.

At first you were CNC'ing the enclosures yourself out of various plastics, which seems to align with your sculpture background. Is that still the case?

I was doing all that myself for a while, working out of a makerspace, a shared shop space, and using the CNC there to do cuts and panels and stuff like that. Eventually I got my own small CNC machine and was doing it all on that, but it's a lot of work. I wasn't so tied to that way of working and needed to figure out a way to outsource that. I tried to figure out how to make a sheet metal case doing a textured powder coat that was similar to the textured plastic, so I figured out enough CAD to do that, and then started doing the aluminum stuff.

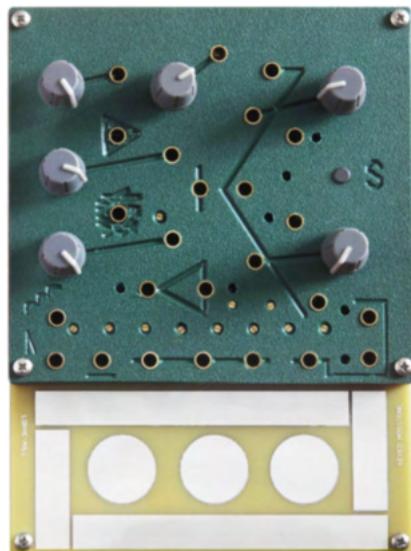
But now you outsource that? I imagine that frees up a lot of time to work on other aspects of Lorre Mill.

Yeah, it does. It changed my process quite a bit when I stopped making every single case myself.

I know you collaborated on the Spectrabloom. Is that the only collaboration you've done?

It's the only collaboration that's turned into a product. That was a really fun design where my friend Daniel Conrad had designed a version that was just three colored LEDs in a line, and you'd

It's not for the sole purpose of growth, it's to feed the thing that's growing.



plug it straight into the wall. I talked with him about wanting to do a take on that, change some things about it, and design an enclosure for it that was flattering to the idea.

How many of those did you end up making?

About 100. That's another one I'm working on redesigning, making

it more minimal and making it a little bit easier to produce. Not that they were so difficult to make, but it required quite a few custom parts, so maybe there's a way to make them more efficiently, make them with more standard parts, or fewer parts.

Design seems to be such a big part of your life, does it carry over anywhere else? Do you ever design furniture or anything?

It definitely is, but I'm not a design fetishist or anything. My interest in design doesn't carry through to where I have to only be surrounded by highly designed items or something like that. I mean, I would love to be surrounded by all Eames furniture (laughs), but it's just not the reality, and I'm not striving for that, though there's a middle road that I try to occupy. I like things that are well designed, but I think if a space as a whole has a feeling that is sort of natural, I think that's what I'm striving for: a space where not every single thing is a highly designed object. I am thinking about design in that sort of more macro sense, not about the verified design object.

Other than electronics building and music, do you have other interests that you pursue?

I skateboard a little bit, and I still draw sometimes.

I taught myself how to draw this past year and that was one of those things that I just thought you either knew how to do it or you didn't; you either had the talent or you didn't. I got a how-to book and after a few months, I was able to draw some things that I thought were pretty good. It really was just a matter of investing the time to do it and not much more than that. When you think you can't do something, and then you teach yourself and all of a sudden you can, it's pretty interesting.

Yeah, it's an amazing feeling. To really have it set in your mind that, like, "Oh, that's not me," and then it is you. That transition is amazing.

Demystifying something is powerful. I feel the same way about electronics. Forever, I just thought it was just this giant mystery.

Sometimes I think it is still a mystery, which I think is why I'm still involved in it. A lot of things can be like that.

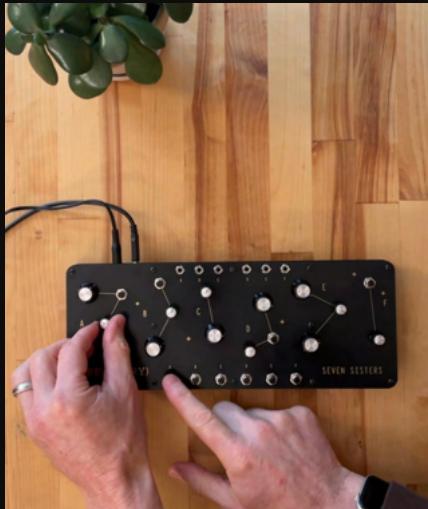
When you're talking about something like Lunetta chips, even though you can take a pin from a chip and output it, I'm still like, "Yeah, but what's inside the damn chip?" It's closer, but still a mystery.

The process of using electrons as a material that you can manipulate is just insane and amazing. It's invisible, which I think lends to that kind of mystery, an invisible thing that we can control. It's fascinating.

Are all of your devices analog?

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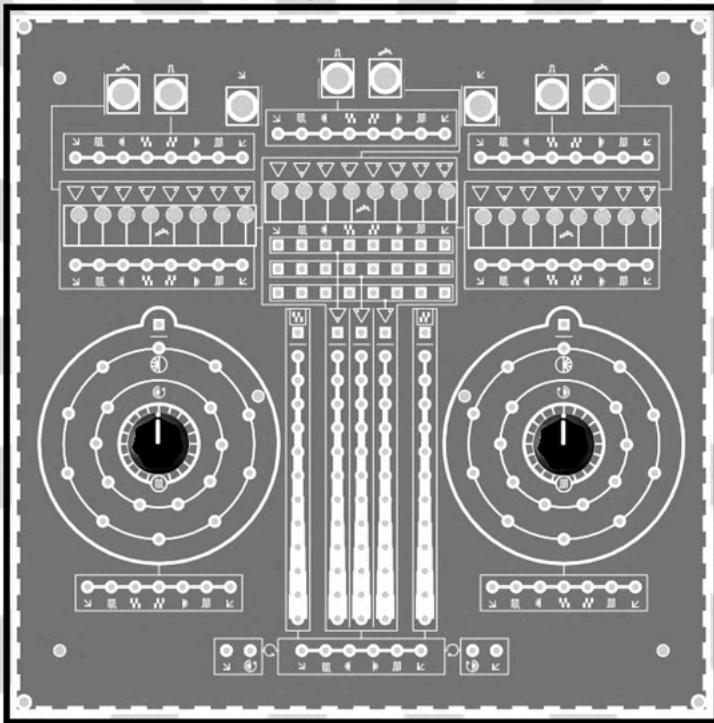
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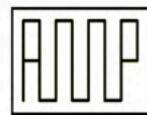
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So far, the only product that has a microcontroller in it is the Mosstone, to do the touch sensing. Everything else is CMOS chips and analog stuff. I've been working more with programming and thinking about digital electronics in a new way in the past several years, trying to build my knowledge about that to try to integrate into the designs. In learning more about digital electronics and programming, I feel like there's such a different kind of mindset in terms of interface design. Mostly what I have done is starting with these chips and letting the chips dictate what the design holds, and then from there what the interface is. When you're starting with a microcontroller, it's a completely different process, because the number of if/then bifurcations of what the design can be, is vastly more. It's interesting to encounter that and think about those differences and how all of that control and all of that possibility can be debilitating, too, in terms of the design process.

How do you deal with that?

The way I'm trying to approach working with microcontrollers is really starting at the lowest level possible, like still using eight bit chips and thinking about them as hardware and then interfacing with them in a similar way to logic chips with trying to get things out of them. I'm trying to approach microcontrollers in the same way that I have analog circuit topologies or CMOS chips. I don't know if that's a good way to go about it, but that's the way I've been doing it. I've been prototyping stuff and playing with circuits that are using microcontrollers for the past few years and the way I've been trying to solve that problem of having this really blank slate is by looking at different microcontrollers and weighing their different peripherals. I want to approach it in terms of low computational power—the most basic entry point into it—and see where that takes me. It's really low tech, and it's kind of behind, but I think because there are so many tools available, you can miss or skip over things in the process of moving toward everything being possible.

You seem to be persistent in working in a way that makes sense to you, using the technology how you want to, no matter the technology that's being used, no matter if that technology is being used to its full potential.

Part of learning about this stuff for me also has to do with really wanting to understand things wholeheartedly. I want to know what's going on. That can get in the way sometimes, and I'm not talking to a really extreme degree or anything, but if I'm going to use a library of code that does something, I want to know what's involved and I want to be able to appreciate the history of what I'm building on. Part of learning would be to try and write it myself, or at least investigate it enough to know that I shouldn't write it myself. I find delight in that.

I've done a little bit of coding, some really basic websites, from HTML to drag-and-drop types, and it's interesting because when I look at coding for a synth application and look at the line, I get it, or at least I think I do. But no matter if I understand it or not, I can still easily copy the code, put it in the program, and implement it. In a way, it's great, it's very democratic, but there's also this disappointment, because when you have an analog circuit, you have this certain amount

of energy that you're shaping and routing, and you have something physical that's resisting, holding, changing, or charging it or whatever, and it's going all the way through to the end. With code, it's just this man-made structure; there's not much natural about it, and something about that makes me feel a bit sad and disconnected.

It's arbitrary, is that what you mean? Somebody just decided this, and that's it.

Yes, exactly. HTML uses brackets. Why? Because some person decided to use brackets. It's disappointing to me. Natural laws, the laws of physics, don't determine how something is created in this context and for some reason this bugs me.

There is a certain point, though...I mean, we made the language of schematics. There is the base physics aspect, but there are all these layers between it, and which layer do you go to? For computers and digital electronics, there is still that base layer of electrons and switches doing all this stuff way down at the bottom, but what you're actually interfacing with is a language and a compiler, and that being the lowest level...you can get lower, but are you going to write assembly? Maybe, but that's still so many layers removed from the electronic aspects. That's something I think about quite a bit, how far down...there are layers of abstraction, and where are you going to position yourself along these layers? Thinking about drawing again, it's such a direct thing; there's zero abstraction there. That's it. There's a mark making tool and a surface. I like to think about using electronic devices that have fewer layers of abstraction, fewer things between you and what's happening, in their interface. Talking about using microcontrollers and working with digital electronics, those things are a little bit at odds, but trying to work with the way they are, and find compromises between those things, feels valuable, and is enjoyable.

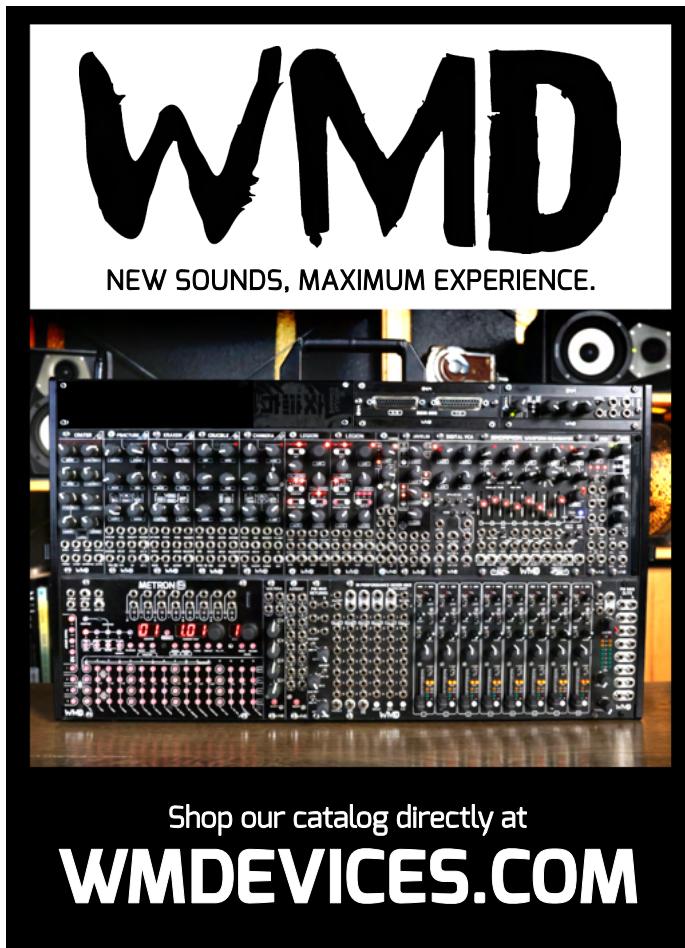
How did you feel when you first started experimenting with electronics?

Continually frustrated (laughs)... My synth making experience began with PCBs and kits from Music from Outer Space and Ken Stone. Also, learning about Serge was really inspiring, with the approach where different pieces of a system have multiple uses. I definitely thought that sort of approach and idea was elegant and beautiful.

Did you take any electronics at all in school? Is all your electronics self taught?

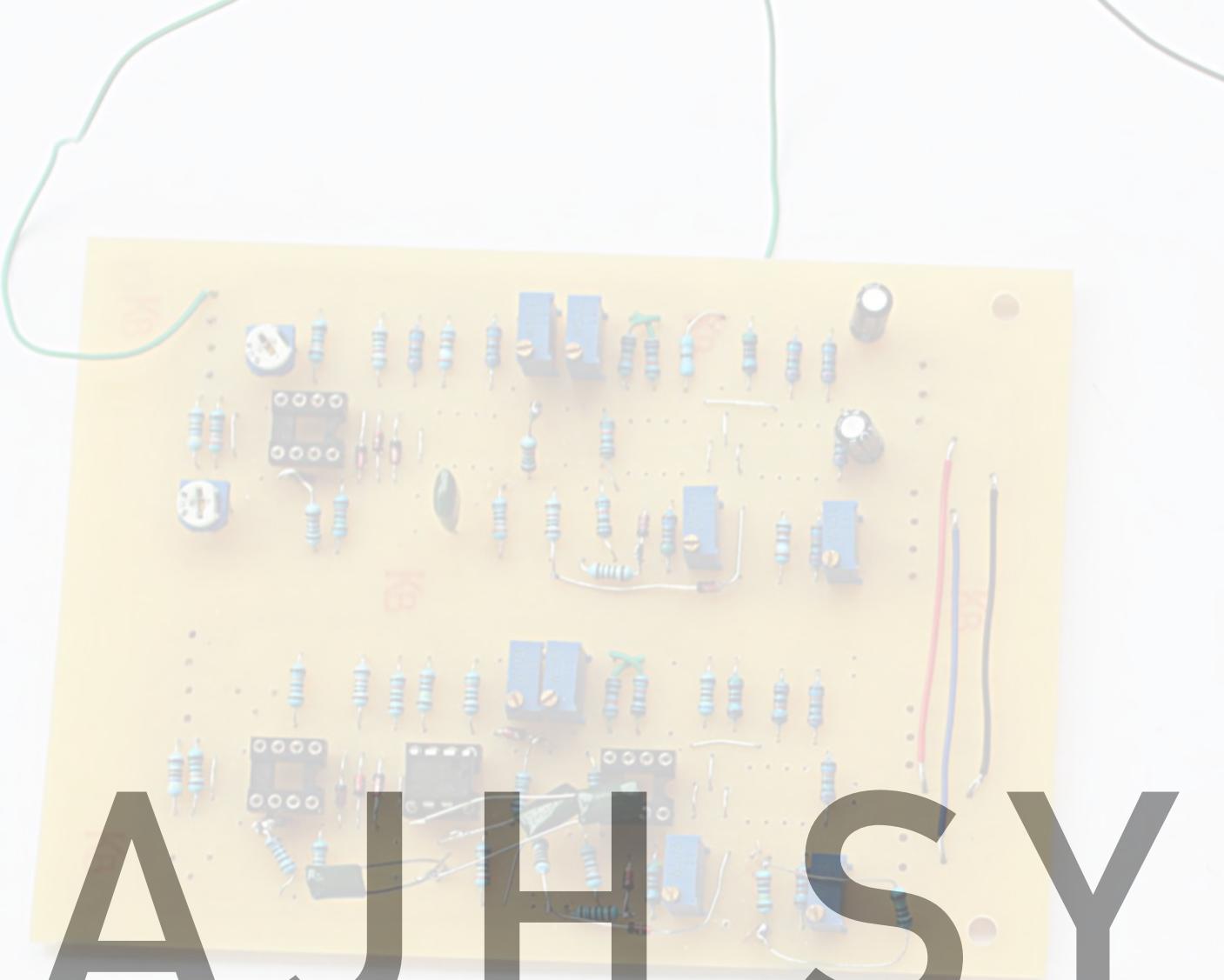
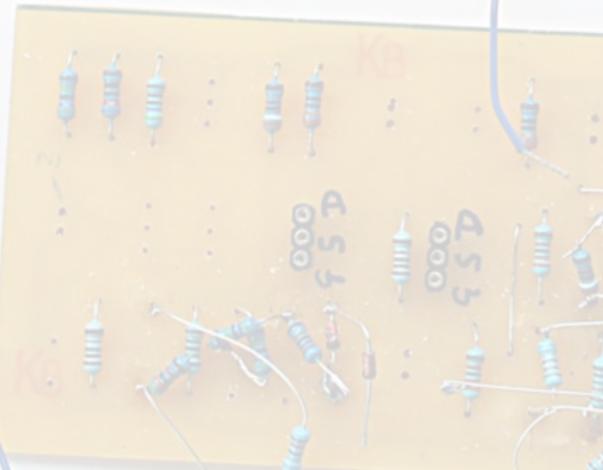
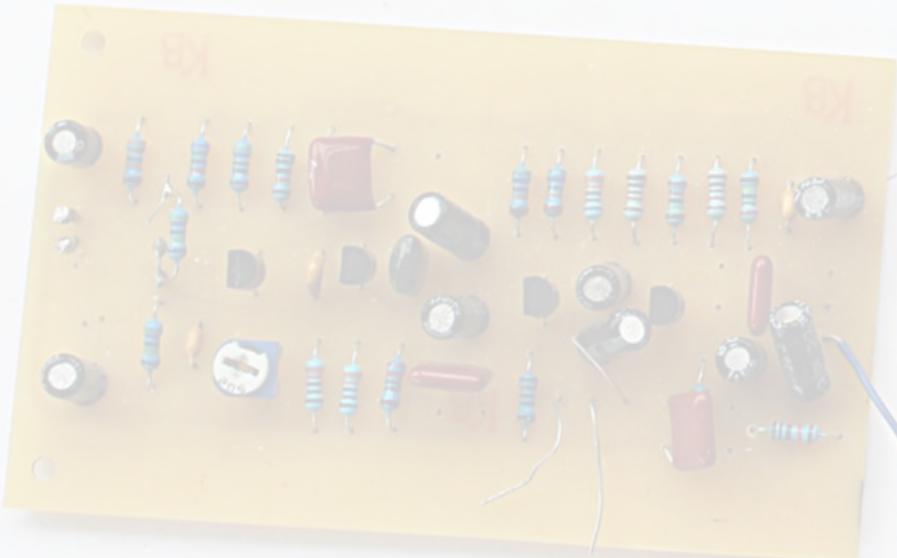
I had some classes that were basic in college, some Arduino programming, but a lot of what I know about electronics is self taught. As a kid I got a subscription to MAKE magazine and a soldering iron as a gift from my grandmother. Overall, it felt like a bit of an independent thing for me; I didn't have a mentor, but I have some great friends I continue to learn from, though. My good friend Lucas (aka ElectronicEntomology.com) and I lived together for a while and I learned a bunch from working with him. I feel like there is a continued aspect to the mystery...part of the puzzle is accessing the information and digesting it in a way that can help you learn. And in terms of being an autodidact, it is really complicated stuff to

CONTINUED ON PAGE 73

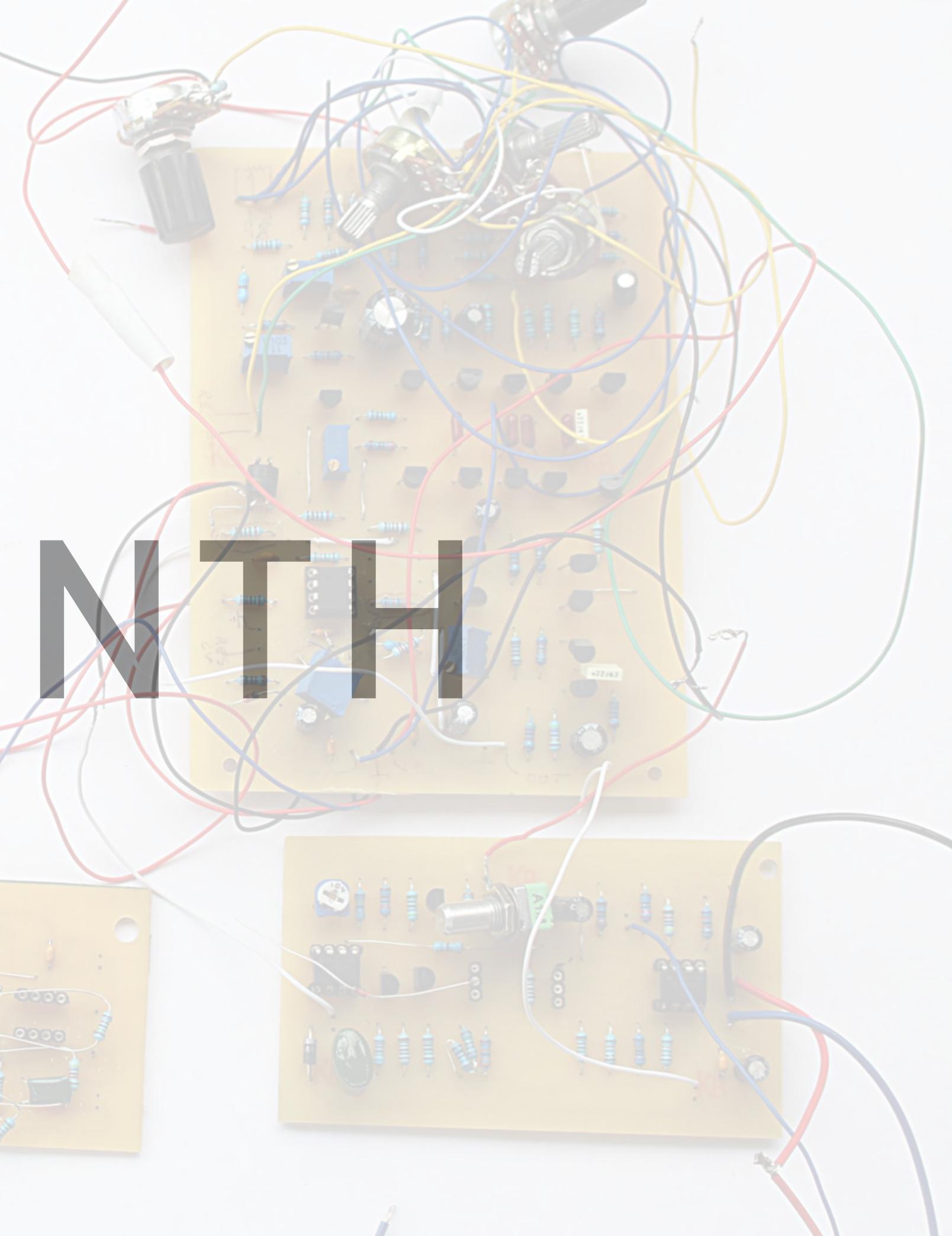


AI Synthesis

AJHISY



NTH





Building fireplaces, houses, and planes may not seem like the most obvious path to starting a modular synth company, and yet for AJH Synth's namesake, Allan Hall, that's exactly the trajectory he took. A lifelong musician, when Hall retired from his career selling fireplaces, he found himself with time on his hands and a strong desire to create the iconic Moog Model D in Eurorack form.

The ten years since AJH Synth's inception have found Hall expanding on his initial MiniMod system and collaborating with musicians like Ian Boddy, and Hans Zimmer on his RadioPhonic system. Although not the standard route, Hall has shown that building a fireplace brick by brick, can translate to building a synth module by module.

Waveform: What were you doing before starting AJH Synths?

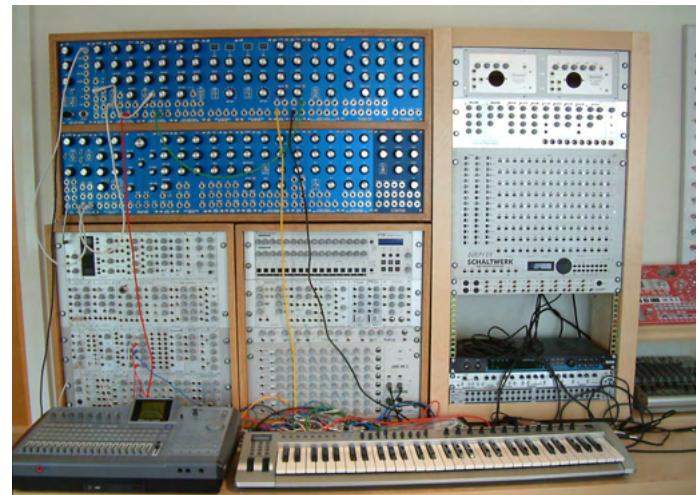
AJH: Making fireplaces. When I was about fifteen, my parents bought an old vicarage that they couldn't really afford. They got it cheap because it was in very poor condition and needed lots of work, so me and my dad fixed the whole place up. We built a kitchen, and wanted to cover one of the walls in bricks, but if we used real bricks, it would take four inches off the walls, so I thought we'd just make these thin "look-alike" bricks. I got some

chipboard and cut it into brick-sized pieces, put some resin on it, sprinkled some brick dust on it, and then we stuck them on the wall and pointed them up. People couldn't believe it wasn't a brick wall, and so we thought, "This is a business." We took them around places, and one shop in Newcastle said, "They're great, but can you use these for fireplaces?" My brother said, "Of course you can!" (Laughter) I said, "Hang on a minute. These are made out of chipboard with resin on them; it's gonna go up (in flames)." The same shop also had a fireplace showroom, and we saw these Adam-style fireplaces and I thought I could make those, so I taught myself how to make silicone molds and worked out how to cast them using a high strength industrial alpha hemihydrate plaster, which was perfect for this application. I worked out this whole process over the period of probably two to three years, and we built it into a good business.

You started a fireplace company when you were fifteen?

I was fifteen when I learned the DIY skills, so I was in my early twenties when we started up the fireplace company. We built it up until it eventually employed about sixty people and we sold it to AGA, a UK company famous for its range cookers. It was a great experience and taught me a lot about business and manufacturing.

Photo Spread: First AJH Synth MiniMod prototype PCBs, 2012.
 Previous Page: Hans Zimmer and Allan Hall with the RadioPhonic System.
 This page: Hall's MOTM & Doepfer system, 2005.
 Page 22: Hall working in his workshop.
 Page 23: Original AJH Synth MiniMod system, 2014.
 Page 24: AJH Synth Matrix VCF module.
 All photos provided by AJH Synth



The best sounding audio, really, is a piece of wire, and anything that you put after that is going to change the sound.

How did those skill sets and experiences you attained during that period transfer to other parts of your life moving forward?

I've built four or five houses as well, a couple of "dream homes" in the Isle of Man, which was great fun until the housing crash. I just love building things. I even built my own aircraft. I saw this kit for an airplane for about £12,000 and the brochure said you could build it in 500 hours. Well, £25,000 and 4,000 hours later, I had it finished and flying. I bought it at the time because I'd moved to the Isle of Man, but as my company was still in the UK, I had the idea of commuting between the UK and the Isle of Man in the aircraft. At the time, we had a big factory that had some space and when things got quiet, I'd just go and do a bit on the aircraft. As my Europa aircraft was nearing completion, I decided it would be a good idea to get the pilot's licence that I'd need to be able to fly it, so I started learning to fly in the UK, but I would go to the airfield only to find that the cloud base would be too low, or the winds were too high, or the instructors were off sick..probably one time out of four you'd actually fly, it was very frustrating so I moved to Long Beach, California for a couple of months and got my pilot's licence there.

That sounds like a good idea. Did the plan work like you'd hoped?

No. I flew it a little bit, but Northern England really isn't the place to have an aircraft; the weather does not lend itself to it. It was rarely used, and I sold it a few years later. I really enjoyed learning all about aircraft systems and it was great fun gaining the engineering skills needed to build your own aircraft.

I can imagine. You're celebrating ten years with AJH Synths this year. Building houses and planes are a far cry from building synth modules, right?

Well, it seems like only about two or three years ago that we started, but it's ten years of the MiniMod System, which is crazy. At the time, I didn't think it had a life of ten years; I was just

doing it as a hobby. I built a model D for myself in Eurorack (format) and a few friends saw it and were like, "Can you build me one of those?" And so then it started, and it turned into AJH Synth. I'd always loved vintage keys, and I thought it would be great to have some of this that you can just patch everything into, so it's no longer a closed system; you've got an open architecture to it. I did the MiniMod (series), because I bought a (Eurorack) system and thought it sounded nothing like vintage instruments, so I thought I'd clone the Model D and see what that sounded like, and it sounded great. It still holds its own as a system and I would put it up against anything that's out there.

When you were designing those, how did you find the circuits for the Model D? Were they easily available at that time?

All the circuits were there, apart from the early oscillator. With the Moog schematics, though, they were never right. (laughs) I used to be a service tech, and I used to service these and you'd be looking at the schematic, and then you'd have this printed circuit board and you'd think, "Hang on a minute. There's something wrong here..." There's quite a lot of it that's different, so if you build it, if you just took the schematic and turned that into a circuit, I think you'd be very disappointed. It might work or it might not. So it was starting with the schematics, but really reverse engineering, particularly the early oscillator, which is quite an interesting thing, because it's totally unstable. Moog only built a couple hundred of them before they gave up and put together the later "early" oscillator design that was a little bit more temperature stable. It was a challenge to take the early RA Moog oscillator circuit and then put a front end on it that was temperature stable without killing it, because, with analog oscillators, it's always interesting. The magic with the Moog oscillators is when you put two or three together. Because they're inherently unstable, each time the capacitor discharges to restart the waveform, you have noise on the power rail so it gives a slightly different start point each time. So what happens is that you get this jitter on the waveform, and you can see it on a scope, and it will actually be moving back and forth like that against the



other ones. It's completely random, but then put a slight detune between them, and put three of them together, and that's when you have a symphony. So that was the starting point, and I designed the MiniMod system as five modules: the Glide Noise, VCO, VCA, VCF, and the Dual Contour. It was a full system and intended to work as that.

Were there any notable challenges as a new manufacturer? Anything that surprised you about the industry as a whole?

When I got into Eurorack as a manufacturer, it suddenly became very obvious that there was no such thing as a Eurorack standard; everyone had their own idea of control voltages and what they

...if you just took the schematic and turned that into a circuit, I think you'd be very disappointed.

should be, even with things like unipolar and bipolar waveforms. We (various manufacturers) actually formed a group, five or six years ago with the idea to create a Eurorack standard in the same way that there was a MIDI standard, but it kind of fell down because everybody thought that their standard was the best way forward. (laughs) There was a lot of discussion, and nothing happened. That's why we have things like our CV Mix module, to bias and amplify or attenuate signals, so that everything will talk to each other nicely.

You said before that you used to service synths, is that a business that you were into for a while?

It wasn't really a business. When we sold the company that my brother and I built, I retired and moved to the Isle of Man and got into the music scene, playing guitar and keyboards in a semi-pro band. The Isle of Man has about 80,000 people, and quite a lot of musicians there, but very few were synth or guitar techs—I used to be a guitar tech as well. If you've got a synth that breaks down, what do you do? Shipping was horrendously expensive and would take two or three days. I had a lot of time on my hands, so I taught myself electronics and started to fix them. Originally, it was just my own synths because I had built up a collection of

about fifty or sixty. After I'd learned the service tech skills, I taught myself the maths and theory side of electronics. There's so much job satisfaction in it, particularly if you get a job that somebody else has given up on. You think, "I've got it. I've nailed it."

I used to fix Fender Rhodes pianos, and my most satisfying moment was when this one guy emailed me and told me he had a suitcase piano that he'd given it to somebody to fix, and the tech had it for four years. He came to my house with all the Rhodes parts in a cardboard box because the tech had taken it all apart at some point. In a few days, I had it up and running and the customer was elated.

I fixed one up about two years ago. There were a few dead notes, and I thought I'd have to rewind the pickups themselves, but it was just where it had been soldered. I soldered it back, and it was working great. The other thing that I absolutely love is the Hammond B3.

Have you ever lifted up the hood on a B3, seen what's under there? I've had people ask me to repair those, but no way. Not a chance.

I've played them, but not worked on them. I fixed a couple of Mellotrons, though, where it was just on that line between working and not working. It didn't take much to throw it over. Fun things, though.

How did it feel when you're starting out trying to learn how to fix equipment? Did you have help anywhere?

With everything throughout my life, I've been self taught. The only thing I haven't been self taught in is flying a plane, but all the rest of it, I've taught myself whatever I've needed. It's a very different time now; there are lots of resources. We've got the internet, LT Spice and circuit simulations, stuff that does a lot of the heavy lifting, and all the forums, where if you've got an issue, there are many people that are happy to help.

Do you still play music? Are you mostly just running the company?

Occasionally, I'll get a system out and have a noodle on it, but it's rare that I have the time. When the system's out, it's because I'm testing something. I'd love to go out, and perform...that buzz that you get from live performance...it's great fun working with other musicians, and I was quite fortunate to work with some really good musicians.

You've done a couple of modules now, the Triple Cross and the Chance Delay, with Ian Boddy. How did those come about? Had you known him for a while?

I go back quite a long way with Ian. When I was in my mid-



...unless you can move time backwards and forwards, there are things you can't do...

twenties, I went to Newcastle, where there was a shop called Rock City Music. Ian worked there selling keyboards, and I got to know him at the time. It seemed a fairly obvious partnership, because he had a couple of ideas for modules. It was great to be given a brief, and then to over-deliver on it.

What do you mean? How did you over-deliver?

Ian's original brief for the Triple Cross was that he just wanted two crossfaders that mixed down into the third one, but we just kept going and thought if it was DC coupled, then we could use control voltages as well, and it'll go right up in the audio range. It was an interesting project to do. With the Chance Delay, we worked with Tom Wiltshire on that one; he did the coding for it.

Tom also makes that TAPLFO chip that you used for your MiniMod Tap Tempo VC-LFO (Waveform, Issue 10). Since you had him help with the coding, does that mean that we've come across something that you haven't taught yourself how to do yet?!

No, I don't code at all. (laughs) I can make a light switch on and off and that's about it. Probably 80-90% of the AJH stuff is analog, but there are a few other (modules) with coding, like the Multi Burst Envelope. I wanted to do that analog, and you could, but you couldn't do it in 12HP. Likewise, for the Chance Delay. Originally, I built that in analog, but there's a lot of circuitry and it was too big for the functionality of it. Then, when I worked with Tom, he showed that the component count was about a tenth of my previous prototype.

How long did it take from when you finished the analog prototype to when Tom finished the coding and you had the final version?

It took about six to eight months for Tom to get it coded to the point where we were both happy. It's one of those things where, unless you can move time backwards and forwards, there are things you can't do, which only became obvious when we started designing it. The problem is that by the time you've applied the

control voltage, you missed the event, so it's going to catch the next event. Stuff like that, you can't do anything about it; it's the nature of it, the laws of physics.

You already had a few filters out there, but your most recent release is the Matrix VCF. What was the motivation for that? Why another filter?

I thought, with filters, we've got it covered. We do the Gemini (2412), which is a dual filter; we do the transistor ladder, the diode ladder, and a few bits and pieces. But with this one, all the filters are useful and there are some really interesting ones in there. It started out as the filter from the Oberheim Matrix 12. It's a pole mixing filter with sixteen different modes, different filters. The original Oberheim only had fifteen different filters because two of them were duplicates, so I thought I'd add a number sixteen, which is a four pole All-Pass filter, so it has a phaser as well. It also has a switch on it, which throws it into Polyvox mode, and it does lots of distortion stuff to the resonance path and changes the character. A lot of these filters aren't self resonant, but when you switch the Polyvox on, all of them become self resonant. But they don't resonate with a sine wave, they're all some pretty nasty resonant wave forms, so it's this kind of Jekyll and Hyde thing where sixteen of the filters are nice and have lots of variety, but then you switch it into Polyvox mode, and it becomes nasty. I'm really pleased with the way it's turned out; it's been a couple of years in the design of this. I took it to Superbooth (2024), and we were of two minds as to whether to show it or not because I wasn't happy with it. The phaser didn't sound great, and the levels between the different filters...when you switch (between them)...that's why it has an input level, an output level, and a clip LED, because the problem is, that when you change filter types and then add resonance, the level can go through the roof. You have to have some means of balancing it, and that's why we put the clip LED in, because then you know when you've reached 10 volts peak to peak. Also, by having an input level, because you've got self oscillation on all the filters, you can adjust the source to mix in with the resonance.



Is there internal circuitry that automatically offsets filter types in terms of levels?

I've done that in the design stage so it's balanced as best as you can, but the problem is when you start putting resonance on, if you balance them all up with no resonance, you've got one set of levels. But then if you put 50% or 70% resonance on all of them, then you find that all the levels are all out of whack again, because the resonance increases considerably on different filter types.

One of the things that you do get as you change filter types, you sometimes get a click, and that's because a filter doesn't just filter, it time shifts too and changes the phase of the waveform so when you switch between filter types, it's a different part of the phase each time, and you may be lucky and get similar levels or you may get a big jump. I DC coupled them all, which takes some of the nastiness out, and I actually designed circuitry that went through and turned off the VCA for 20 milliseconds when the filter type changes, however I didn't include this because you can create some pretty wild effects when you scan between the filter types at audio rates, and if we muted the output, then you would just get silence if you tried this. Because we have CV control over filter selection, you could use a sequencer to change this, one filter per step or whatever, and particularly if each of the notes included an envelope, then you wouldn't really notice any click from DC offset, because you're on the tail end of the envelope.

I'm interested to try it out and slowly morph the wave shapes with maybe just a sine wave or something like that, to switch between them.

My original filter design was actually two of these with a cross fader, so that it did exactly what you say. You could take two filter types and morph between them. But it was about 24HP and I thought, it's going to be hugely expensive and if you want to do that, buy two of them and a Triple Cross, then you've got a stereo pair to start with, which was, of course the idea behind Radiophonic synth that I did with Hans Zimmer.

That looks like so much fun. What were his specs for that project?

Part of the brief from Hans was that it has to be stereo because he writes for cinema, where the speakers are quite a distance apart and you've got a big stereo field to play with. That's why there's a lot of stuff duplicated on it, because it's designed as a stereo synth.

With the Radiophonic for Hans, I know that you met him when you delivered the system to his London studios, but how did your relationship with Hans start?

About nine years ago, I took the MiniMod system to NAMM. His EWI (Electronic Wind Instrument) player, Pedro (Eustache), who makes his own instruments out of drain pipes and things like that, came to our booth and said that he worked with Hans Zimmer, and that Hans had one of my systems and thought it was great. I thought no more about it, and then about three weeks later, I got an email from Hans, saying, "I'm using your system. I'm really pleased with it. Keep up the good work." After that, we exchanged emails occasionally and then, a few years later, he decided that he wanted the audio path on the large Roland System 700 he uses in his studio to be AJH Synth, because he said it sounded fatter. So I worked with his synth tech, Chaz Labrecque, and he installed MiniMod VCO's, VCF's and VCA circuit boards behind the Roland panels to replace the original Roland circuitry and create an AJHSynth audio path instead. Externally, it looked unchanged, and that was quite a fun project. Then, a few years ago he called me and said, "I've just bought Maida Vale Studios (the home of the original BBC Radiophonic Workshop) and I'm going to recreate the Radiophonic workshop there and I want an analog modular synth for it." I started off with something a little bit smaller and he kept adding to it, and it turned into the Radiophonic.

How long did it take for you to build it up for him?

Not long. It was all modules that we already had, there wasn't anything that was built specifically for the Radiophonic, so it was just really getting it designed so that it looked aesthetically pleasing as well as sonically useful. Because of the number of modules in there and the combination we chose, it is immensely powerful and versatile, but also because it is intended to be in the new Radiophonic workshop his idea at the time was that it had to be fairly easy to learn on, so it had to be logically laid out; the sound starts on the left and works its way across to the right. He has two of them now, because he was doing another film, working in Santa Monica, and wanted to use the Radiophonic on it, so we shipped a second system to the US.

That must have been kind of a full circle moment. Growing up in the UK, was the Radiophonic Workshop something that you were aware of?

Oh, yeah. The Doctor Who theme was one of the first things I learned to play on synth! I'd been a fan of the Radiophonic workshop for many years, and its sound effects and music was used on many of the BBC TV programs that I grew up with.

What are some of the important philosophies you've gathered from your years of designing circuitry based on vintage designs?

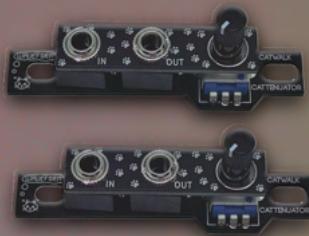
Usually, anything you add is going to change the sound to some degree. The best sounding audio, really, is a piece of wire, and anything that you put after that is going to change the sound. It degrades the sound as distortion, which is why vintage stuff sounds great. We noticed this

CONTINUED ON PAGE 73

NEW!!!



Catwalk Pressure Sensor



Catwalk Cattenuator -
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DIY SPOTLIGHT: DJUPVIKS ELEKTRONIK

BY WILLIAM STOKES

Helmed by Jonas Rosén, it's safe to say Djupviks are fast becoming one of my favourite developers. Rosén's operation has all the punkish precocity I love about DIY modular in spades, and it follows that his background is in hardcore music and the pursuit of all things gritty, characterful and full of attitude. "I think people in this genre are too slow," he reflects. "I've released twenty five modules in, like, four years!"

How did you get into the world of DIY Eurorack?

I started synth DIY, in 2013 building Eurorack, then switched over fairly quickly to Serge, and I just built more and more complex things. People told me, "You could invent your own

...it was like a hit-or-miss thing; either you loved it or you hated it, basically. I guess that's just who I am, that's how I do stuff.

stuff," but I thought that hole was too deep to just fall into, "if I go in there, I'm not coming back!" So I deliberately just kept it out of my life, but then the pandemic hit and I was itching for things to do so I started designing them and I just taught myself to draw circuits. I'm a DIY person, I come from punk and hardcore music and we'd always put out our own records and do everything ourselves.

That makes sense. It feels like your approach is almost rebellious, like you want to attack ideas from the side instead of directly.

Yeah, that comes from my background, I suppose. I've been involved in hardcore punk music since I was a teenager and even in that respect I was kind of rebellious. I started different bands that were punk bands or noise bands or grindcore bands, and it was like a hit-or-miss thing; either you loved it or you hated it, basically. I guess that's just who I am, that's how I do stuff.

Let's talk about the Svalbard. I recently used it for a performance in spatial audio at the University Of Gloucestershire in England. It was amazing to think I was

creating such complex sounds in real time, with no sampling or effects.

I usually design stuff to be open-ended. I think Serge called it "patch programming," where he designed his boards so that everything can go into anything, basically. I try to keep that tradition alive somewhat, like you might have some outputs, but you don't put it on the front board for some reason. With Svalbard, I included stuff that goes in the opposite direction of where it's "supposed" to go. Sometimes, it doesn't work out that great, but for Svalbard, I suppose it did. It's kind of a musical genre, daisy-chaining PT2399s. It's easy to hack and do things with, so I started just playing around with that and I included a filter even though there's really no point, since the PT2399

already has noise-reducing filters and low-pass filtering. It's quite famous for being too noisy, and if you downsample it, it makes those strange, "metallic popcorn" sounds that People want to get rid of. But I thought, "Let's just enhance it instead!"

What's coming up next for Djupviks Elektroniks?

I've decided this year I want to slow down a little bit though I still have lots and lots of ideas and have a whole stack of prototypes in my workshop. Yesterday I placed orders for two new modules: One is kind of like a very dirty stereo filter based on the Wasp filter, which is considered to be really dirty on its own, but I've taken every measure to make it even worse! The other one is called Spectrum, which is a stereo switch capacitor filter, which basically takes the input signal and uses it as a clock. So if you have a high pitched sound the clock will run really fast, and if it's lower, it's going to go slower. If you put in like an arpeggio or something, it's going to have a stuttering effect. It's going to produce different results, and you can switch tempo and stuff. I'm really pleased with that, it took ages. I think that's the module I've been working the longest on.

BUILDING THE DJUPVIKS ELEKTRONIK SVALBARD

BY WILLIAM STOKES

In 1897, SA Andrée, Knut Frænkel, and Nils Strindberg set out from Svalbard, Sweden, in a hydrogen balloon with a view to passing directly over the North Pole. Things were not to go well, though: the balloon, *Örnen* (meaning Eagle), arrived from its manufacturer having not been tested. The steering method employed by Andrée was ineffective. *Örnen* was shown to be leaking an inordinate amount of gas. Just two days after takeoff the balloon crashed on the ice, and a fight for survival quickly ensued. The trio of explorers managed to get as far as the deserted island of Kvitøya, where evidence of their fate would not be discovered until 1930 after lying enshrouded in mystery for thirty three years.

The story has inspired much discussion and creativity over the years, for instance Per Olof Sundman's 1967 novel *Flight of the Eagle* and, more pertinent to our area of interest, the 18HP Svalbard "broken delay" Eurorack module from Swedish designer Jonas Rosén, aka Djupviks Elektronik. Djupviks is what I think of as a "sound-first" developer: while its modules have an instantly recognizable aesthetic with their blood red and silver panels (here the etched image is of course a hot air balloon), they're far from likely to be the most ornate-looking additions to your system, with a vast majority of the effort (and cost) going into the most important thing—the sound.

The Svalbard consists of three ostensibly identical delay lines; Channel 1, 2 and 3, though I like to think of them as SA Andrée, Knut Frænkel, and Nils Strindberg. Each of these presents its own input and output, controls for delay time, feedback, and filtering, and a CV input for time. I say ostensibly, because when used in series the delay times of Channels 2 and 3 become offsets to Channel 1. In addition to this is a Mix output providing all three channels in parallel, and a Wet switch for removing the dry signal from the input of delay Channel 1.

The delays themselves are based on a PT2399 chip, which is famously good at emulating the character of analog delay, partly thanks to its inbuilt op-amps which filter out harsher digital noise. But Djupviks have other ideas. "PT2399 delay sounds way too clean to me," Rosén captions in a YouTube video of the Svalbard in action. "So I added filters to enhance grit, filth and noise." This they do very well indeed.

The second half of Svalbard's functionality is as a no-input mixer, purportedly an area in which it takes not a little inspiration from Djupviks Elektronik's own Shakti. With so much I/O it would be a crime not to include this as a developer-ordained option, and as such, the module falls into that rather rare category of having two completely different but equally enjoyable functions. This is also an area in which the filters really come into their own,

having massive influence over the Svalbard's sound.

As for the build, the Svalbard is a very accessible and low-stress operation. In this way it's very nicely weighted: when it comes to playability it's a wild and volatile beast that requires some careful tweaking and tuning to get the very most from it (and at times some quick changes to keep things under control), so to follow a detailed and arduous build process with that sort of functionality would likely feel a little tiresome. As it is, the Svalbard kit still provides the all-important endorphin release of finishing a build and mounting the module into your case, but all its SMD parts come pre-soldered, so it is, in the words of the very short build guide, "pretty straight forward", with the guide itself more acting as a reminder of good soldering practice alongside Jonas Rosén's two cents on how he usually approaches it. With a bill of parts consisting of ten jacks, twelve pots and knobs, one toggle switch and one power header; I chalk it up as the kind of build you can enjoy while checking out an album you haven't listened to before. The PCB is spacious, too, which is always nice.

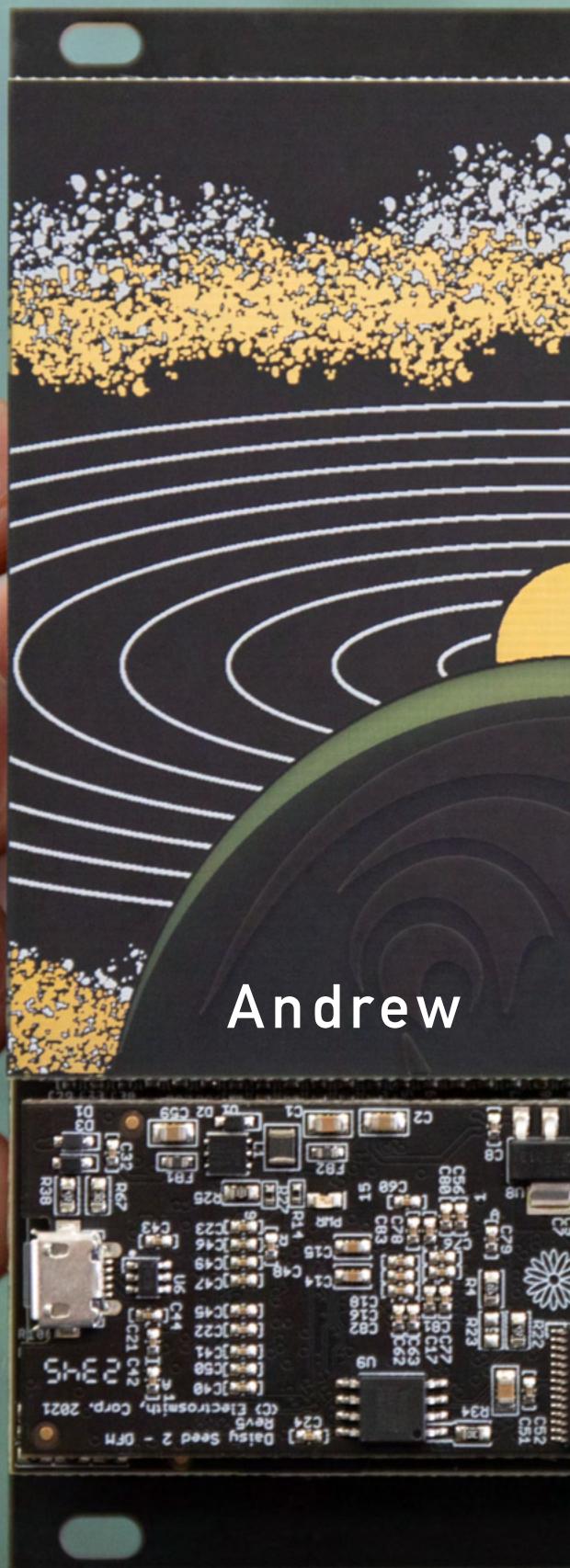
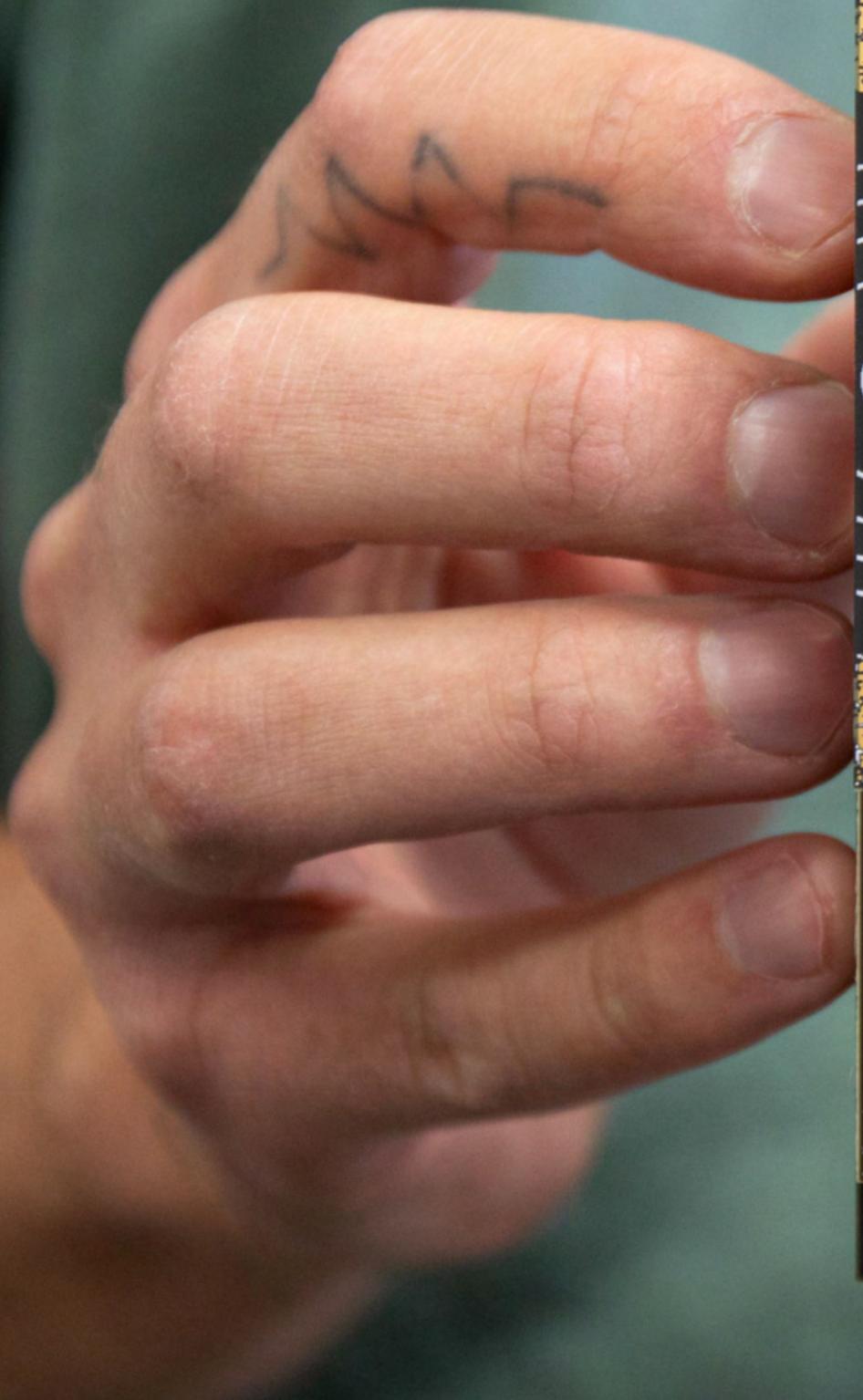
Mounting the Svalbard in my case for the first time (with everything soldered and checked, of course) I switched it on, and decided to patch the Mix output into Input 1. For the first few seconds... nothing. Then, after moving a couple of knobs, a strange sort of popping sound. Then, a marvellous type of long wave radio-style interference. Then a swell of white noise-infused feedback delay. This is not only a beautifully compact iteration of no-input mixing, it's a unique kind of study in interlocking delay feedback lines, and it's begging for its own rules to be broken.

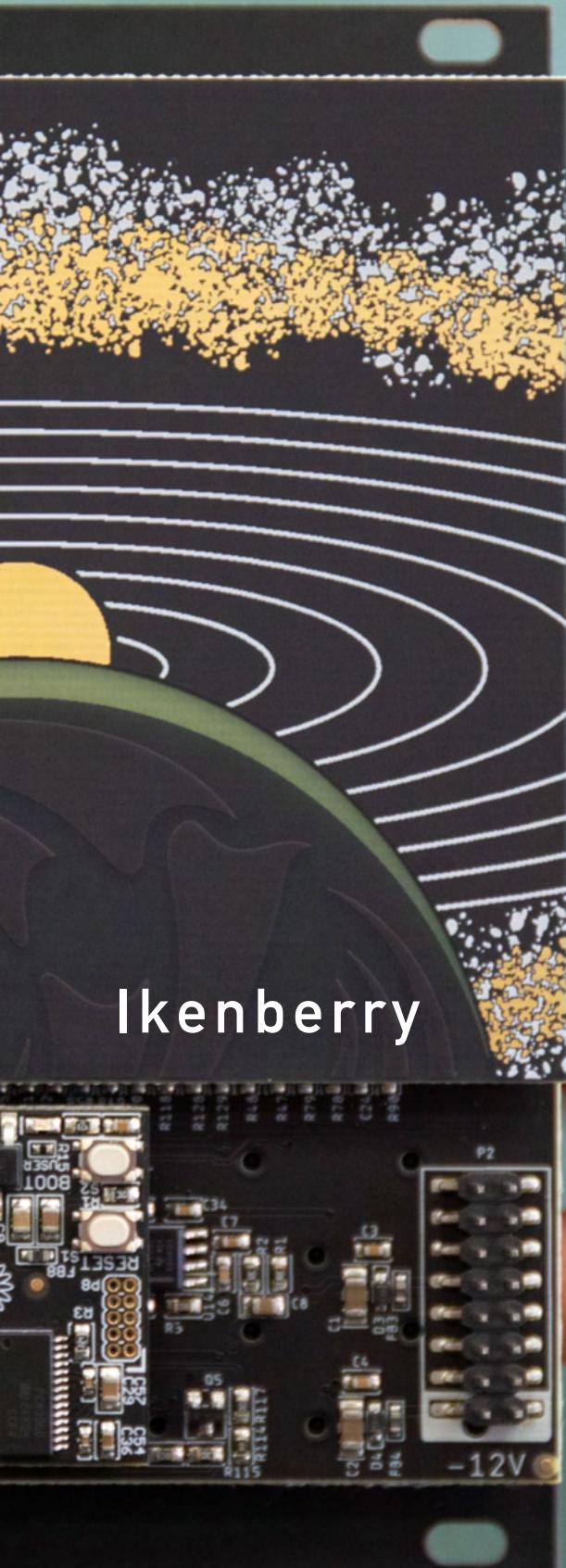
If you're in the market for a conventional delay and are wondering if the Svalbard will give you three-for-the-price-of-one, you're unlikely to be satisfied. This module does what it says on the tin: it's a "broken" delay, meaning that its response is unpredictable by design.

If anything approaching noise music is your thing, however, this module is all but a must. You definitely have to find the sweet spots—which at times prove elusive—but once in them it's a digital sonic theme park. Set its filters clockwise of noon and (if I'm not mistaken) you're re-inserting resonant high-passing into an already low-passed signal path, which is exactly the kind of crazy I love and makes for some animalistic harmonic character. You can of course feed it signals and it'll give you delay, but at best this is non-linear, relatively uncooperative and uncanny in character, more than it is lush and spatial. I found it to perform particularly well when combining an external input and an internal input from the Mix output in the signal path—add some modulation into the picture and *whoa!*



Above: Djupviks Svalbard
Photo provided Thonk





Ikenberry





If you have the passion for it, do it; you shouldn't let technical proficiency stop you.

Nailing down a single driving force for Andrew Ikenberry is not an easy task. With Qu-Bit Electronix, 2hp, and Electrosmith—home of the Daisy—all under his watch, each company provides a different focus, but shares a similar philosophy. Qu-Bit was his first company, and the avenue with which Ikenberry creates what he terms "Future Coast," modules designed for "the purpose of exploring the world of sound, the things that haven't come up yet." 2hp, with its physical constraint limitation, offers an easy starting point for modules which can have a surprising depth of features. Electrosmith is where Ikenberry's mission comes full circle; lowering the barrier of entry and democratizing access to sophisticated digital audio equipment design.

With the Daisy and its various levels of implementation, Ikenberry has helped other designers—and dreamers—fulfill their dreams, something he finds a lot of satisfaction in. Ikenberry's boundless energy and infectious enthusiasm and passion for what he does is obvious to any who makes his acquaintance or uses his creations.

Waveform: I used to have this fantasy of living in San Clemente with not much more than a single fin longboard and a library card. It's kind of magical down there...waves, fish tacos, pretty laid back.

Andrew Ikenberry: I love it. It's one of the most beautiful places. It's great as far as a laid back beach town goes, but also a surprisingly good place to run an electronics assembly business: There's a lot of tech between LA and San Diego, and we're right in the middle of it. We have about a 10,000 square foot building, and do the automated electronics assembly for our circuit boards, though as well as the machines do all that, it still takes a fair amount of skilled labor. Since we're in the middle of such a rich tech territory—specifically, semiconductors and hardware type stuff—we're really connected with a big labor pool. We're also very connected with a lot of sales representatives for the various chip companies that we buy from, as well as the machines that we use, and their service techs, which is really useful; nobody has to get on a plane to come fix one of our pick and place machines. I don't care what machine you have, it's going to break at some point, and you're either paying someone to fly out from who knows where, or they're going to drive up from San Diego, which is the case for us.

Having that kind of equipment and overhead always seemed like such a scary aspect of running a manufacturing business. I know you went to school in Berklee, but did you have experience in business or manufacturing or anything like that, or was it kind of trial by fire for you?

It's primarily trial by fire. Looking back on it now, I can really see how crazy it was to think of doing it all ourselves, and if I knew what was involved, I probably wouldn't have done it. There was certainly a lot of figuring it out as we went along, and ignorance was bliss; that's why we dove in headfirst. I think in the Eurorack industry, in music tech at large, there are a few companies that were doing the same business model, and they inspired me, like Bill Matheson from WMD, who was building his own boards. The first one that I saw in person was Mark Verbos, who had his own pick and place set up in Queens. I was living in Brooklyn at the time and I was lucky to have him invite me to his shop. I think that got the wheels turning. He could build his own boards, and he didn't have to wait on anybody else, or source them from Asia or wherever. I was thinking that it seemed really nice to have that control over your own process. When you're a small boutique music tech company, you need to figure out your assembly. You can solder by hand, but you're usually going to use some sort of automated assembly of all the parts on your board, and it's either going to be through-hole or SMT. Most everybody does SMT. This is one of the biggest hurdles: you need to find out who's going to do that for you, and then pay them to do it, and then wait the lead time for it.

What was it like when you started to do the manufacturing yourself? Were you nervous about that at all? It seems like that's a big jump.

I was nervous, but I was really lucky in that I was using a contract manufacturer that was about an hour south of here, and we became really close friends with the proprietor of the shop. We were not a huge customer for him, we weren't moving the needle at his business, but we told him we wanted to do it ourselves, to bring it in house, and he said, "Let me help you get up and running and be there when you have questions." It was amazing.

We were so lucky to have him, and he steered us in the right direction as far as what machines to buy, and then helped us troubleshoot the normal aches and pains you have when you get up and running with something like that.

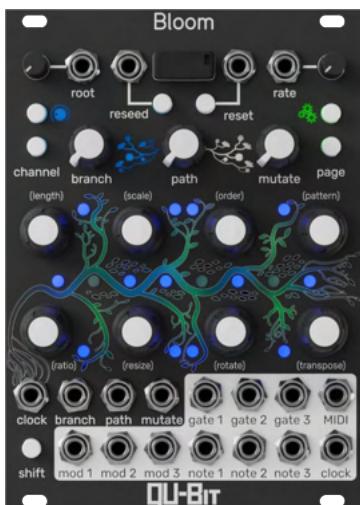
Are there any products that only exist because you own your own facility?

The big one that comes to mind is the Daisy. There is no way we would be selling the Daisy platform if we weren't building the boards ourselves. We get the parts cheaper because of our economies of scale, because we sell this product to a bunch of other people. We basically charge the same price you would pay somebody else to make the same thing, and if we had to pay somebody else to build these boards, that product line wouldn't exist; it would cost twice as much and we wouldn't be able to make any money on it. But since we are vertically integrated, we're able to build it at a price that makes sense for us and our customers.

What was the nexus of the Daisy? Did you feel like you had a problem and that by solving it, you could make the process of transferring a digital idea to a module easier?

Sort of. The Daisy has really been a long-time dream that I've had since I started in the industry. I started Qu-Bit my senior year in college, and the first product that we ever made was based on the Raspberry Pi. I'm a software guy by background, and so I felt right at home using the Raspberry Pi, because I could use Linux and all these high-level programming tools and languages and then run it embedded on the hardware, which at the time, was my weaker skill set. I don't know how many Google searches I did at the time for "DSP embedded audio platform." The board didn't exist, and I always thought somebody would make this product, that somebody should make this product. People have tried to make it, but either they were \$75 a board, or they didn't have the software, or whatever, and it never really happened. I think I know why: It's too hard, and the boutique audio market is too small, generally speaking. If you're looking at it like, "I'm going to sell this to all of my Eurorack buddies, to boutique pedal

I love sound, and I love new sounds. That's a driving force.





Everything wants to descend into chaos every single day, and your job is to keep those forces at bay.

brands, and for weirdo desktop devices," there really is not enough volume there to take a chance, to risk all this upfront capital that you'd have to invest. It's not just making the boards, but also the code base, the software ecosystem. That's really where a lot of your capital and your risk is going to go. We were lucky that we were already using all these platforms to make our own products, and we finally developed our own ARM Cortex board that we were reusing over and over again. It wasn't even a layout, it was the same circuit on every module. This was right around the time that we made the first (Qu-Bit) Chord module, the really big 28HP polyphonic oscillator. We started reusing that circuit on every successive design, and sometimes it had a little problem that we didn't anticipate, so we thought why not just land on the perfect set and then design it onto a smaller, module-type board? The next thought was that not only should we do that for ourselves, but we should sell this to other companies. That was the fruition of this big dream of mine, this audio platform that all these awesome music tech companies could use and not have to reinvent the wheel. It's a lot of work to come up with modern digital platforms for audio, it's not easy. It was a real passion project for me to lower the barrier to entry and democratize access to sophisticated digital audio equipment so that not only could the huge music tech companies have the budget to make these complex, sophisticated devices, but anybody could. That was the dream.

Daisy has been out since you Kickstarted it in 2020, so five years already. When you started Electrosmith, did you know that you were going to do the Daisy? Was Electrosmith formed for the sake of the Daisy?

It was. At the time, we sold a lot of other accessories, jacks and

parts and whatever, because we thought it fit with the brand, but over time, we moved away from that.

You have different evolutions and steps along the Daisy pathway for different stages of developers like the patch.Init(), the Patch Submodule, and the Patch. Why all the iterations?

We were trying to hit different needs for our customers. Like, one thing that the Patch Submodule does that's unique, is that if you're careful about your carrier board design, you can actually eliminate needing any external parts, aside from your jacks and your pots, and then just slap it on the back of your main PCB. You don't have to do any of the external circuitry; you don't have to lay out the parts, and you don't have to get them assembled. That was the big idea behind it.

I know you said you started the Daisy when you were in college, how long did it take for you to develop it and bring it to market?

We were basically working on it, off and on, for five years. Not concretely necessarily, but the little building blocks, the little pieces that eventually fit together to make the product we know as the Daisy.

Did you do all the programming on it yourself?

I did not write any of the code. Stephen Hensley, who's on staff, did. He's way better at that than I ever was. He's a fellow Berklee graduate and the one who wrote the whole code base and did the PCB layout for the Daisy.

What did you study at Berklee?

I studied Electronic Production and Design, that's the name of the major. It was formerly known as Music Synthesis, but by the time I went there it had expanded beyond just synthesis, and it encompassed everything to do with modern electronic music. We were learning a lot of production, a lot of electronic music history, and a lot about DSP. The section of the major that became my primary focus was the technology side of it, specifically circuit design and writing code using dev boards like the Raspberry Pi and the Arduino. That really became my passion, trying to learn how to make my own hardware instruments, and once I got into the upper layers of the major, I tailored my journey more towards learning those types of skills. I studied with Dr. Richard Boulanger, a well-known professor at Berklee and the high priest of the programming language Csound. I was lucky to learn from him.

Did you discover your passion for building and design while you were at Berklee, or had you always wanted to build instruments?

I got really into synthesizers probably three or four years prior to going to Berklee, which is when I first got into electronic music. I played music my whole life, starting out playing drums when I was eight years old, and then guitar when I was in high school. I got into pedals, which wound up being more interesting to me than the actual guitar playing, building this crazy network of pedals and patch cables. Then I got really into synthesizers, specifically modular synths, and that was my focus when I got to Berklee. I wanted to learn the engineering aspects, to really understand it so that I could make my own modules. Modular is this weird world where you're making your own instrument as you go, and that's one of the magical things about it; you're not restricted. The next logical step from designing your own instrument with modules is to make your own modules. I always have to trace things back, to get one layer deeper. That's been a trend of my musical journey, so that seemed like the next logical step, and that step happened during my freshman year. The timing was right, and by the time I was graduating, I was about to start selling the first Nebulae Qu-Bit module.

He told me that it was the Daisy that made it seem like it was possible, and that's exactly the thing that really lights that fire for me...



I saw on your website you have a photo of the prototype for the first Nebulae. It still looks good.

Yeah, it looks okay. (laughs) It's funny, because this was before PCB front panels were common. We were just prototyping that way, and we always thought that we were going to go to an aluminum panel, but the ideas were there; it's got the holes in it where the LEDs are shining through. If you look at Stardust (Ed. - their Cosmic Tape Looper module), that's kind of the fruition of that concept that we had really early on.

I feel like PCB front plates have really opened up a world of creativity. I love the freedom of design that the medium offers. When you're coming up with the origin for a new idea, is it a collaborative effort? Do you have meetings where you're like, "Alright, now how about this idea for Qu-Bit, and this for 2hp, and this one for Electrosmith?"

It's always a team effort. For most of the modules or products that we're making, it's a three-person team: the engineer, Stephen Hensley; the designer, Michael Corell; and myself. I usually function more as part of the decision-making process, the testing process, the sounding board, etc., and then the talented people do the nitty gritty work of making the beautiful art. I'm always a big part of the early stages, but I'd say everybody helps contribute to the initial designs and concepts up front, and then we hash it out from there.

I suppose that when you come up with a module that's got to be physically bigger than 2hp, you know that automatically you're going to funnel it into the Qu-Bit category?

We're thinking in a brand mindset before we even start. It's usually like, "Let's make a Qu-Bit module," so we think of what's missing in the Qu-Bit product line, like what are some interesting industry trends that we could tap into, or some concepts that we've always wanted to do but haven't explored yet. That's usually where the seeds come out of and the light bulbs get started.

The Qu-Bit Scanned was one of the first modules we reviewed

in Waveform (Issue 1), and I've always thought it was such an interesting idea. Were you ever able to meet Max Mathews, who came up with the concept for Scan Synthesis?

No, he passed away my freshman year at Berklee. I really wish that I would have had the honor of meeting him personally, but he was good friends with my mentor, and we did learn about Scanned Synthesis there. It was really fascinating to me, because it's one of the few truly novel, unexplored synthesis algorithms out there. When you think about synthesis algorithms in general, you have analog synthesis, wavetable synthesizers, and you have physical modeling. No one's ever talking about scanned synthesis, let alone in hardware. I remember the first class I ever heard about it; it blew my mind that there was this new thing that nobody was talking about, and that no one had ever used before. It sounded really interesting and beautiful, and that sparked the plan to eventually do something with it. It took a while to figure out how to get the hardware to be able to support it, to port the algorithm, and to do all the work to do that, and I think there's a lot more that we could do in that world.

Does that mean that you're planning on revisiting that module sometime?

You're never too old, you're never too limited in your knowledge to learn these skill sets.

The Scanned module is discontinued now; we don't sell them anymore. I wouldn't say that it's a closed chapter; I would love to return to that someday and really flush it out with a lot of the stuff we've learned since then and use the newer processors that we're using.

Is there any Qu-Bit module that you felt you really came up with something new and novel, where you had something like a sonic epiphany?

I think we've had quite a few of those over the years, but the strongest example of that is the Nebulae. Being able to play with a phase vocoder on hardware in an experimental context is really an amazing thing. Phase vocoding allows you to stretch audio, so it splits the time component from the frequency component. The



phase vocoder technique was not super commonly used on hardware, so for me, the Nebulae was this "aha!" moment where it was doing the thing that we sought to do: putting this computer music technique in the hands of musicians who can have real time control over stretching their audio out. It's not because they're trying to keep it in time or in tune, but just tweaking it out of time, atonally, with no quantization. That's really the magic.

You have two versions of Nebulae. How do you decide when to either make a new version of something, or when to end production, like you did with Scanned?

When it stops selling! (laughs) Carrying inventory costs money and you need to build at certain economies of scale, so once the sales slow to a certain point and the numbers don't add up, then we start to examine that maybe we should either address all the customers' grievances or wishes to make it better, fixing all the things we should have done the first time, or if we think it's played out, someone did it better, or if it doesn't fit with our strategy anymore, we'll put it out to pasture and discontinue it. If it's something that we think we can really improve upon, that people would still be interested in and that we can add something relevant to the conversation, then we'll V2 it.

You're never too old, you're never too limited in your knowledge to learn these skill sets.

You have modules with names like Stardust, Aurora, Nebulae...modules with celestial names, and I wondered if that was part of forming the brand identity at the outset. I noticed on your website that you describe Qu-Bit modules as being of the "Future Coast" method of synthesis. How would you describe "Future Coast Synthesis?"

The term "alien" comes to mind and I think that does speak to a lot of the things we're going for with the Qu-Bit brand; the unexplored world of sound, the things that haven't come up yet. What are the sounds that we'll be able to do in the future, that we aren't able to do now, or we weren't able to do prior? A lot of this space imagery is inspiring to us and fits what we're trying to do in the rack; to explore outer worlds of sound. I was largely inspired by the computer music world and all of the academic, esoteric stuff that was happening in purely computer-based compositions; a lot of stuff done in text-based programming languages, like Csound, Cmix, and Super Collider. It was so far away from your traditional subtractive synth workflow, so esoteric, abstract and forward thinking, that I wanted to find a way to take the magic that you have in these timbres from the computer music world and get that into the modular rack. When you really think about it, we're so early on in computer generation of sound, it's easy to get lulled into the sense that we've done it all. We have our physical modeling, we have our subtractive, we have additive...We've seen it all, and now we're just rehashing all this stuff. But with the digital frontier of sound generation, the sky's the limit, and we're really just getting started with all of these techniques. We're trying to be at the forefront of that and push the envelope of not just what we could do digitally, but what we can do on embedded hardware—digital hardware,

Photo Spread: Andrew Ikenberry holding the Qu-Bit Stardust.
 Page 30: Ikenberry at work.
 Page 31: Qu-Bit Bloom, Stardust, Mojave, Nautilus modules.
 Page 32: Automated assembly lines.
 Page 33: Electrosmith Daisies: Daisy Seed, Patch Submodule, Pod, Patch.
 Init(), and Patch.
 Page 34: Ikenberry at the warehouse.
 Page 35: 2hp Lunchbox.
 All photos provided by Andrew Ikenberry



This is just a dream story of what's possible with this technology.

audio design and processing. I love sound, and I love new sounds. That's a driving force. I always want to find new ways of doing things and new types of music and I'm always trying to keep my eyes and my ears open for these new techniques and new sounds.

Running three companies under one roof, how do you handle all the production? Do you have enough facilities to run production of the Daisy and the Nebulae V2 at the same time, and then to be shipping out orders? That seems like a lot.

It is a lot. We're lucky that we have two automated assembly lines that allow us to run two products simultaneously so we can assemble two different circuit board designs at the same time. One line is just building Daisies, that's all it does, that never changes. It will build Daisy Seeds, and then it'll do the Patch Submodules, and so on and so forth. The other line, we swap out. So that'll build a Qu-Bit module, or a 2hp module, or a Noise Engineering module or something like that. That line is doing changeover once every day, or once every three days at the most.

How challenging is it to do manufacturing for other companies?

It's really interesting in a lot of ways and it helps us learn a lot. It's one thing to be good at manufacturing the boards you design; it's a whole other skill set to be good at manufacturing other people's boards.

In what way?

Overall, it helps us to raise the quality. Think of it like this: We design with our own small part set. We have all the files stored locally. We can walk over there and talk to the person who's operating the machine, the person who set up the machine or is programming the machine, and it's all really easy. It's easy to do a good job when you're only building your own stuff. Once you're building someone else's product, just communicating all of the

assets becomes a serious thing to overcome. You don't realize how important basic file management is until you've done electronics manufacturing. Just keeping all the revisions straight is a serious task; it sounds simpler than it is. Transferring all of the files and keeping them up to date and preventing bad data from getting mixed in is something we have to do. On top of that, you throw in an entirely new supply chain, an entirely new system of parts, a new way of designing, a different layout for your boards, and it creates a vast amount of complexity, which in manufacturing is really just a battle against entropy: Everything wants to descend into chaos every single day, and your job is to keep those forces at bay. That becomes imminently more important when you're working with other people's designs. One thing it helped us to do was to get a lot better at building boards because we needed to get a lot more organized and strict on top of everything, and it helped us to learn more about the way the larger industry works. At this point, I've visited countless other contract manufacturers that build military boards, or are building motherboards for HP, etc.. We go to these shops and we're studying the techniques and the tactics they're using, and then we're applying that to our Eurorack modules. These aren't going into space, they're not going into weapons, but it's important to build them right and we're always striving to do that. Building other people's boards forced us to become that type of manufacturer instead of just saying, "This is good enough for our own boards." Building for other people forced us to take this craft really seriously.

You work with Chompi Club, how did you meet up with them? Did they come to you before they launched their Kickstarter, or was that something afterwards? Did you advise them on that as well?

The Chompi is an incredible story. I knew Tobias and Chelsea (Hendrickson) from way back when they did Techno Logic (Ed. - A community synth organization based in Spokane, WA), where they were running

CONTINUED ON PAGE 73

EARSPACE

by Robin Rimbaud



**It all began with a black and white photo,
chanced upon in a book on the history of
twentieth century music.**

A decidedly cool-looking fellow: sharp suited, cigarette precariously balanced on his lip, cleanly cropped hair, a knowing smile, confident, playful, his hand moving over an indeterminate machine, surrounded by a bank of reel-to-reel tape machines and other enticing analogue gear. A caption underneath revealed his name – Tod Dockstader (1932–2015). Even his name was modish. I had to search out his music, which at the time was most certainly a challenge in the late eighties. A cassette tape was to be the revelation that led me on a provocative journey into his mutant sound world.

A series of sonic postcards broadcast from the furthest regions of the universe, *Eight Electronic Pieces* (1961) plays today as if time is compressed. Sirens speed past, a radio dial is turned, an evaporating heartbeat pulses beside a cartoonish swish, sizzling filaments explode in the light, undulating aliens transport their space cargo as industrial kettles boil, a ball bounces as oscillators rumble and tumble across this futuristic horizon. There is no map to guide you on this journey.

Name-checked by both Autechre and Aphex Twin as an inspiration, Dockstader was a recording engineer who created sound effects for *Tom and Jerry* and *Mr. Magoo* cartoons in his daylight hours. When his work colleagues left at the end of the day, he would remain in the studio, "organising sound," as he called it, experimenting with magnetic tape and tone generators. Taking inspiration from the chance operations of John Cage, combined with Edgar Varèse's astonishing *musique concrète* *Poème électronique* (1958), he admitted he never knew where the work was going or would end: "In the early pieces on this record I simply set two or three tapes of sounds going at once – chance combinations, accidental themes, chaos – all were recorded. Then I sat down and edited the half-hour result into three or four or five minutes, into something that seemed to be a "piece."

Almost sixty years after release, *Eight Electronic Pieces* continues to challenge and surprise, flirting with chaos at every turn, like a shepherd trying to reign in his sheep as they try to escape the sonic pen. This is the sound of someone thinking beyond time and music, sculpting the future out of their present and past. But why is Dockstader not better known, his name rarely appearing alongside those of other sonic pioneers of electronic music, such as Stockhausen or Xenakis?

One rather dispiriting truth is that Dockstader didn't emerge from the refines of conservatory music or the academic world. Indeed, he was largely self-taught and ironically even rejected by the influential Columbia-Princeton Electronic Music Center in the early 1960s, possibly due to his lack of formal musical training. Without this connection and long before artists could share their work on streaming networks and social sites, it meant his work largely remained on the edges, beyond even the grasps of those who might be interested.

Add to that was the fact that he worked in cartoons and TV, which was seen at the time as something rather low brow, and it

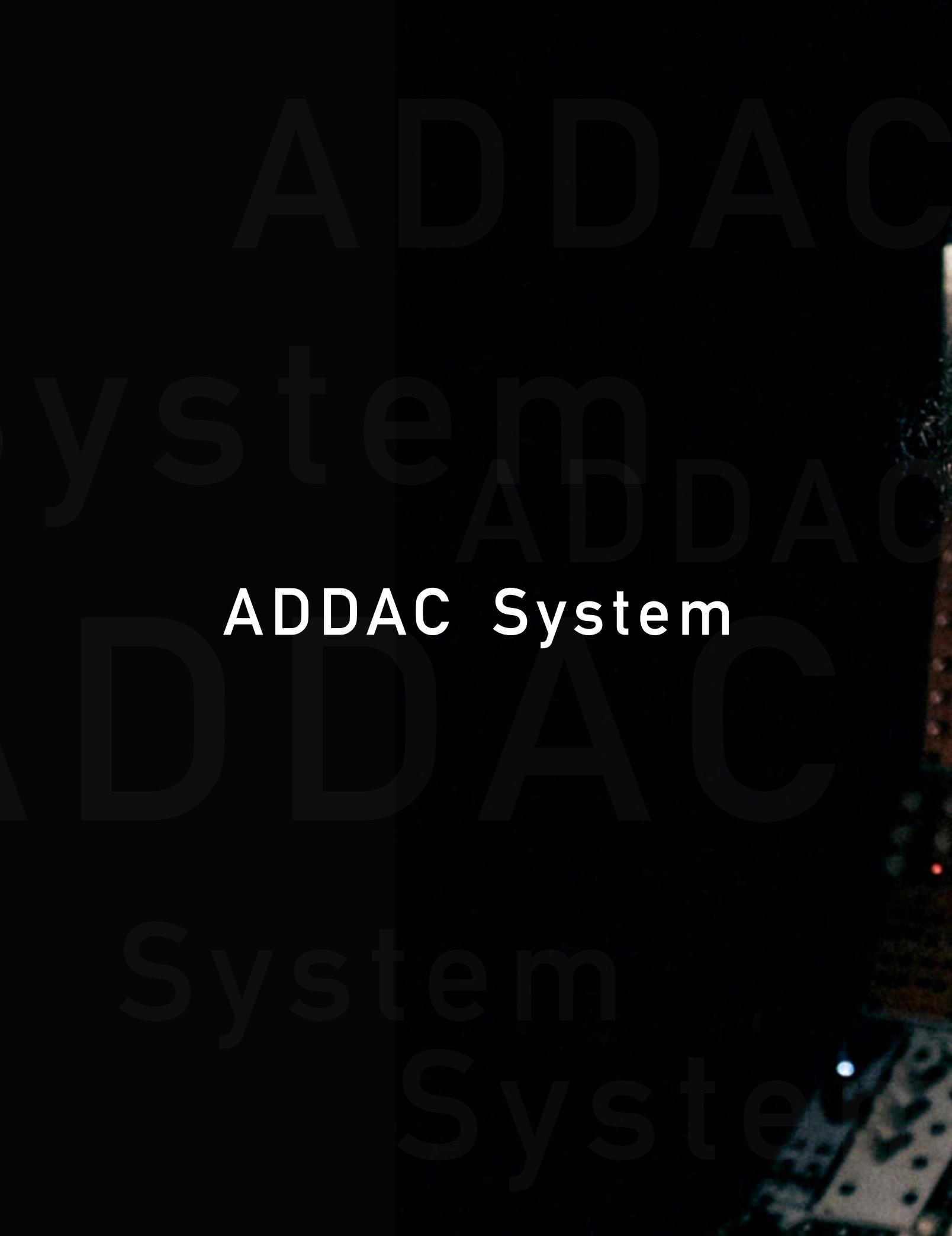


Above: Dockstader at Gotham recording studio, circa 1965.
Photo provided by internet search

meant his position was even more marginalised and the world of "serious" music continued to ignore him. It's demonstrative of how times have changed, since today, diversity is seen as such a positive thing.

Curiously, for many people, it's been his rediscovery through contemporary independent record labels that have opened the world up to Dockstader's music. Releases from labels such as Sub Rosa in Belgium and Starkland in the USA have brought his music into wider circulation, with critics raving about the "striking originality" of the music, and his "poetic vision." Fortunately too, you can also now enjoy eight full-length albums worth of music on streaming services, carefully selected from over 4,200 audio files that were left behind after his death. Now, Dockstader can be comfortably spoken about in the company of such veritable champions of sound such as Luening, Varèse, Schaeffer and Subotnick.

This story isn't unique to Dockstader. There are countless artists who shall remain ever obscure, and certainly the history of 20th century music is littered with figures who remained fiercely independent and worked on the edges of any recognised system. With visionaries such as Daphne Oram, Bebe Barron or Else Marie Pade rediscovered in recent years, only time we tell who we will all discover next, and that's one of the joy of time passing. None of these artists will ever be household names, but how much does that matter? Let's remember to embrace what we have in the present, and let their music inspire, intrigue and unsettle us. Let the sonic architects of the past speak to the future!



ADDAC System





It took me a couple years to get there, to realize that this might be something that I could do for a long time, something I felt very good about doing.

Many Eurorack companies create their modules from the needs, desires, and curiosities of their founders, and Lisbon-based ADDAC Systems is no different. ADDAC's André Gonçalves' passion to integrate digital technology into synthesizers as well as his desire to inject controlled random chance and organic movement into modular, are the driving force behind many of ADDAC's releases. Modules like the ADDAC112 VC Looper + Granular, ADDAC403 VC Time Signature Clock, ADDAC508 Swell Physics (which emits CV from the theoretical interaction of ocean buoys), and ADDAC310 Pressure to Wind CV Controller (which lets you control parameters through your breathing), are just a few examples of the companies commitment to pushing out into new ways to create sound.

A visual and musical artist, Gonçalves took a detour from an academic path to focus on ADDAC. He discovered rock climbing after being an avid skateboarder for years; the physicality of climbing, along with the particular mental focus and visualization that it requires, has translated well into his work and company. Along with modules, ADDAC makes cases and frames of all sizes, pedals, and even made a small run of ADDAC skateboards, adorned with their modules for the artwork, so that Gonçalves could offer local Portuguese skaters some affordable skate decks.

Celebrating fifteen years in business, ADDAC continues to grow, expanding their product line and reaching new artists and musicians in the process.

Waveform: You just celebrated fifteen years in business. 2009, the year you began, was sort of the start of the second wave of modular. How long had you been involved with it before setting up shop?

ADDAC System: I bought my first module and then two Doepfer cases around 2005. Then, in 2009, I quit my job and was trying to make it as an artist and musician. I had a lot of free time, but I didn't have much money, so I started developing some modules that I didn't have in my system and thought could be interesting. I made a few prototypes, and once they were done, I published it on Modwiggler and YouTube, and it started from there.

Do you remember the first time you thought that maybe this was something that you could do for fifteen or more years?

It took me a couple years to get there, to realize that this might be something that I could do for a long time, something I felt very good about doing. I used to meet a lot of artists and musicians in exhibitions and festivals, and at some point I was on the other side, not a peer, but a facilitator, and I was good with that. I didn't feel diminished by going from the artist to the provider or the engineer

What kind of art were you doing up to that point?

Visual arts, lots of robotics, computer vision, all the early multimedia stuff happening at the moment in the early to late 2000s. At the time, I was represented by a gallery, and in 2008-9 with the crash, the galleries stopped because there was no money being invested in art. That took three, four years to recover, especially here, and for artists, it was like a forced hiatus. So that made me try some other stuff.

Do you have a background in design? Did you study robotics?

I studied visual and industrial design and then I started working at a design company, coding for the web in the early 2000s. Then I started to try to use sensors via MIDI with I-CubeX, which was the first platform that you could plug and play with different types of sensors, be it light, tilt, or pressure. You could use it with MIDI VM and Max MSP, so I was coding pretty much everything in Max MSP for my music, and then at some point, with installations, I started to learn electronics to control motors and servos and using lots of basic stamps, even before the Arduino. When the Arduino came in, I was using a lot of that, and I started getting into electronics because of these more robotic automations that I needed to do for the (art) pieces. At some point, I thought maybe I could code an audio module. At the time, there were few digital modules in Eurorack. Coming from Max MSP, there were a few things that I really needed, and one of them was a WAV player. That (.Wav Player) was one of the first ADDAC modules, or the first that was successful. Actually, that module made me do the whole thing. I needed that on my system, because all the analog stuff that I had wouldn't allow me to generate the complexity that I wanted. Doing a lot of sample processing on Max MSP, and being used to doing that, I felt that because I was still using the computer on the side, if I could do everything enclosed and with a dedicated interface...It was me trying to get the tools that I was using in the computer into modular. My idea was to use an SD card that could load much more and access some of the functions; pitch or sample rate, and also the start position, the length and such things. When I finished it, I uploaded the video and everything onto YouTube and I made a post on ModWiggler. It was very late, maybe

around four in the morning, so I went to bed. The next day I woke up, and I had seventy orders, which was like, "Whoa! What?!"

How hard was the .Wav Player to make back then?

Because it's digital circuitry, I was okay with doing it. It was later when I had to learn more about filters and VCAs and all that, where it became a bit harder, because I had to go in depth into electronic theory. That was very interesting, but these first things were digital, and in the digital domain, if you follow the data sheet....

You mentioned before that one of the things you were doing was working with sensors. We just reviewed the Pressure to CV Wind Controller in our last issue, and you have a whole line of sensors with the heartbeat sensor, the pulse sensor...is that something you envisioned, a system where you could hook it up to anything that can generate a pulse or a beat?

In a way. I really like sources that are not precise but that you can control somehow so that it's not simply a white noise that you sample. I like to go in depth with control on random. Sometimes generating digital random numbers is not that interesting. I always find these controls a little bit like that as well, because if you have, like, a light sensor, if you want to control it with a flashlight or whatever, you can still use it as a proper interface and use it as a proximity sensor. But if you just leave it there, in the environment, and if the environment has some light changes, then you'll have some sort of randomness coming out of that sensor. It's not exactly like you're measuring light, it's just a random source that you use as an organic random instead of a forced electronic or digital generation thing. Even with the heartbeat.

Hopefully that's not too random (laughs).

It can be, because if you use it to advance some sequencing tool, that is not a sequencer. For example, if you connect it to Stages from Mutable Instruments, you can change the state of your patch with it. Maybe you plug it in a way that it's not completely plugged in, and sometimes it reacts and sometimes it doesn't. I

Maybe you plug it in a way that it's not completely plugged in, and sometimes it reacts and sometimes it doesn't.



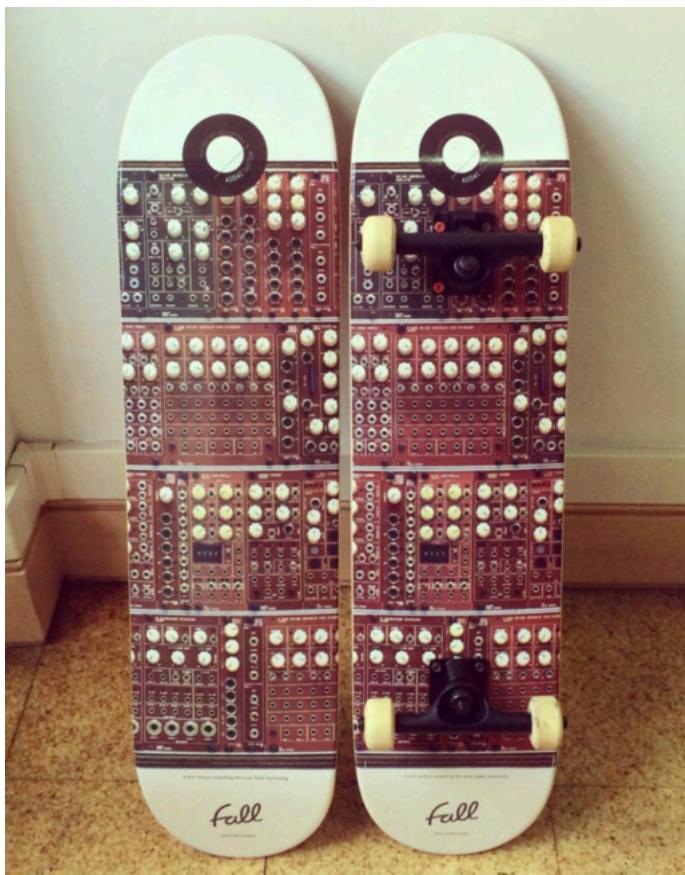


Photo Spread: André Gonçalves.

Photo by Vera Marmelo

Page 40: *Exercises in Style*, Installation, 2012.

Page 41: ADDAC System modules: Random Bezier Waves, VC Time, Intuitive Quantizer, VC Looper & Granular Processor.

This page: ADDAC Skateboard decks.

Page 43: Pressure to CV module.

Page 44: Triple Gate pedal.

Page 45: ADDAC 15U Foldable Frame.

All photos provided by ADDAC System.

“That's it. This is what I'm into now.” I was completely addicted.

really don't want it to get in sync with my heart (laughs), but I still use it in that sort of way, to generate something random. Sometimes I use dividers because your heartbeat is too fast for random generations, and then you pass it through a probability or something, and that's not steady. It's random, but you can't say it's completely random; it's a controlled system to use in other creative ways that are quite useful.

I like what you said with the heart sensor; if you move it just a little bit, maybe it will trigger some of the time, and maybe it won't. Hopefully that's due to the trigger and not the heartbeat! So do you use this in your current setup?

Actually, the heart (sensor) is your pulse, or you can put it on the earlobe. It's measuring blood flow, because when the blood is pumped, it gets a little bit more opaque, and it detects that change in light, basically.

Are you sometimes setting that up and doing the breath sensor as well? Do you make music that way, hooked up to a bunch of sensors?

I don't have it connected to something that you can really see me operate, like a light sensor or something. Normally it's there and doing some minor modulations, or triggering every once in a while. It's not like the Bezier or the Swell Physics (modules). Normally you can hear those more obviously, you can locate them. But these always have some background function that is

not so straightforward. That's how I envisioned people using it. I always know that you can use it in a straightforward way, with a heartbeat or other references, but you can also use it in a totally unorthodox way. I think that it may even give you more interesting results. How many times do you need a small modulation? You don't want it to be noticeable, but you want it to change somehow. These sorts of things can be very easy to manage, and because they have specific envelopes, they give you different types of reactions. The way I approach them is to be used in a very broad sense, not in a straight way.

When you're performing or using that system on your own, do you ever try to manipulate how your body acts in order to make specific modulation changes, like breathing faster or holding your breath or anything like that?

I'm a very absent performer; I barely move. (laughs) Normally, I use either projection or light, or different combinations of how to project stuff, like projecting over the audience and filling up the space with haze, and getting all those kinds of lasers without being lasers. I've used lasers as well, like controlled from the modular and then you have more direction, which becomes a little bit like the Vectrex that people have been using for a while. I also have a Vectrex, so sometimes I also use it. It works as an X, Y oscilloscope. I'm not plugging the audio into the Vectrex, or into these things; I process it somehow to get some visual results that I like. I find some kind of dramaturgy that I can follow during the gig that can evolve. So it starts with something, and

then the reaction maybe changes a few times throughout the concert, and is completely dynamic and reacting to the music. It feels like it's together, but not in the purest sense that it's raw, like the sound that you're hearing is totally the image that you're seeing. I won't be manipulating these things in a performative way at all, I'm shy in that sense, I like to be behind something, or with my back to the audience, with the modular facing (the crowd), so you can look at the modular and not me.

So before ADDAC really started, were you doing more performance and music, or gallery art? You said you had a gallerist.

Sometimes I would mix both things, like some gallery pieces became performance settings, or a piece I could use. I had this one piece that was a balloon just floating on a fan, and I repurposed that to concerts. I would fill up a balloon, put it on the fan, and the balloon was by my side. I would be playing, and then with the amplitude of the sound, the fan would blow harder, and the balloon would levitate, so as soon as the sound goes up, the balloon is projected up, and then it kind of comes tumbling down, and as the volume comes up again, the balloon would pick up.

You were so experienced with Max MSP and coding. Did you also do projections in that realm, via the computer?

...we found hamburger and hot dog cases in paper, so that's the packaging now.

I used to program visuals, background projections, in Max MSP and Jitter, but then it became so common that I felt the need to let go of projectors and try something else, so I used Super 8 projectors for a while. I've always been trying to find what I can do next in a performance, to complement the music with something. I have to have something else that people can look at, that makes the music become bigger, the experience richer.

What kind of music were you into growing up?

In high school, I was always in the metal scene, but then I got into no-wave, Sonic Youth, and more abstract rock, and then in the 2000s Raster-Noton and early minimal techno. Then Tim Hecker, Ben Frost, and also music based on field recordings, more electro-acoustic music as well, free jazz, and all that type of exploratory on the fringe stuff.

Were you playing in metal or free jazz bands in high school?

Yeah, guitar.

Do you still play guitar?

Just for fun. I still play the same high school stuff, the Melvins...that's the only song that I can play on a guitar...that and "Greensleeves," because I studied classical guitar for a while. I trained so much, and only now can I play the last part, because there are these riffs that are quite fast, and you have to do this fast hammer on, pull off thing. Just the other day, I was like "Oh, I can do this!" I didn't practice, but suddenly my body could do it.

There's something with your neurons to muscle firing or whatever; I could never be fast on a guitar. I trained. Scales up and down, up and down. I could never get too fast. Like there's some latency in my inner processor, or whatever. When I was young, it bugged me like, "Ah, shit. I have to do it some other way."

You've got to figure out your style. Don't you think it's odd when your mind and body are able to do something out of the blue like that, something it couldn't do before? Obviously, the capability is there, but what unleashes it?

I started climbing in the last two years, so I grew a lot of finger strength and forearm strength. I don't know if there's any influence from there, if it translates somehow, but I can do it now, which was something that I could never do properly. I used to fake it with more fuzz, but now I can do it.

Is there anything more fuzz can't fix? A while ago I learned about visualization techniques, and it helped me learn certain things like doing hammer-ons on a guitar. I would visualize something first, and when I tried to do it, it was like I already had worked on it. It really helped me get better.

You have another awareness. The visualization is actually pretty impressive because you memorize stuff that you really need to do

in that split second, and if you're thinking about it, then consciously you're forcing your body to do it. In climbing, it's the same thing, planning the moves, and knowing how the body needs to move.

I've tried climbing, and it's brutal on the wrists. Do you like climbing walls, or do you go outside?

I do both. I mostly go to a gym close by to the studio, but then every once in a while, I try to go to the rock. It's so nice. I used to be a skateboarder...I skated for ages, until my knees were





bothering me, and I stopped doing everything. But I was feeling the need of pushing some energy out and my high school had a climbing wall, and I'd climbed for two years, so when a friend told me that he was climbing, I went one day. I got there, and I was like, "That's it. This is what I'm into now." I was completely addicted.

How often do you do that?

Three times a week, religiously. I hate repetitive sports, like running. I can't run. No way. Only if I'm late to get somewhere can I run. I can ride my bike to go home and back to work, but I'm not going to do twenty, forty kilometers on a bike just for the sake of it; I can't deal with it. Climbing just gives me that extra...it's like a puzzle. You have to sort it out, and you have to train to get better, and learn and understand your body more. I really love it. That's my escape.

I noticed that at one point you sold an ADDAC skateboard on your website.

If there's the idea, then I will go the extra step.

Yeah, I was always going to the same skate park, and it's the skate park close to a poor neighborhood. I would always watch the kids struggle to get a new board, and I decided to make a run (of boards). I put some online to sell on our website, and for the kids, I was just (selling them) for whatever I paid for the boards. It was a nice thing to do.

I skated as well, and growing up, skateboards were like fifty bucks, which was a lot as a kid. It was really hard to afford the new board.

Exactly. And my parents didn't like me to skateboard, so I wasn't allowed to buy boards. Sometimes I could get a board from a friend that was an old board that was a little bit better than my board, but it was only when I grew up and I got out of my parents house and came to live in Lisbon and was working when I bought my second new board.

On top of skateboards and modules, you guys have a lot of stuff for sale, like, cases, racks... How do you manage having so many types of products?

We are a team of ten at the moment and most of them are on the modules, like making, testing, and assembling. Then a couple more people are taking care of emails, orders, processing, assembling, packaging and finishing the modules, cleaning up,

and all of that. I think in a way, that saves us, because we have so much that there's always something selling. We've never had a big seller. I think the module we sold the most was the quantizer. I know that a lot of the things we do are so specific that it's niche, but there's always someone that is like, "Oh, these make sense on my system." We have two or three people on the frames, and those are something that I have a lot of fun doing. I like being creative; I can't stop thinking of ideas.

Is everything manufactured in Portugal?

Pretty much all materials are provided in Portugal, though of course, you can't get parts or PCBs here.

You're one of a few companies I noticed where the boxes you send the modules in are made of recycled cardboard, and they come wrapped in a paper bag instead of bubble wrap. Even the screws come in a paper envelope. I even saw on your website that you've got a machine that cuts down cardboard so you can use it for packaging material.

We made an effort. I'm a designer, and I have a lot of fun doing module boxes, but also, because we don't sell thousands, it doesn't scale up to make a dedicated box for each module. It's expensive, and that's an extra price that I would have to pass on to the consumer. And why? Especially because a lot of the time you're going to immediately throw it in the trash. I always use the recycled cardboard standard, because I can buy in bulk and have that price reduced; it's a tiny fraction of what it would cost. Recently, we were still using bubble wrap, and in the last two

years, we decided we have to exclude that from the equation, and all plastic that we can exclude from packaging. Besides our big cases for the frames, where we use plastic tape and some bubble wrap, we are using paper tape for most of the modules and most of the packaging, except if the package is too big, or we're shipping to some place where the boxes might get wet, then we'll cover them in plastic tape.

I know that a lot of manufacturers wrap modules in plastic for electromagnetic and static electricity reasons. You haven't had any problems with that?

On some modules, like the granular (ADDAC112 VC Looper and Granular Processor), we use a shielding plastic bag, but other analog modules, we've never had issues. Now we ship all modules in a standard paper bag, to protect it from the dust of the shredded paper that we used to fill in to cushion the module on transport. Everything is recycled cardboard. Sometimes I lose hours just trying to search (for packaging). Like today, I just got some new packaging materials for the pedals, and they are so small that we didn't have any box to fit them in, especially the long one. The measurements are not compatible with most of the boxes, so I was looking for packaging, and we found hamburger and hot dog cases in paper, so that's the packaging now.

That's pretty funny. You brought up your granular module.

That's a hefty one, kind of a flagship for ADDAC. Was that a long process designing that?

I think it was eight years. Maybe two and a half years of development, but I had the basis for it coded six years prior to that. The module was working, but I could never get the firmware update to be easy. We had the quantizer, where in the early days, we had a few issues and it was cumbersome to update that firmware. It's not even that hard of a process, but it's something that most users are not used to doing, so everything had to be explained in a very detailed way. I didn't want it to fall into that cumbersome process again. I tried another platform, and another platform, and it was getting somewhere, but I still wasn't happy. And then QuBit did the Seed. He had the memory; he had the speed; he had the community, and it's well done.

Are you the sole designer for all ADDAC System products, or do you have a team of designers where you all collaborate?

Most of the stuff I do, and then I brainstorm with Ruben (Costa). Ruben has been my main helper since the start, since the .Wav Player. The morning when I woke up and saw those orders, I called Ruben and said, "I need help. Do you want to do this with me?" He's been helping me since, and he also has his brand, Teia modules. We brainstorm on things, so if I'm working on something new, I'll show it to him, and we'll talk about it, and a little bit the same with his stuff.

So you have been working together for fifteen years?

Yeah. It's been good, especially because we know each other. He tests all our modules. He's quite good at it.

How did you two meet?

We were the only guys with modules playing in these experimental venues and we started talking. I knew that he was assembling, doing his own modules, like kits from Music from Outer Space and Ken Stone and all that early stuff.

When you first started out, was it just you two and then it kind of kept growing? How did you find the process of growing a company?

It's been scary...I've been very conservative...In the start, it was only me and Reuben, we've only have trained an engineer for the last four years. Most of the stuff that we did in the beginning was paid in advance. People would pay, and then we'd assemble the thing. It was always this thing of making ten modules, and then getting that money and then slowly and steadily growing until the point that I needed someone else. In a way, it has always been very organic, the way it grew. A friend of

mine needed something to do, like if we had cables to solder or something like packaging, putting boxes together, putting some frames...That's Filipe (Felizardo), who was my third person coming in. There was another guy, who I taught when I was a teacher in a professional school here, and when he left school, he called me and said that he would really like to work with me. On my budget, because we're still small and everybody earns above minimum wage, we don't have much profit at the end of the year. If we're getting profit, I'll raise the salaries for everybody.

I don't think too many companies operate like that.

I love doing this stuff. I don't need a car; I don't have a driver's license. I have a home. I never bought gear. That's how I've been conservative. I've always been saving. I never went too big. We've never had a big fancy space or anything like that. We don't need to go to the fanciest place, or be right in the center of whatever.

I think it says a lot about your philosophy, and explains one of the reasons that you have been around for fifteen years. You mentioned that you were a teacher for a bit. What were you teaching?

Workshops in Arduino, visual coding, like processing open frameworks for C++. I also taught electronics and the history of contemporary music in a professional school here in Lisbon for a few years.

So you were on an academic route at some point?

I was in a PhD for computer music and I had already started doing the modules, and that was actually my research study. I made papers about our first modules, like how I structured them, what's the need, responding to what problem and so on. I stayed there for about three years and I did a few papers that got published, but then I had to stop and do the thesis. At some point, I was either going to do modules or do the thesis. Modules are way more interesting, so I froze the PhD. If I want to, I think I can still go back and finish it, but it's not something that is in my mind at all.

CONTINUED ON PAGE 75



GEAR REVIEWS



WMD Performance Mixer MKII wmdevices.com

When WMD announced their closure at the end of 2022, it was an enormous bummer. After seventeen years in business, the Colorado-based company had cemented themselves as an important cornerstone in the industry. Not only were they steadfast in their forward-thinking and unique designs, but they also helped many small designers manufacture and distribute

No other Euro mixer looks like or has Performance Mixer MKII's deep capabilities.

their modules and helped others turn ideas into reality. Their absence left a hole that was felt by many, and it must have left a hole with them as well as they regrouped, re-energized, and refocused, announcing a return in early 2024, albeit with the business taking on a different form. No longer making modules for other companies, WMD is now focusing their efforts solely on their own ideas, which have freed headspace and bandwidth, and therefore are now free to do things like release arguably the most fully featured Eurorack mixer ever made.

The long awaited update to their original mammoth mixer, Performance Mixer MKII builds on its predecessor, fixing a few things, adding a few, and streamlining the building process with some future-proofing (e.g., the Patchbay, Power board, and Master section are all separate PCBs, making fixing/replacement

ability to CV Level and Pan, X-fade between two inputs on one channel, Mute, add Aux sends pre or post fader (Aux 2, which can also be VCA'd!), mix a bit behind the scenes with a DJ style Cue, assign Group Mutes (fave feature), send your mix out via MIDI into a DAW (for easier mixing in the box), expand it up to a twenty-four (!) track mixer, and listen in headphones. And it's not just the inputs/tracks that are stereo; everything is, including busses, aux channels, and the cue mix.

The tech specs are excellent (too long to list here), with less noise than before, and the workflow is well thought out, with all jacks on the left side, leaving the mixing surface completely clear. Light up faders, input Gain, channel features and Master meter help

with navigation as well. I've learned to RTFM post unboxing, but I'm familiar with mixers of all sorts, so I thought I'd jump right in. Once I had a layout, I was happy with

(melody/noise/ambience channels 1-4, bass in 5, kick 6, snare 7, and other percussion 8) I went about setting up Mute groups. Instead of solo buttons, if you want to break it down to one or two elements, a Mute Group is the way to go. Really, it's more of a mix/mute snapshot as you save the mute configurations of a current setting into one of eight slots. I try to be methodical from module to module for stuff like this, so in Mute Group 1 nothing is muted, Group 8 everything is muted, and in between there are various combinations. It makes it easy to jump from complete muted silence to a full-blown mix. For example, if I need to be able to quickly break everything down to just kick, snare, and bass, I saved that in Group 6 as that's the first percussion track (bass on 6). When I want to bring everything back in, I just hold Group and 1 (full mix) and on the button release the Mute Group

takes effect. No matter the song, keeping everything aligned in this way makes it easy to remember, and easy to play, and it's this thoughtfulness that abounds throughout PM MKII.

Each channel has a Pan or X-Fade toggle. Since each channel is stereo, with two different inputs, say, two kicks, in X-Fade mode you can blend them together to create one distinct kick, like you would a sub-mix. Pan mode is just as powerful for one channel as you can get true stereo movement but also go fully L or R where one channel could have two flavors. In conjunction with the two auxiliary channels, as well as CV control for every L and R input, the mixing capabilities are pretty vast.

I've always viewed mixing as a utility, something you home in on AFTER you've perfected the parts of a track, whether that be more of a rock band-type of structure, a dance track, or something more free form. Other than getting the correct gain structure for a track, changing levels, doing some muting, and finding the perfect location in the stereo spectrum, for me, mixing was something that, for the most part, was end-of-chain, set-ish-and forget (ish). I would never say that, other than doing "final" mixes on an old Tascam 388, I'd never really played a mixer as an instrument, but I was determined to try this with PM MKII; and after a short time, I found myself using, and

...this mixer has changed my live game, and that's not hyperbole.

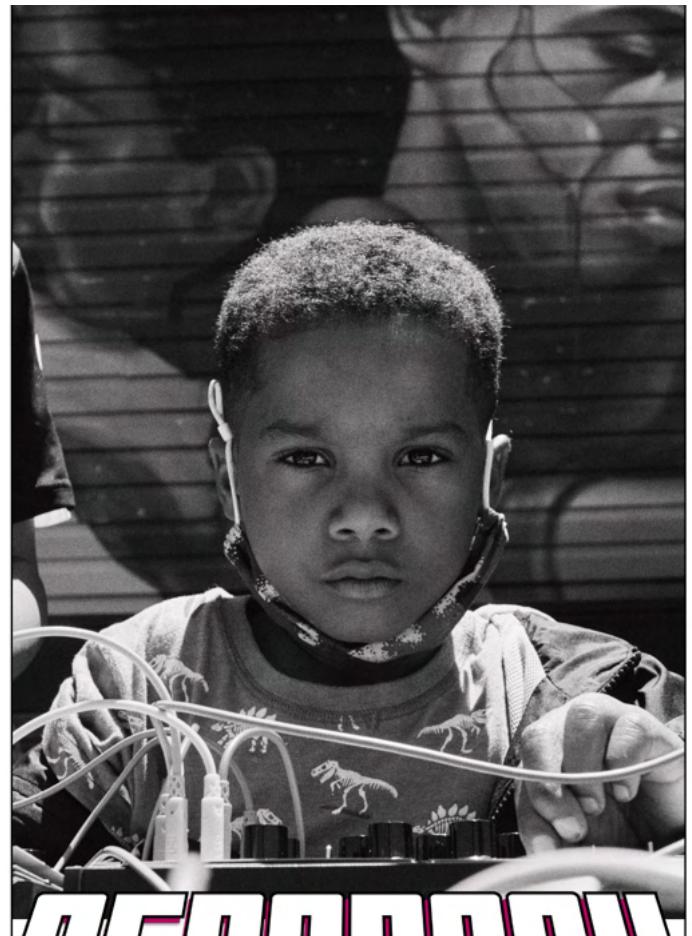
thinking of it as more of a controller than a mixer. Playing with it in the stereo field pushed me into using more true stereo tracks than before, giving my tracks more depth and dimension. As a tactile controller, I love the light up faders. They felt excellent and sturdy, as did the knobs and the overall build, though the Gain and Aux controls for each are of the trimpot variety and not quite as robust as the more used Pan/X-Fade or Master controls, which I'm guessing is a space consideration. We're seeing more and more "performance-based" modules, and it makes sense; showing up to gig, or hanging out in your basement even, we're in an era where not only is anything possible, but everything is tweakable, bringing incredible depth to a performance.

WMD also sent the Returns expansion module, which offers three more Aux channels with attenuation, and the Direct Outs module, for sending out each stereo track to another destination. I put them all in a row in a skiff in front of my main rig, and it brought my live set up a notch (or two). For a hands-on performance mixer built for Eurorack, PM MKII is the top of the heap. It does come with a boutique price, and for sure it takes up a lot of space, but if you're serious about having a versatile, well laid out, excellent sounding and thoughtfully constructed mixer for live (or not), then look no further. I'm surprised at just how much this mixer has changed my live game, and that's not hyperbole.

As an aside, WMD, I'm sure this is something you've heard since your announcement about coming back a while ago, but really, can you ever hear it enough? We're glad you're here/back!

- Ellison Wolf

Price: Mixer \$1499, Returns \$139, Direct Outs \$99



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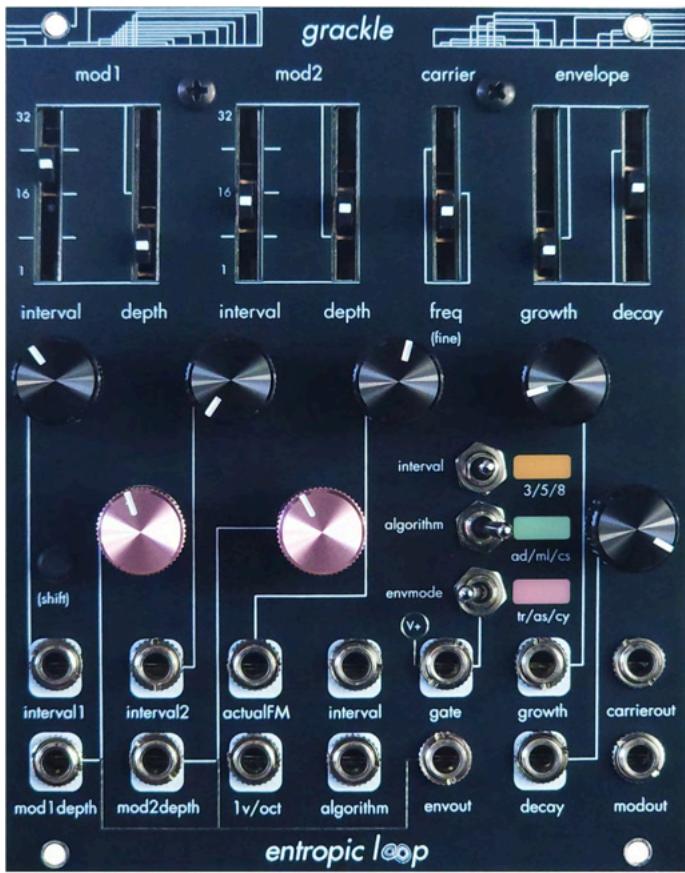


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Entropic Loop Grackle

entropicloop.com

Entropic Loop is a new company that's a collaboration between Omiindustries' Naomi Mitchell and programmer/musician Eris Fairbanks, and their first module release, Grackle, will hopefully be the first of many to come. A three-operator FM synth voice, Grackle has all the accoutrements that you would want from any great sound source module; almost every parameter is CVable (most with attenuation), it has a nice playable topography with a good mix of knobs, sliders, and toggles, the layout is just spacious-enough, and there's even some extra flair in the Dusty Mauve knobs and pastel LED colors.

With two Modulator oscillator channels and one Carrier, the interplay between the three channels is rooted in some serious mathematics; fractions in this case. I've always loved fractions—I

only a Frequency control, which can also be modulated by external CV (and with a Shift button can do fine tuning), and there are outputs for both the Carrier oscillator, and a combined output for the two Modulators. There's an onboard envelope which affects the Carrier, triggered by patching in an external gate. The envelope has Growth and Decay sliders (which can be CV controlled and attenuated) and three modes of operation: tr (triggered), as (asymmetric slew), and cy (cycling) to shape to the envelope, and this can also be CV controlled to switch between the modes. There's an Envelope output as well to use with external modules or for some self-patching.

In terms of the math and how Grackle creates sound via fractions, it does so by selecting which of the three Intervals to choose from for the denominator of the fraction (3,5, or 8), and the numerator, of which is chosen by the Interval sliders for each Modulator, where the marked numbers 1,16, and 32, found on the left of each control give a little foothold, and this is quantized to whole numbers for more friendly fractioning.

Holding Shift and moving either of the Interval sliders its full span will enter "unlocked mode" for the Mod oscillators, turning off the quantization of their value. In this mode you can get thru-zero frequency modulation for the mod oscillators, which is pretty cool, though I wish there were some visual indication, some LED that blinks or something, just for easy ID.

It's interesting to note that when CV is applied to the Intervals, positive values modulate the numerator and negative CV values tweak the denominator, which can get pretty crazy—mathematically/fractionally speaking for sure—when in unlocked mode. 19.6375 divided by 16? Calm blue ocean, calm blue ocean, calm bl...

Once your fraction is determined, it's then multiplied by the frequency of the Carrier frequency, thereby giving you your mathematically deduced sound. I wonder if Entropic Loop had to hold back when designing this, including the more conventional knob and slider controls instead of a numerical keyboard to punch in the fractions, like live coding an FM synth, but either way, moving any of these main parameters can cause great sonic change—no surprise there. You can control the pitch via a 1V/Oct input and add CV in to modulate the FM amount as well. Depending on what algorithm is selected—there are three to choose from: ad (addition), ml (multiply), and cs (cascade).

In Add and Cascade modes, the Depth controls simply control the amplitude of the two mod oscillators, but in Multiply mode, the second mod oscillator's Depth controls both oscillator's amplitude that are then multiplied together and then Mod 1's Depth adds some wavefolding afterwards. What this all means is that between the three Algorithm modes, you can get all manner

It's one of the most inspiring sound source modules I've come across lately...

find them soothing and orderly (at least until you're forced to de-fractionalize it by dividing the numerator by denominator, and then my need for order opens the floodgates and anxiety starts to creep in) and Grackle has a lot of fractional variety on hand. Each of the two Modulator Channels has Interval and Depth slide controls, and both can be CV controlled. The Carrier has

of sound from typical FM'y metallic bursts to beautiful punchy bells to crisp electronic kicks. You can also patch in CV to modulate going from algo to algo.

Using both outputs, with the Carrier as a somewhat melody, and the Mod output as a swirling background pad, I was able to craft some great tracks; some spooky and otherworldly, others very

rooted in an AI dystopia. All of which, with just Grackle as my only source and using the two outputs through some reverbs and delays, were very full and interesting. The movement Grackle makes, the changing of sounds, can be extremely compelling, addictive almost, and Grackle works very well for exploring percussion sounds. Patching in CV for slowly evolving soundscapes on the Mod Intervals proved really inspiring. I loved so many of the sounds I was getting, not so much that they were "different" than a more typical FM synth or module, but more of an extension, more of a deeper exploration of FM in general. With related ramp and triangle modulation tastefully patched into the Interval CV inputs on both Modulator channels, I got absolutely beautiful, stepped and cascading metallic lines that sounded like a fun 80s cartoon chase theme, further exemplified when I increased the CV amount on both and nailed a variety of 80s video game sounds.

CVing the Algorithm mode created interesting patterns through the sonic variations, and shifted smoothly and seamlessly between them. Going from a slow phasey PM'y sound to robotic garbles to metallic clangs, first slowly to hear the shifts, then quickly, was a lot of fun and created some great melodic rhythms. Again, the sounds coming out of Grackle—at almost every stage of testing—was nothing short of mesmerizing. I just love Grackle's sound.

Exploring Grackle's more rhythmic capabilities, in Cycling mode, by adjusting Growth and Decay in the lower portions of their controls, you can get some intense ratcheting and since

both parameters can be CV'd, you can get some greatly changing rhythms out of the Carrier output, since that output has the most pronounced effect from the envelope.

Whether you understand, memorize, or care at all about the numbers, the fractions...the math that makes the module, it makes no difference; Grackle is incredibly fun to play and very inspiring. It's not hard to get recognizable sounds and tones, but you can get some incredibly unique ones as well. While so many modules lend themselves to experimentation, something about Grackle—maybe it's the interaction of the Carrier and Mods, maybe it's the algorithms, maybe it's all that math—is more fun to crunch numbers with than most. It's one of the most inspiring sound source modules I've come across lately, and highly recommended.

- Ian Rapp

Price: \$600

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An advertisement for the band JAKOJAKO. At the top, the band name "JAKOJAKO" is written in large red capital letters. Below it is a portrait of a woman with dark hair pulled back, wearing a light-colored, patterned traditional-style top. In the bottom left corner, there is promotional text in red: "TẾT 41 OUT NOW ON MUTE". Below that is the website "jakojako.bandcamp.com". In the bottom right corner, there are small icons for social media and file sharing services.



1010music Bento 1010music.com

1010music's Bento Box, their flagship sample production lab, is the natural progression and summation of some of their previous feature-packed products, more specifically their Blackbox sampler. At 8" x 8.5," it's bigger than any other 1010 device and contains many of the winning features from other 1010 products like their nanobox lemondrop granular synth and their Bluebox mixer, and adds upon and addresses some of the wish list features many have had with some of the other desktop boxes, like having

It feels good in hand—or on lap—it's lightweight (at about 2 lbs.), and the build quality of the unit feels great.

a built-in rechargeable battery (yes!), and a bigger screen. It's smaller than an Ableton Push or MPC, and I found the overall size great; perfect for portability. It feels good in hand—or on lap—it's lightweight (at about 2 lbs.), and the build quality of the unit feels great. The enclosure is on point, the knobs are solid, the velocity and pressure-sensitive pads are perfectly responsive, and it can be charged via USB (and host via USB, too). Located on the back there are plenty of ins and outs (3.5mm for audio, headphones, and MIDI) for interfacing with other devices, though they are a bit hard to read as the text is embossed in the black plastic of the case as opposed to being screened on in another color. It's easy enough to label these on the back of the unit to remedy this, as I did, and I would recommend doing so. As for the screen, Bento's got a really nice looking, very visible,

full color multi-touch (you can use two fingers to zoom!) 6" x 2.5" display, which is a pleasure to use (for the most part; I'll get to that), indoors or out, and offers up a lot of information. Overall, I really like Bento's construction and makeup for music making; the mix of pads and knobs, along with the screen and specs are perfect for playing and portability, and most importantly, Bento sounds great.

As for how it functions, it's a little more of a nuanced answer. As of this writing, Bento is not a finished product—it's past its infancy, but not yet into adulthood—and it seems a lot of features will be added in future firmware updates. There are still some things (like Song and Scene) that are laid out on the hardware side that aren't implemented yet on the software side, so these are easy to predict as forthcoming, but other features that I'd love to see, may or may not make their way into Bento. This is something to keep in mind, and only time will tell how it all plays out, but 1010 is run by people I believe in and their track record speaks for itself. Also, as of this writing, there is no full manual for Bento, but there are a few video tutorials, definitely enough to get started with and go deep on your own, as using Bento is intuitive enough, and navigating and exploring is a snap. There's a lot in Bento, and I feel confident in saying that I pushed nearly every button, pressed every arrow, turned every encoder, touched the screen all over, to find my way to make music on Bento and discover its power and navigation.

Bento has eight endless encoders, the touch screen, four directional arrow pads, twelve navigation pads (Tracks, Inst, Launch, Seq, Song, Scene, Mixer, FX, Proj, and Rec, Stop, and Play), and sixteen touch and pressure-sensitive pads. Sometimes you use the arrows to get somewhere or select something, sometimes the screen, and sometimes the encoders. There is some overlap between the various methods, but there were times/screens where the arrows would move things around but the encoders did nothing, and likewise, times, like while choosing an instrument, where only scrolling and touching the screen would navigate where needed, when it felt like the knobs might be easier and better to use here. It could be because of what is upcoming in Bento, where the knobs or arrows are going to be

functioning in a certain way for something else, but that's hard to know, and it did sometimes feel strange to be on a page where some of the navigational tools had no effect on anything. Either way, all navigation modes feel great, and even when figuring out how to move around, it worked really well. Nothing is too complicated or too deep in terms of access, something I really appreciate to get/keep a flow going.

As for its mode of operation, there are eight tracks in which you can put five types of instruments: One-shot (like drum kits, which have up to sixteen different sample slots), Loops (again, up to sixteen sample slots), Multi-samples, Granular, and Slicer. You can load all sorts of presets that come with Bento, and the ways you can customize each sound and preset are vast. Level, filter, overdrive, modulation (for almost anything), pitch...if it's a

parameter that is standard for tweaking a sample, grain, or instrument on a DAW or groovebox/workstation, it's probably in there (or forthcoming). Navigating through these and adjusting each is intuitive, even with some of the navigation gaps, and makes working with Bento really pleasurable. You can also add reverb, delay, and a modulation effect (phaser, chorus, or flanger + distortion)—each of which can be modified greatly—on a per pad or per sample basis, and there is global reverb and delay. There is no preset saving right now, but I'm going to assume that is on the list of upcoming features.

As for global settings, you can configure each project's root note, choose from twenty-three scales, select a swing amount, and set its tempo. The instrument presets that come loaded into Bento cover a lot of ground and sound great. From pads to synths to basses to Foley, I expect the library for this will only get bigger and stronger, though it's already off to a decent start, and you can customize the instruments immensely. I would love to see arpeggiation and a hold/latch function added.

The Mixer screen is where you can adjust output and track levels, along with reverb (which has a freeze function...nice) and delay levels for each track, and mute them as well. Talking about a freeze function, you can freeze a note by hitting an up or down arrow while playing a pad for a keyboard type instrument, and while this feels more like a glitch, it's a nice feature to have. When you do it this way, it also changes the octave of the instrument, so you need to move the octave

back to the original position and hit the frozen note to unfreeze it (unless you also want to change the octave), though this can be done while the note is frozen.

The Launch screen will be familiar to anyone who's used to launching clips in Ableton Live in Session View. There are four clip slots per track, and though I'd like more, one problem if this increased would be that the screen real estate would make it so you would have to scroll down, so not all clips would be seen, or all of the clip squares would have to be smaller to get them all on one page, though this would make them harder to see and trigger correctly. As for triggering, launching multiple clips at once would be easier if you could group them together and hit one of the pads in the group to trigger the clip group it's in. Add to that, the ability to be able to easily toggle on and off the groups would add some flexibility to it all. Ditto this for having mix groups as well. Also, it'd be great if on the Launch screen you could easily copy/paste clips to duplicate them, move them around in their clip hierarchy, as well as delete clips. As of now, you're stuck with them once they're created, whether a clip is empty or not.

The sequencer is really the heart of Bento, and each instrument can be sequenced on its own, with up to four different sequences for each (the four clip slots). You can add steps one at a time, or record steps as you play in real time. You can edit each step via its start point, length, location, velocity, and probability, and you can also edit the sequence's global parameters: quantize size, step length, and step count, as well as clear steps (and sequences) and double the overall sequence length. The touch screen allows you to zoom in on a selection, and even select multiple steps for

clearing, which is nice, though programming a sequence one step at a time, especially if you want a detailed drum sequence using all sixteen samples, can be a bit tedious, especially with fingers. I wound up using a stylus to select steps/events, and that made it easier to set everything up. One issue that I have the way it is now is that when you select a step, it either creates or erases it; there's no way to select an already created step via touch for editing purposes. You either need to scroll through the steps to get to the one you'd like, or you need to edit a step at the outset of its creation. Also, while you can swing a project, I'd love to see per step swing. I love having everything all nice and tidy on a grid, but the ability to make syrupy, stuttery, off-kilter grooves with micro-tonal (another wish!) melodies would be sweet. It would also be great if on the Sequencer page you could scroll through every track (and each track's four sequences) instead of having to navigate back to the Track screen to select the desired track in order to view its sequence, then go back to the Sequence page.

One thing I really wanted was a way to audition a sample without needing to play the track, which was a problem if there was a sequence for any track or instrument recorded, as that would start playback for everything. But in order to do so, you have to hit play, starting any sequence. Ditto for auditioning loops. Also,

you can't sequence loops at this time, which would be nice, even

if potentially o v e r w h e l m i n g sonically, as loop length could mean that samples pile up on one another. You can do this now during playback,

and it can be quite interesting to do so.

I really wanted to try out recording directly into Bento and slice, dice, and mangle up recordings and I did this with both audio (just some random song part straight out of my computer) and capturing audio with a Shure SM58 microphone. The input level was pretty low with the mic, so an amp of some sort (or a more powerful mic) could be helpful, but after turning the gain and overdrive up in Bento, the sample was plenty audible, and it was, of course, really fun tweaking the sample; modulating the pitch, adding ping-pong delay, and a bit of filtering. The ability to create and save presets, tracks, and instruments in this way is something I hope gets streamlined more as time goes on, as it's one of the things I'm most excited about with Bento. I really want to use Bento as a field recording sample player.

As a granular instrument, if you've used the 1010 nanobox lemondrop, you'll be good to go right away, as it's got the same granular engine. With two samples that you can play, filter, modulate, customize, mix with a VCO, and overall debauch, it's a flexible and feature-laden mode that really benefits from having a larger screen, as does the Slicer. Slicing up audio and manipulating it was pretty

CONTINUED ON PAGE 72





Expert Sleepers Disting NT expert-sleepers.co.uk

Has it really been five years since Expert Sleepers released the disting EX Super Alpha? Eleven since the first incarnation of the disting? Time certainly moves quickly, but I'm not sure it outpaces the speed at which technology moves. Comparing the disting MKI to the newest evolution of the disting series, the disting NT (what does the NT mean?!), is like comparing apples to satellites; and it's worth stating that while tech has advanced greatly since the first disting's inception, all distings still work great and are valuable tools in any rig.

Still, the disting NT is its own breed. While the previous disting's

...it's much easier to navigate and parse out information because of the bigger screen, along with the larger footprint of the module.

were related, built up from some of the same code and algorithms as their predecessors, NT was built fresh: new code, new algos, new tech...NT? This new approach has meant that NT has the years of testing and playing that has gone into its design, incorporating a more streamlined approach in places (bigger screen!), and a larger scope of possibility than its forebears. According to Expert Sleepers, the direction NT is going to take will be determined in large part by user feedback, and it's nice to know that somewhere in the world your voice, your vote will count towards making this world (or at least your modular) a

better place. Speaking of better...while EX is/was great, and has a decent screen, NT is like seeing a movie in the theater compared to on your old Sony Ericsson phone. There's still the understated, sparse layout of the controls that is consistent with all of Expert Sleepers' digital modules, but it's much easier to navigate and parse out information because of the bigger screen, along with the larger footprint of the module. Let's be honest, the small or non-existent displays were always the only thing holding back any of the previous distings. Not any longer. Though the screen isn't anything luxurious, and tired eyes still wish it could be a bit bigger. Either way, I couldn't wait to dig in and figure it all out, and while earlier distings could only run one algorithm at a time (EX could do one or two), NT can run a bunch at once—separately, or stacked on one another, and along with the screen, this is the biggest change.

Usually, the size of a screen on a module is a good indicator of its complexity, and that is the case here. NT isn't necessarily weighed down with controls; it has only three pots, two endless encoders, and four small push buttons (along with twelve inputs and six outputs), but within that combination there is a lot of possibility and a lot to learn, as witnessed by the 268 page disting NT manual. Granted, each algorithm gets its own page or more of explanation/navigation, but that's a lot of words...and a lot of work, on both ends. Usually this equals a bit of a headache, and there were some, for sure, but NT makes things as easy as it could be by putting its screen, knobs and buttons to good use, melding them nicely with one another. The screen is, of course, the key here; configured to show what each control will do, with the functions more or less located directly above said control, and there is a built in redundancy to configuring the functions, parameters, and routing, so that one has various ways to get somewhere, and can find the method that works best and go that route. You can configure things via fold out menus (menu diving!) or use the single line of menu text at top of the screen, depending on what screen you're currently in. There are other "tricks" for streamlining NT's operation, and I can only imagine that getting more familiar with it in time will open up more little menu shortcuts and a much quicker workflow. The menus are pretty intuitive, even for those who are menu averse. There's nothing to decrypt; on the contrary, it's only the navigation of the whole thing that truly needs figuring out.

Maybe it's because I was already familiar with EX's functionality,

but still, I was surprised how quickly I was able to get started with NT and get deep with it, tweaking and setting things up. This was all done mostly with ease, though there was definitely some random panic pushing of buttons trying to get to a specific screen or submenu. Again, NT is forgiving here; I never fell off the proverbial cliff during my push button panic attacks and I think overall it's quite a bit easier to get around than the former versions. The larger screen really does make a huge difference, both in navigation and confidence in navigation.

The ability to stack algorithms is perhaps NT's greatest strength

as you can do it all in-house if you like, and with some fanciful routing, turn NT into a fully fledged synth. Starting with a sample, you can trigger it via internal CV, and then thread that sample through various effects, eqs, utilities...you name it. While patching in an effect was pretty easy and straightforward, dialing in a sample took some time to get going. You have to load the sample, route the gates, triggers, and outputs, set the notes (if you're sampling an instrument), etc. The first time I did it, I felt

overall. NT is so versatile, and it works with so many things; Spin FV-1 programs, MIDI devices, user written code, and you can add some of Expert Sleepers' to NT as expanders of sorts—it already comes with the 2HP TMB (Tiny MIDI Breakout module)—adding extra CVs, MIDI connections, inputs, gates, etc. for certain algorithms. There's really nothing that NT doesn't reach, or is built to reach in the future.

This is a deep module that is going to get deeper. I still think the

The ability to stack algorithms is perhaps NT's greatest strength as you can do it all in-house if you like, and with some fanciful routing, turn NT into a fully fledged synth.

like there was a lot of scrolling and setup, accidental button pushing and re-doing of things. The second time, it was much easier, and the third—all starting from scratch, of course—and NT's workflow and ideology started to sync.

In terms of features, if there's something you want, it's probably in there, and if it isn't yet, it's probably going to be soon. The word is that eventually all the past disting features will be added to the NT, adding to the vast uses NT already possesses. One thing I always felt a little pressured by, especially with EX, was to use any of the distings as something more than say, an attenuator. They're so powerful, it always felt a bit like a waste to use either the whole module (like with the early distings) or one half (like on EX) for something basic and utilitarian. With so many options—six on board outputs—I don't feel that way. If I need to use an adder or something on a patch, I don't feel like I'm wasting all of this potential with NT, and that feels like a big deal. With the six outputs, it's possible to use all six as dense effect/utility/sound source/etc., at least until you run out of processing power, which is displayed for each algorithm that's running on the main screen.

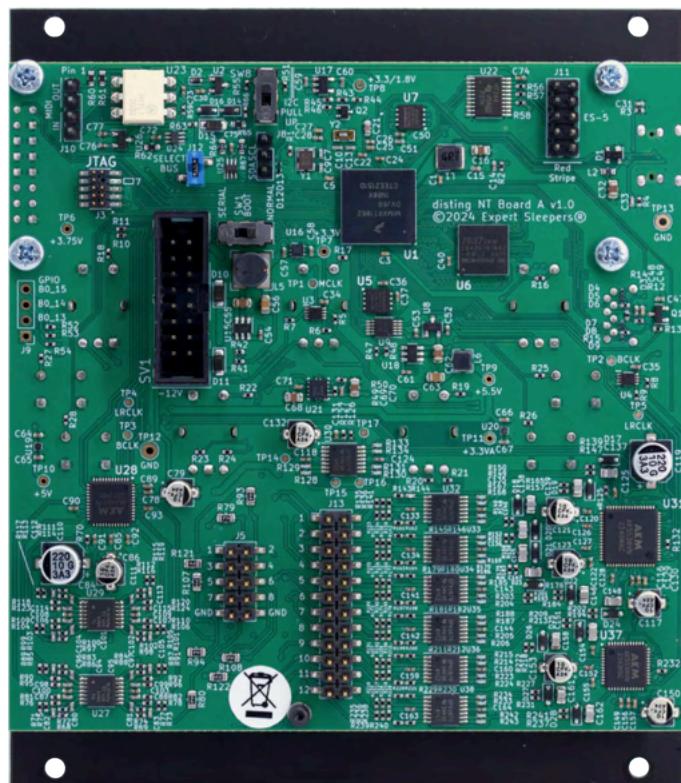
As you would imagine, NT has extremely flexible routing, and channels can be mono or stereo, you can edit, save, recall, tweak, import and play samples, and do any of that sort of stuff to any of the algorithms. You can even use a C++ API to write your own plugins and load them into NT.

Once I figured out the way NT works, it was mostly smooth sailing, though again, some things took time to configure correctly. I ran into some gain staging issues, where I had to tame some incoming signals into NT so that my signal wouldn't clip, but that's more user issue/error than anything else, and understanding signal flow helps with this. I wish that every algorithm that processed an incoming signal had an input and output level control, along with the mix control, which they have. Sometimes, when I'd be running the bitcrusher through the phaser through the delay through the reverb, I would have distortion and artifacts (not caused by the effects) from my gain staging issue, and though it was usually happening in the reverb, it still took a minute to track it down and recalibrate everything. One of the elements I really like about NT is that you can easily audition the position of effects in your effects chain by moving things around. You have to do some menu diving for this, and I do wish it could be even easier (drag and drop? I know, I know...it's not a touch screen!), but this is a pretty strong feature

older distings have a ton of value and I find use for them in my rig all the time as utility gaps, for whenever I need something that I don't have a dedicated module for, or need another instance of something, but NT pushes this concept even further, to an almost absurd degree. The reverbs and delays sound great, the utilities are useful, it's got polyphonic sampling, MIDI control, expandability, a decent screen, is vastly configurable, and so much more that I haven't even touched on. With user feedback contributing to its functions, a future-built platform, and a company with a longstanding history of continually adding value to its products, disting NT promises to be around for a long while.

- Jason Czyryk

Price: \$699





Matrix VCF AJH Synth ajhsynth.com

Featuring all fifteen of the famed Oberheim Matrix 12 synth filter options, plus an additional All-Pass four-pole phaser mode, totalling a whopping sixteen filters available in one module, AJH Synths raises the bar more than you'd ever think was possible for what constitutes a multi-mode filter with their Matrix VCF. But wait, there's more! Matrix VCF also has a Polyvox-inspired overdrive circuit for each of the chosen filters, effectively offering thirty-two total flavors of filtering under one 14HP roof, all while retaining an all-analog signal path. Craziness.

The filter modes available are Low Pass and High Pass (each offering from one to four poles), Band Pass (two or four poles), Notch, and four combination filter types (Two Pole HP + One Pole LP, Three Pole HP + One Pole LP, Three Pole AP + One Pole LP, and Two Pole Notch + One Pole LP), along with the four pole AP phaser, all neatly displayed along the left side of the module, illuminated with an LED next to each for whichever filter is in operation at the time. There are controls for Frequency (with CV input for modulation, where the control becomes an attenuator) and Resonance (with CV input). There are In and Out controls, with the Output being a VCA that can be modulated with CV, and there's a 1V/Oct input for tracking the filter within a three to five octave range. 1/3 and 2/3 inputs for tracking the cutoff frequency at 3V/Oct and 2V/Oct respectively are also on tap, and of course, saving the most obviously desired feature for what the Matrix VCF offers for last; yes, you can modulate the filter mode, with the

Mode control becoming an attenuator when patched.

With so many filter types here and such different behavior for each type, you'll soon grasp how handy the In and Out are for getting a nice level. An LED near the Output will flash red when the signal is too hot, and switching from filter to filter can keep you busy getting levels right so that you don't have any unwanted distortion, especially when you factor in a healthy amount of resonance. Because of this, modulating the Mode can have issues in terms of levels, but we'll get to that.

Matrix VCF operates foremost as an excellent traditional multi-mode filter module. If you've ever had the pleasure of being able to play the Oberheim Matrix 12 in the flesh, as I have—once, about a decade ago; a neighbor of mine had one—it's a synth that leaves an indelible impression. I was pretty green and wasn't able to navigate the synth very well (i.e., at all!), but my neighbor was well versed in it and would punch up settings, then allow me to noodle away. I remember being awestruck by both the possibilities the Matrix 12 offered and the incredible sound coming out of my neighbor's custom made studio monitors; it was a transformative moment. Until then, I really thought a synthesizer was just an electronic keyboard with weird sounds and didn't fully understand the science or technology behind it all. It set me on the path of synths and electronic music that I've been on ever since.

Even though my monitors are off-the-shelf mid levels, and my studio is nowhere near as acoustically blessed or equipmentally stacked as my old neighbor's, the AJH Matrix VCF sounds every bit as impressive as the Oberheim to my ears. With so many different modes, you can get nearly any filter sound and behavior that you could want, so that creating kicks and snares with every filter type (why not?!), dialing up long mutating drones, and using the Matrix VCF for traditional filter uses only demonstrates how versatile this module is. It might just be the most bang for the buck VCF ever. Really. And while the clean filtering is on point—almost utilitarian at this point—with the P-Vox (Polyvox) mode on, the Matrix VCF really shines, or rather shreds. The interaction in this mode when the resonance is at a certain amount—depending on the filter type—

can be truly gnarly. Again, you really have to watch your in and out levels to make sure you're not getting harsh distortion (unless, of course, that's what you want), but the P-Vox setting really pushes this filter over the edge, and a lot of times over the limit.

The 1/3 and 2/3 inputs are really interesting for keyboard tracking, but used as extra modulation inputs (to give a total of four (for the frequency + resonance),) Matrix VCF can do all sorts of things that other filters could only dream of.

Of course, the crème de la crème of Matrix VCF is being able to cycle through the filter modes, going from one to another, though there is one caveat, in that there can be pops—which is totally normal and expected (and explained well in the manual)—that can happen when switching filter types. No matter, if sequenced or modulated at a more rapid pace, it's not so noticeable, and modulating this at audio rate, it becomes more or less part of the sound. Plus, there are workarounds for this by creatively employing various envelopes and techniques and part of the fun of all this modular stuff is problem solving, which is also why modular is so addictive. And also why modular rigs so often start off with nice, modest intentions, only to balloon into gargantuan setups oh so often.

As for modulating the Mode at audio rate, it brought this filter's usage to another level. Patching in a static square wave audio rate signal into the Mode CV input and tweaking the Mode amount and the frequency and res controls, and also the frequency of the VCO to nearly LFO rate and back again, brought me to new sonic territory, in a ring mod realm, but with less metallic over and undertones. Shaping the sound, using Matrix VCF as more of a sound source in this way, provided some stunning moments. Switching between tracking the VCO that was patched into the Mode CV input and tracking with the 1V/Oct input on Matrix VCF to see which I liked better was interesting. I found myself slightly mesmerized watching the range of modes change with the sequenced VCO—how many modes were being cycled through—due to the voltage change of a melodic sequence as opposed to, say, a fully cycling peak-to-peak LFO.

As for that range of modes, using Five 12's QV-L I was able to dial up a triangle LFO

with just the right amount of level and offset to pick the location of the filter mode range on Matrix CF and span of modes to where I could cycle through any number of filters, and using a random square wave LFO I could move through the selected range in a non-linear, more organic fashion.

Pursuing further this type of exercise, it's possible to program/sequence filter types by figuring out each filters CV value ($5V/16 = 0.3125V$ from filter to filter), though it's even easier using something like Joranalogue's Step 8 to use the sliders of each stage to select the required voltage for each filter mode on Matrix VCF. Just remember that the Mode control becomes an attenuator when CV is patched, so make sure it's fully CW if you want the full span of all sixteen filters. I decided I wanted to sequence only the four LP filters and figured out the voltage amounts needed to access each; (one pole $=+3.75V$, two pole $=+1.25V$, three pole $=+4.375V$, and four pole $=+1.875V$). It was a fun math/sequencing exercise and, with some modulation of the frequency and resonance that was synced to the main clock I was using, it created some pretty interesting rhythmic variation to match the pitch changes. Each note was tied to a particular filter type, and therefore had its own specific tone, which could be sculpted further in a myriad of ways. For my LPF only purposes, the differences tended to be somewhat subtle until I added enough resonance to make them more distinct, but it gave me a glimpse into what a more detailed version of this exercise could be. Also, using something like Step 8 for this made selecting the various filter modes a breeze.

Choosing even just a few filter types to sequence made me realize how powerful that could be, and the filtering minutiae available with this methodology is quite vast. Really, outside of just having a ridiculous amount of filter types in one module to audition, this is where the golden sonic explorations lie, that would take many more modules to do in any other instance. This is the most flexible and versatile filter I've ever come across. Bar none.

Filters are not something you have one of and are all set for life in modular, at least not in my case; far from it. There are so many flavors, types, and uses it'd be

tempting to build a giant wall of nothing but VCFs. But for those not going that route, the Matrix VCF covers so much ground, and covers it so well it's absurd, and not just in the normal filter use scenarios. It's a great sonic adventure partner. I feel spoiled with it, and I'm not sure I'll ever be satisfied with a normal LP/HP/BP multi-mode VCF ever again.

- Ian Rapp
Price: \$469

deals with the digital part. HV1 spans about eight octaves and it tracks nicely and accurately. One of the menu/screen items (we'll get more into that) has a tuner that displays exactly how accurate. The analog side of HV1 consists of an FM input with attenuation, a Sync to pair with an external VCO, a PWM control with CV in, and a 1V/Oct input. HV1 outputs four analog waves: sine, triangle, pulse, and sawtooth, all contained in an "Analog Core" labeled section. The triangle wave of this section is fed into a digital phase shifter, which takes up the right side of HV1.

The digital side of the module follows suit with the same four waveshapes as outputs, along with a 16-bit / 150kHz resolution wavetable output. Even though this is the "digital side" of the module, the four basic waveshapes here are also analog derived. A Phase Angle control that goes from approximately 0-720 degrees and a Lin PM CV input with an attenuator (labeled "PM CV") moves those waves around in relation to the analog waves, and naturally, modulating this can bring about all kinds of shifty goodness. There is also a Wavetable Morph control with CV in and attenuation, and an assignable (Bitcrush or Wavefolding) external CV input.

The screen/menu part of HV1 is kept very much tamped down and is easily manageable. There are only two screen modes: Tune and Menu. Tune is a one pager that shows the tuning, whether your analog side is in VCO or LFO mode, and the phase angle between the left and right side outputs. With a long press of the endless encoder, you can tune/detune either side, and you can lock the tuning as well for each. The Menu page is a little more in-depth, but with up/down and left/right arrows, navigation is pretty basic. Here you can see the wavetables in action and scroll through and select the wavetables available; further down is where you can enter the tuning mode. It's the Options page that's more feature packed, but again, not crazy deep, which doesn't mean it isn't powerful with rich features, it's just not feature rich. This could change, of course, with future firmware updates, and you can add to this by uploading your own wavetables via the front facing SD card. There are options



HV1 Hybrid Oscillator
Weston Precision Audio
westonaudio.com

HV1 isn't Weston Precision Audio's first go around with VCOs. As a matter of fact, it's their third currently available oscillator (not counting their AD110 drum and B2 kick/bassline modules); not to mention their previously released VCOs, of which there are more than a few. This is to point out that out of the nine modules in their lineup, one third is dedicated to VCOs. That shows some serious love in that department, and though HV1 shares traits with other WPA VCOs past and present, it more than justifies its existence in the WPA pantheon of oscillators.

A combination analog and digital oscillator, HV1 is Weston Precision Audio's first module with a screen, something I assume took a lot of consideration. HV1 uses an analog triangle core oscillator as its base that is fed into a digital circuit. The module is split into thirds: the top third is where the screen and menu controls live, while the bottom portion of the module is split in half; the left side has to do with the analog portion of the module, and the right side

for choosing FM Type (Lin Thru-Zero or Exponential), FM Coupling (AC or DC), Sync Type (Reset or Reverse), Wavefolding Algorithm (sine, phase multiplier, triangle, noise x phase multiplier, and added lo-fi bit-crushed phase). Scrolling down a little further gets you to page two, which is also the end of the menu. Page two lets you assign the Aux CV input (wavefolding or bitcrushing) for modulation of the Wavetable output, shift the right side triangle output up +1 octave, shift the Wavetable output down by one octave, and turn antialiasing on or off for the Wavetable out. Again, within these two pages there's a lot of configuration that can be had, a lot of opportunity to configure the sound.

Turning into LFO mode (all oscillators become LFOs) is pretty interesting as, since the digital oscillator is driven by the left side, this now-LFO effects the right side output, same as before, but this time if you push the right arrow for the screen/menu, you can see the movement of both oscillators and the relationship between them, which supplies a little more eye candy. With nine total waveform outputs on HV1, and with the ability to play with the phase relationship between the four left-side outputs and the five right-side outputs, that means that at any given time, you can have nine LFOs. While I probably won't use nine pitch-related VCOs too often, I can never have enough modulation available, and HV1 is a killer modulator. The eight basic waveforms are great, but the WT output, where it can be configured, phased, and manipulated in so many ways is like the special sauce on the burger, the icing on the cake, the far-out modulator on the modulation device.

While you can mess with the phasing between the two sides of HV1, as mentioned, you can also tune or detune each side separately, so that HV1 can be used as two separate but connected voices, since they're both controlled by the main oscillators CV inputs. You can get some dyads happening, harmonically or not quite so.

The screen animation is pretty informative, being able to watch the wavetable cycle through its paces when being modulated, and while small, the information provided is appreciated and well laid out and is as easy to read as a 0.5" x 1.0" OLED with tiny text can be.

Syncing the two oscillators by patching out of any output on the right side into the Sync in brought about interesting rhythmic squelches like HV1 was fighting itself a bit, struggling to stay afloat and in the realm of sonic audibility. FMing with another VCO, in this case Endorphin.es' Godspeed introduced a lot of destruction, but could be tamed a bit with the onboard attenuation. As a matter of fact, I found that I liked the sounds out of HV1 a bit more when I held back on modulating it—not an easy thing to do, this thing known as self control—and dialed in the sound and phasing on HV1 before adding modulation. It's pretty easy to get lost FMing and modulating and being tasteful was rewarded.

Obviously, as demonstrated by the discontinued PA0 Phase Animated Oscillator and now the HV1, Weston enjoys experimenting with phase, and I agree, it's fun to pit two waves against each other and phase them in and out of each other, sometimes in sync, sometimes not, to create unique rhythmic patterns. HV1 can handle either WaveEdit or Serum wavetable files, and as of this writing there are plenty of tables to experiment with (some provided by Chris Meyer of Learning Modular) and with the easy to get SD card, I assume more will be available in the future.

I would love to have the ability to use the Aux CV to cycle through the wavetable bank options, as doing so by hand by turning the encoder was quite cool.

HV1 is a really interesting module, excellent for thick and dirty basslines as well as complicated melodic runs. Actually, I got some of the best basslines I've ever had out of HV1 by detuning the WT output from the main's pulse output and CVing the phase on both. It was fun keeping the pulse output while auditioning the various wavetables to see the mixtures that could be created.

- Jason Czyeryk

Price: \$395



**CPM DS-2
Stylophone
stylophone.com**

While you might think of Dubreq as the company that makes the Stylophone, which, of course, they do, if you haven't been paying attention lately, their lineup includes more than just stylus-played synths. In the past few years the company has released some pretty interesting, well-priced instruments including their Theremin and Beat drum machine, and I've been enjoying the immediacy, portability, and sounds of their Gen X-1 synth, which I received as a Christmas gift about 4 years ago (a great gift, at that!). Their new CPM DS-2, a tabletop/Euro compatible drone synth, has those attributes as well, though with DS-2 Dubreq is stretching out a bit from the more offbeat, more unique electronic instruments they've produced up to this point. This is a good thing; the DS-2, while being familiar to anyone that's rocked a Euro rig or analog synth, is quite a fun little synth.

Consisting of a very flexible dual LFO channel, two VCOs with filters for each, and reverb and delay, DS-2 can do a lot more than just drone, though DS-2 is an all-analog (except for the digital reverb) drone machine. That's not hyperbole; "Drone Synth" is printed on the machine itself; that's the intention.

Laid out in the typical left-to-right analog synth fashion, there are two assignable and synced channels of fourteen different LFO shapes that go from 0.02Hz to 70Hz. While there is only the one Rate control that controls both LFOs' frequency, some of the LFOs have double the amount of waveforms for the same time period, which gives some pretty good familial variety. Either of the LFOs can be assigned to modulate either drone channel's oscillator pitch or waveshape, as well as their filter cutoff, and the amount of the LFOs for each can be dialed in with

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attenuverters for all of this.

Each Drone channel is a 3340-based oscillator, and they're identical; both with a switchable -1 or -2 sub-oscillator that can be mixed with the main variable waveshape. Each drone also has a 3320 chip-based switchable (LP or HP) filter with Resonance and Cutoff controls before being sent to a volume/mix output that can get into saturation territory if pushed past the 3:00 range. The two drones can be hard synched and pitch linked.

As for the effects, there's a PT2399-based delay with Dry/Wet, Time, Repeat, and LFO amount controls, and the reverb has quite a bit variety with eight algorithms—from plates to halls—and is based off of the Alesis/Wavefront AL3201 reverb. There's a little speaker on board, and a mix/headphone section for interfacing everything. DS-2 includes some cables, and a TS adapter to split the output from the Main out into both L and R channels for stereo operation, though there's no dynamic stereo movement, no ping-pong delay or anything. I did find it strange that the splitter cable is a TS, not a TRS, so that you get two identical channels out of it through that output. If you want to get separate channels, you'll have to grab a TRS splitter.

There are a total of twelve 3.5mm patch points; the drone channels have Pitch, PWM, Cutoff ins, and Main Out, and the LFO channel has Rate and Reset ins, and Wave I and Wave II outs. Because of this, it might seem that DS-2 is designed almost specifically to be used with a Eurorack rig, and in fact can be removed from its case to be mounted as a 42HP module. If that's not your bag, it can also be battery powered (x6 AA batteries included!) and DC powered. It was easy enough to remove from its case (after some outdoor playing, of course), and it fit right in, though, as DS-2's enclosure is plastic, and so is the faceplate, which isn't an issue really—it's plenty sturdy—but it's also the only module in my rack that does have a plastic (or non-aluminum or PCB material) faceplate.

The immediacy of the Dubreq aesthetic and playability is obvious from the outset; DS-2 is a lot of fun. I put it in my backpack and took it to a park on a nice sunny day, sitting far enough away from drone-averse dogs and dog owners to make some noise. I got some stares, mostly because I was one

of the few ones out there not multitasking; most everyone was on their phones while throwing balls to their dog, or on their phone while flying a kit, or on their phone eating a sandwich...DS-2 had my full attention, though I was sort of writing this review in my head while I was playing it, so I suppose I was doing some internal multi-tasking.

On its own, since there's no onboard sequencer (or stylus!) to pitch it with to create melodies and such, and I'd brought nothing else to play with it, I spent that time in droneland. With all the modulation and waveshape possibilities, there's plenty of movement and shifting of sound that can be done, and it was a lot of fun seeing how far I could stretch this little synth. The answer? Surprisingly far. When pitch-linked, the first oscillator's frequency controls both drones, where the second drone frequency controls the offset between the two and this can make for some really cool swarming type sounds. Sharing one LFO between the two oscillators, both affecting pitch, while one is on the positive side of the LFO depth chart while the other is on the negative, with every movement of the LFO they get further apart before coming back together, and that brought out a musty, breathing, organic feel. You can also sync it up to get some more pleasant, musical harmonics between the two notes, and adding in a good mixture of the sub oscillators for each channel can get a surprisingly full sound. Speaking of sound, the tiny speaker, even though it's not going to knock your socks off sonically, it adds to the portability of the whole experience. I also really like that everything that you need is on the front panel, which is consistent with other Dubreq releases.

There are a couple of things I need to mention. Along with the TS splitter cable, it would be nice to have a little grip or texture on the knobs to grab them easier, as well as having the pointer painted white for easier and faster identifications. Also, it's a little bit tricky to turn the LFOs fully off—to zero them completely (straight up position)—and to do so it worked best working with one oscillator at a time, turning the volume down in the other, so that you could listen to make sure that the LFO wasn't affecting the oscillator or filter on one channel before doing the same and moving on to the next. Center detent pots

would have helped.

Apparently, Dubreq is planning on making more synths like this, which will be able to be connected by the ribs on the side of each. They're off to a great start, as the DS-2 is a lot of fun and integrates easily into a CV-heavy setup, whether in the park or the basement. Dubreq obviously works really hard to come up with instruments that are unique and fun to play for all skill levels of musicians, and I'm really looking forward to seeing what else they come up with to pair with it, even though DS-2 stands strong on its own.

- Evan Morrow

Price: \$299



EF118 Vulcan's Hammer Electro-Faustus electrofaustus.com

The Roman god of fire, volcanos, and metalworking, Vulcan was the son of Jupiter and Juno, husband to Venus, and grew up underwater with sea mammals as friends. He was also an avid craftsman, and rumor has it that he made Jupiter's lightning bolts, weapons, and jewelry of all types. While that short, abbreviated list of biography and skills may seem incongruent, if not impressive, perhaps a certain maelstrom surrounding Vulcan's life would have calmed slightly, had he put his creative energies—and his trusty hammer—towards more constructive pursuits like making musical instruments instead of weapons (and also, if his father hadn't thrown him into a volcano). Make love, not war, remember? Well, where Vulcan left off in his artistic pursuits, the duo of Joe Vella and Eric Kessel, better known as Electro Faustus, have picked up, granted, quite a bit later. With their EF118 Vulcan's Hammer, Electro Faustus has crafted an accelerator-controlled oscillator, and has brought swinging, bashing, crushing and potentially

tenderizing out of Mount Etna and into the peripheries of your modular/synth/musical realm, whether it was their intention or not for the bashing part.

The Hammer itself, while made primarily of off-the-shelf parts found at both electronic supply and well-stocked hardware stores, is surprisingly robust, not that you'd want to take it to battle or anything. It is well-proportioned and replete with good balance and feels quite good in the hand when one wields it. And wield it, you must. With only an On/Off switch, a $\frac{1}{4}$ " mono output, and a volume control, there isn't much myth or mystery to this Hammer—no Wikipedia page for it yet—so it's easy to jump right in and get swinging. Or bashing.

As a sound source, EF118 emits only a simple, glitchy square wave. The Hammer is quantized—chromatically, I think, though it's hard to get it to sit still long enough to verify it. Waving the Hammer to and fro on a 180° axis results in stepped pitch changes (low to high or vice versa, depending on the orientation of the Hammer), spanning nearly four octaves, from approximately 100Hz to 2000Hz. In its raw form, the Hammer feels pretty limited, and waving it back and forth a few times is mildly enchanting with its brute glitchiness. Adding a slew of effects—reverb, delay, etc.—brings with it some power, and surprisingly, some beauty as well. The movement of the oscillator by swinging the Hammer around is simple, but can be resplendent. Whether moving slightly and slowly, or hammering away in rapid succession, some of the movements created unique sounds where the use for sound design was pretty evident. But this application, for me, was not where lightning strikes.

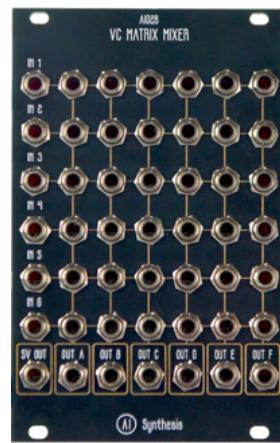
Using the Hammer to FM another VCO with its square wave, was quite interesting. The movements of the Hammer, again, created sounds that you can't easily get anywhere else. When I tried to replicate it with merely a square wave VCO, I really wasn't able to—glitchy quantization or not—the Hammer movement is that unique...and touchy. This became especially true when I decided to use it to crush raw walnuts. Oh yes, I did. I've long since moved on from the typical plants+synths tandem and try to bring food into the scenario as much as possible, so I put some walnuts on a sturdy work

table and smashed away (the walnuts were between plastic), obliterating those poor unsuspecting food items into smithereens. I was using the Hammer to FM the Joranalogue Cycle 5 using its Variwave output (which was being slowly modulated, with a sine LFO), and since the accelerator of the Hammer was mostly in the higher octaves being close to a 180° angle, it was the sound of the walnuts screaming. Typing this now makes me feel a bit like an ogre, but I was constantly telling myself that nuts have no feelings, and therefore that it was perfectly fine. Oh, the lies we tell ourselves. Bigger swings brought out more dramatic sounds and movement—bringin' down the hammer! —until I started to feel guilty (and hungry), and decided to stop. And have a snack. Of pulverized nuts. While I can't say that no walnuts were harmed during this experiment, they tasted pretty fine.

There are some caveats here. First, I would love to have the ability to get into LFO range with the Hammer for modulation use. There are way too many cool applications, from opening filters and VCAs to controlling effect amounts, that would benefit from the Hammer's idiosyncratic output. As well, if it could be used as a trigger/gate that could also be really interesting, though I suppose you could use the Hammer (or any hammer) to hit/activate a patched up gate or trigger switch.

It should go without saying that any instrument made so that you can swing, bash, crush things and (ahem) tenderize will find much use in the Waveform synth dungeon/test cook kitchen. While patching, tweaking, pressing, and touching are all nice physical interactions one has daily with an electronic instrument/modular synth, any "out-of-the-ordinary" way to become more physically involved with sound creation/manipulation is welcomed. Vulcan's Hammer is an interesting instrument: fun, quirky, and not as dangerous as it sounds, and is a good time and a unique way to create and interact with sound. Looking forward to the release of Vulcan's Sawzall.

- Ian Rapp
Price: \$199



AI028 Voltage Controlled Matrix Mixer
AI Synthesis
aisynthesis.com

I love showing friends who are familiar with my "strange hobby" (their words; I liken it more to an obsession) certain modules or instruments to see their reactions. Instruo's Scion always gets interesting responses when I explain what it does, and anything by Teenage Engineering or Landscape always gets my design-oriented friends excited, but I love nothing more than showing people something they can't make heads or tails of; that I'm excited about. AI Synthesis' AI028 Voltage Controlled Matrix Mixer is such a thing, with its no-nonsense academic, test-lab look. With nothing but a bunch of jacks (forty-nine, to be exact)—no pots, no switches, no screen or anything that lights up—it couldn't look less like something you'd use to make music with.

This isn't AI Synthesis' first foray into matrix mixers, as they have two more "conventional" matrix mixing modules: AI008, and AI018 (mono and stereo, respectively). And AI028 certainly isn't the first VC matrix mixer, but while almost all other offerings have some sort of attenuation/level control for the incoming CV, giving both a visual break to the monotony of jacks as well as more control, AI028 does away with this, fully committing to help support 3.5mm jack manufacturers bottom line.

A six input X (1-6), six output (A-F) mixer that can be used with CV or audio signals, this means that there are thirty-six total VCAs on board. That might be a record, definitely for the size. It must be, right? The

only flourish here is the addition of a dedicated 5V output used to feed passive attenuators for manual control at the CV input of a channel. Now, I only used the +5V to measure it once and then left it unpatched, for really, I wanted to patch this thing to its max capacity. It was not easy. Patching up thirty-six VCAs means needing thirty-six modulation sources. Again, a lot. Some of this was accomplished using a Zorx 1U CV Bus to mult and attenuate various inputs, and along with Five12's QVL, XAOC Batumi, Pamela's New Workout, Black Noise Modular's Cosmos, and whatever else I could conjure up that had multiple CV outputs, after much searching, I was able to source the thirty modulators. I laid the unpatched modulating cable ends next to my rig as neatly as possible for when I was ready to get going; it was a mess o' cables, indeed.

As for the inputs, I used two inputs of a copied sequence that was fed into two very different sounding sound sources (WORNG's Acronym and Entropicloops' Grackle), one related bassline via Erica Synths Fusion VCO), and three inputs for a kick, snare, and hi-hat-ish sounding thing that was part Winter Plankton ZAPS, part Malstrom Audio Mandrake, and part Zlob Entropy (for noise duty on the "hats"). The outputs all went through various effects; two different sounding delays (Endorphin.es Ghost and Vongon Polyphrase), one short reverb (Expert Sleepers Disting Alpha), one looooong reverb (Strymon Starlab), a chorus (Morphor Ensemble), and distortion (Eurorat), without doing too much effects stacking for ease of differentiation. This was already a pretty involved patch, especially for something I thought I was just messing around with, and with thirty-six CVs, it was about to get even more so. From there, each went into their own separate channel in my output mixer, the WMD PM MKII, which I was testing as well. After getting the basic input and output levels situated, I started patching up the CV inputs on AI028. I decided to give each input an audible voltage using various amounts of the supplied +5V at their A Output to use as a sort of reference mix, with everything always playing; no muting or modulating happening. It's easy enough to just throw modulation into each CV input, but I figured I'd try to make

sensible, musically related and relevant type of patching closest to the A Output, and get more random and esoteric the further out I got towards the F Output. I think I accomplished this, though the audible difference was minimal (except for my reference track). Going into the PM MKII and I was able to mute each track easily once I had the rest of AI028 all patched up to compare mixes, as well as play. Musically, I preferred the mix at D Output, but even though it had a mixture of random and intentional CV'ing, it mostly sounded random, with a lot of interesting movement.

My next experiment involved a generative ambient idea I wanted to create. Slowing all of the modulation down to a crawl, replacing the percussion tracks with droning notes and stopping my sequences so that all sound sources were simply droning, I then adjusted some of the parameters on the effects to make them more drawn out; long tails for the reverbs, and plenty of feedback/repeats and super slow delay times. The result was beautiful, mesmerizing, with hollow notes lingering for days while newly played parts were stacked on top, creating more substantial tones. I tweaked the tuning of the sources to be spread out from one another so that some low bass notes would come through while chiming bell-like notes floated on top. To anchor all of this, I repatched Mandrake and had it sustain as long as it possibly could while being triggered slowly and randomly at long intervals. Tweaking the modulation at the source, while changing the feel of the music, proved unnecessary; with that amount of modulation, with that much going on, changes sounded different, but not necessarily better (or worse), at least to my ears. After some fidgeting with settings, I came up with a pretty track (mixture of tracks, really) that I wound up letting play in the background almost the entire day. The sounds were beautiful; the movement felt human, and the track felt very alive.

With thirty-six different voltage amounts going into keeping AI028 going at its maximum usage, even Frankenstein's monster would tip its carriage-bolted head in appreciation of the mammoth amount of cabling applied to bring it alive. It was no small feat finding enough modulation (even with a bunch of self-patching) just to get AI028 all patched up, and this was

without using any stackable cables for any of 028's entry points as they would inherently block an input or two. When it was all patched up, there was nary a spot of real estate with which to rest a wary cable or stray knurlie. Good thing that the layout of 028 (and any matrix mixer worth its weight in salt) is intuitive, as if it were necessary to read any faceplate text once all the cables are set, it would be regarded almost as a techno-archeological dig to break through the cable crust to get the aluminum surface.

AI028 is an interesting piece to the modular puzzle. Teamed up with plenty of LFOs, EGs, and whatever else you can throw at it, its uses are many, and its exploratory options immense. As a voltage controlled (or control voltage) mixer, an ambient soundscape machine, or a gnarly rhythm-maker, this machine plays as serious as it looks. Just make sure you have your cables all laid out nice and neat and all your LFOs free. Still, you may have to borrow some modulation from a good friend.

- Ellison Wolf

Price: \$329



Paragraphs II
Vongon
vongon.com

While Vongon's Paragraph II shares a lot of similarities with the first iteration, a lot has also changed, with some very key differences between the two. The new Paragraphs is no longer an analog filter pedal based around the AS3320 analog chip, the IC used in synths like the Prophet 5, LinnDrum, etc., and instead uses a Daisy-powered 4-pole Moog inspired ladder filter (the same filter found in their Replay synth) as its heart. Also gone is the

metal enclosure of the first version, replaced with the walnut case that's in line with the rest of Vongon's pedals. Perhaps the two biggest changes—both very welcome—is that Paragraphs II now has stereo ins and outs, is more reactive to playing style and technique, and has plenty of options to modulate the filter. The onboard dual stage (Rise, Fall) bi-polar envelope generator (from 5 ms to 4 seconds) is the key to all this and offers three distinct modes: Follower, Trigger, and Cycle.

Follower opens up the filter following your input volume; strum, pick, or synth harder, and the filter frequency follows suit. This works well for auto-wah type sounds and can be used for ducking signals as well. Trigger uses a sensitivity control that determines whether the trigger is active or not, and gives a one shot opening of the filter set by the EG settings. Short percussive attacks, long and slow fades, and everything in between. Cycle mode lets you get into tremolo territory, the speed of the cycling being set by the Rise/Fall sliders (or MIDI). There's also a 3.5mm CV input for modulating the filter and a 3.5mm MIDI TRS input that offers control of all the pedal parameters, and also gives you the ability to save and store up to nine presets.

The filter itself has Frequency control (20Hz to 12kHz) and Resonance control and, on top of being able to be controlled by the envelope, can also be modulated with an onboard LFO (0.1Hz to 100Hz). Two LFO shapes are available—sine and a smooth random—the amount of which can be adjusted to taste. Paragraphs II is not a complicated pedal by any means, but it still takes some thought and reading of the signal flow to see how it works, and more importantly, how to isolate the features to fully realize the control and features available. A clean, unadulterated input signal runs parallel to one that goes through the filter, and there's a Mix control to mix your signal to taste. Like setting the EG to a slow and steady rise before it could fully bloom, I found that to get a good feel of what Paragraphs II can do; it was best to set it to 100%, mixing out the dry signal completely and starting from the ground floor. Therefore, I turned the LFO modulation all the way down so I could get a grasp on the different EG modes, to see how they reacted to my playing and what

they offered. Tweaking the filter to find a sweet spot and adjusting the Rise, Fall, and Sensitivity, and I was brought back to my early days of pedal discovery with the Boss SG-1, something I used almost entirely for auto-swell purposes. Paragraphs II has way more going on than that pedal, and even without doing any dynamic filtering (and therefore no modulation on the filter, but with added reverb from Vongon's Ultrasheer), I found the three modes responsive and performed as I'd hoped. Now, this is sort of a utilitarian test up to this point, really just getting a feel for the EG, but even so, with the bi-polar ability and adjustment amount (along with your Rise and Fall settings), you can get a lot here. Set to a negative amount, in Trigger mode there were the reverse sounding leads which I used to love to do with the Danelectro Back Talk reverse delay back in the day. Reverse swells in Follower mode, and swelling tremolos in Cycle mode. Adding in modulation to the filter with the LFO and things could get wobbly, stuttery, beautifully mutating, and on and on. There's so much to get here among these three features; it's a vast grab bag of sound sculpting tools, with further gains in the stereo field. The LFO offsets the phase of the two outputs by 180° so you can get some beautiful stereo spread and the rate determines the phasing/panning speed when in Stereo mode and that can be interesting, though I wish this amount was adjustable and not fixed, as it would be nice to be able to open up more exploration in that way.

Cycle mode turns the envelope into basically another LFO to modulate the filter, and with the combination of the two stages of the EG, you can create linear shapes: triangles, sawtooths, reverse sawtooths, and pulses. With those and the two rounded LFO shapes onboard, Cycle mode really covers all the waveshape needs nicely. It's interesting to think of these, the EG and LFO, as complements to each other; the succinct and precise rising and falling of the envelope being cycled into an LFO, and the more loose, flowy style of the LFO. Two different halves of the same being, a Jekyll and Hide of sorts; a yin and yang. There's all sorts of sonic goodness to be had by exploring these two different dichotomies of sound shaping within a singular device.

Some sounds I got were disturbing atonal

ringtones, like a doorbell from a demented dimension, or a distorted, ineffective jackhammer. It's possible to get delayed filter wobbles, like having a filtered tremolo in the background that comes in depending on the rise and fall settings. It's possible to use an external LFO where the rate could be synced to tempo via the CV expression or MIDI input. Also, with the MIDI in you could clock both the LFO and the Depth, which could be really interesting in tandem with the envelope settings.

It was even fun experimenting without an input—no sound source, other than Paragraphs II itself—with the resonance up high so it would self-oscillate. Adjusting the envelope settings, the frequency of the filter, and the LFO gave all sorts of strange bubbly squawking sounds, and using the LFO depth on full for the smooth random shape and the LFO rate set high brought about a sequence of sounds, though I would have loved to have a not-smooth random LFO to try out here as well.

I spent a lot of time in Trigger mode, messing around with formant type solos, similar to a talk box, which can be had by modulating the filter and the envelope settings to the right amount. Interestingly enough, when in Trigger mode with the Rise and Fall both set to fast settings, and the LFO rate and Depth both at max, different notes sounded smoother than others. For example, just a single held B, in any octave, had a smoother repeat than other notes. This, in turn, affected the LFO rate, which affected the panning/movement of the output in the stereo field. Maybe it's the beating of the frequencies, harmonics, whatever, but it was just an interesting phenomenon that I encountered while playing, something I really enjoy, these odd tidbits of exploration that involve my hands, my playing of an instrument. The combination of the feel throughout parts of my body; my hands, the guitar against my chest, the vibrations in my ears that enhance the sound experience.

If you couldn't tell already, most of my testing was done with electric guitar, as I really wanted to be in real-time control of the subtleties of the input signal, as opposed to patching in a more static synth (which was still most excellent), though you could most certainly create plenty of

nuance at the input with that as well. Lately I've really been craving the feel of holding and playing an instrument that I'm creating the sound with, more of an extension of my playing where I can feel the vibrations of the wood through my torso. With a setup of Paragraphs II, my Cherry red Gibson ES-335, the Vongon Ultrasheer, and my DIY Tweed clone, I found all the feels: jittery, relaxed, mysterious, warm, sleek, expansive and otherwise.

Paragraphs II is a beautiful pedal, as easy to connect with on a soulful, expressionistic level as it is on an experimental one, and I'm looking forward to finding more ways to use it, and unlocking more of its potential.

- Ellison Wolf

Price: \$449



Oscar Tria, Alpha Duo, Foxtrot Duo BlaknBlu blaknblu.com

The first thing I noticed about Cambridge-based BlaknBlu's Oscar Tria (a stereo digital oscillator), Alpha Duo (stereo VCA and ring modulator), and Foxtrot Duo (stereo multimode virtual analog filter), is that all three modules employ the same layout for the controls and patch points. This is something you see a lot with pedal manufacturers, where enclosures are the same from model to model, but almost never so in Eurorack. Whether this sameness of layout is for efficiency of manufacture, user familiarity, or perhaps to set parameter limitations on the design (limitations are NOT a bad thing), is hard

to say, but all the outputs for all the modules are on the left side and middle of each module, which is out of the norm. It's not so much that it's odd as that I'm so used to, so conditioned to seeing jacks only at the top or bottom of modules (or maybe at the side edges, in some cases), and I do prefer it that way, especially since the CV inputs (and attenuators) are at the bottom of each module, and the inputs (with attenuators) are at the top of the module on each side of a two-position toggle. While these are all digital modules, they behave in an analog fashion and are devoid of any screen or menu, both to their benefit (as on Alpha Duo), and a bit to their detriment (as on Oscar Tria).

Oscar Tria packs a lot into a 10HP frame (all the modules are 10HP). With three

modes available: Green mode, a traditional stereo VCO; Yellow mode, a super waveform (saw, triangle, square) + a sub-oscillator; and Orange mode, a twenty-chord mode, there's a lot to discover. Some of the naming of functions seems odd; there's a Page 1/ Page 2 switch, more akin to a module with a screen, that gives the controls on Oscar alternate functions; Waveform controls the -1 sub osc level, PW controls the -2 sub osc level, and the

Pitch knob detunes the second oscillator (the Right output). With two pages, it could be a bit confusing, but the controls when on Page 1 are the same for all modes; the Waveform control determines the VCO shape, the Pitch control the tuning, and the PW control the width of the pulse wave, and only Page 2 means something different depending on the mode. This is exemplified by the color of text surrounding each control as the text color matches each mode's Page 2 functions. On top of the Mode and Page 1/2 toggles, there are also Octave, and CV Mode switches, which sums or separates the two CV inputs. Depending on the mode, you can get hard sync, TZFM, swarm oscillators, and polyphony with chord selection. In Green mode, as a traditional stereo VCO

with waveform morphing between saw, triangle, and square (along with square sub-oscillators, with -1 and -2 available), you can get some very fat, very deep tonalities—excellent for bass lines—and you can CV the waveshape, and the PWM. Yellow mode is for the swarm setting, and it is indeed buzzy, but not quite as dynamic as I'd hoped—it feels very centered, even with both oscillators panned hard right/left. Its Page 2 functions, the pan specifically, (along with control over the sub octaves) just didn't add enough to this mode, and I would have preferred to detune, or spread, the oscillators apart as in Green (and Orange) mode. Orange mode is a bit more in-depth in that you can use it for chord generation. As there is no menu or screen, it's not always easy to determine which of the twenty chords are selected—let alone remember them all—as that function is determined only by the continuous Waveform knob. Maybe that doesn't matter too much, depending on your usage. I like that the Pulse Width knob controls how many notes are in the selected chord (up to five), and you can CV that, which is pretty cool. You're also able to detune the two oscillators here, which can get pretty interesting and ugly (in a good way), especially when the note amount for the chord is up there and the chosen chord has some complexity to it. Oscar Tria remembers the settings from mode to mode, so you can switch modes and not sweat having to remember the setup, though this disappears once you turn it off—there are no saving/recall capabilities. A versatile VCO, there are a lot of good moments to be had here.

Foxtrot Duo, a multimode VCF that can operate in mono, where the two inputs are summed before entering the filter; or in stereo mode, where you have two separate channels going through the same filter. Foxtrot earns its stripes; it's very flexible, and with three popular analog filter styles (though Foxtrot is digital, remember!?)—a 4-pole Moog-y ladder, a 2-pole Sallen-Key, and a state-variable filter based on Oberheim's SEM, you're getting a lot of bases covered. For controls, there's a Frequency, a Resonance, and a variable BP-LP-HP knob that lets you morph between types. All of this can be modulated and dialed in, and I like that there are two CV inputs with attenuation for modulating the cutoff. Sometimes you

want to do a sweep and add a little something extra in there from time to time, and having onboard capabilities to do so is a plus. Initially, I lamented that there didn't seem to be a Res CV in, but you can do that via an assignable Aux CV input, which is where you can sweep through the filter types as well. The Aux CV can also—somewhat confusingly—when in Mono, split the filters into a stereo pair (mono, stereo, stereo, mono...) and pan things around. It was really interesting when I switched it to Stereo and patched a stepped S&H in there to control the offset of the frequency between the two filters. Some great movement was happening, and this was all while leaving the tuning static on my VCO (Oscar Tria, naturally). Actually, I preferred it that way as opposed to patching in a 1V/Oct.

Though I didn't have the ability to do side-by-side testing on them all with the real things, and even though they are digitally derived, all three filters sounded pretty good. The ladder dropped off nicely with a pleasing edge, when pushed the Sallen-Key had the unmistakable howl of early Korgs, and the sound of the SEM was impressive, showing teeth with the Res on high, and backing off nicely with lower resonance. It opened and closed up nicely when in LP mode, and sounded great sweeping it in BP. Overall, a really nice filter with some unique takes and a lot of uses. The modulation for controlling the frequency offset of the two filters is worth the price of admission alone. Really cool. Last of the bunch is Alpha Duo, a stereo VCA with ring mod capabilities. This is the simplest of the three, in terms of functions, still with some interesting twists. Being able to process two inputs for either summed mono or stereo operation, Alpha also adds three different drive/distortion flavors, true stereo panning capabilities, and has a Quadrant selector, which is where you can get your ring mod flavor. Overall, I found Alpha Duo useful, with nice features, and the drive added some nicely different flavors, which seemed to change a bit depending on what Oscar was sending through it. Chords sounded really nice and nasty, and The VCA input gain can be attenuated and the applied CV is switchable from log or linear, like most mid-featured VCAs, and with the drive settings you can color the signal pretty well. Alpha seemed a bit vanilla at first,

and really, I suppose you could say it is, but it was interesting switching modes, quadrants, and it was worthwhile doing some ring modulation in stereo.

Using the three modules together as a unit, all patched up..those gritty, ring moddy chords with contracting note amounts was indeed a bit different and definitely entertaining. While I still don't like the placement of the outputs, with some right angle Tendrils cables, it was easy enough to tweak and destroy; to switch filter modes, VCO modes, and pan it all around. Even though they are fine on their own, it's obvious that Oscar, Foxtrot, and Alpha want to be together. The identical layouts, the names, the adherence to stereo...I found it hard to separate them. These are interesting modules, and worth seeking out.

- Ian Rapp

Price: \$329 each



**ADDAC814 6x6
Stereo Matrix Mixer
ADDAC System
addacsystem.com**

In their description, ADDAC System states that the 814 is designed for easy expansion, and has a photo of four of them next to each other. A 6x6 stereo matrix mixer is already bigger than most, and a 24x24 (or more) might warp minds. Mostly because a matrix mixer, even a 4x4, while completely usable and interesting, often suffers from one major malady, exponentially so, when you get into double digit channel amounts. Namely, they can be confusing. What's patched into the input of Channel 1? Where is Channel Z's output going? Yep, you're about to go on a

point-to-point cable journey in search of answers. Doubly so when you're dealing with a stereo matrix mixer, which is on the bench here.

ADDAC System's 814 tries to mitigate this problem as best as it can, and does so in a few simple, but effective ways. First, for both ins and outs there is a white space on the module to write in the to's and fro's so it's easy to keep track of what's patched where. 814 also uses multi-color knobs for fast identification. There's a diagonal white row of knobs that signifies that the routing of the input is the same output, for use in feedback generation. While I find matrix mixers really useful in a utilitarian sort of way—they're great for honing parameter amounts as well as auditioning various pathways—being creative with feedback paths always leads me to interesting places. Even in matrix modules where I've forgotten

how it's all patched up (again...no problem with 814 on this account!), running sound sources through various effects, and piling them on top and feeding back into one another is always good fun.

The other rows of knobs—alternating black and red—help to make quick identification and playability by having some visual color separation. It's obvious that ADDAC System has felt the pain of staring at a module full of identical knobs—something like trying to discern tree genera in the middle of a dark, dense forest—and felt the pain.

Another way 814 helps is by addressing the knob/jack paralysis that is caused by a sea of knobs and jacks and jungle of cables is with a dedicated, discrete module (included) that houses all inputs and outputs, which is connected to the main module via ribbon cable. This enables one to place the patched up in/out module away from the main module, so there's a clear, clean space with which to tweak and explore. It's these thoughtful additions and flourishes that make it a pleasant working experience.

With those important, yet utilitarian, aspects out of the way, it's time to pontificate, albeit much more briefly, on the enjoyment of a stereo matrix mixer. It's

almost a meditation, this thinking about the various ways of stereo routing, whether it's a true stereo signal or a copied mono signal (814's left inputs are normalled to the right on each channel), and being able to send each side of a signal into a different filter, effect, VCA, or whatnot is a great way to get some interesting stereo spread. But you can do that with most any stereo mixer, so... Aah, but a matrix mixer means you can send the signal back into itself for immense feedback looping. You need to pay close attention because it's easy for it to run away and blow out eardrums, but chaining and feedbacking a single stereo signal with any chain possible through the six channels available can be monumental, immense. Again, it's helpful to be able to write the signal origins on the module itself to keep track of everything, but it's so fun to tweak something early in the chain, to see how it affects everything further down the line. When you do this, there's so much seasoning to taste that it's as easy to get lost in the sound as it is to craft something utterly unique, and I really loved crafting slowly undulating drones with 814. Stacking three slightly detuned oscillators (very Moog-y) in the first three channels, running through various slowly modulated filter, eq, and effects combinations, fed back into themselves and finally into again a slowly modulated (via WORNG's Vertex stereo VCA) WORNG Soundstage. Such a good time. Experimenting in the stereo space can be incredible, and with a handful of VCAs, loads of LFOs, and effects, 814 is primed for spatial supremacy.

While 814 is perfect for audio signals, it's DC coupled, so it can be used for creating complex modulation as well. At first, I had a hard time wrapping my head around using it for this purpose, not being able to let go of the idea that complex modulation always equals randomness. Whatever the reason, this is my internal hangup, and using 814 for modulation was time well spent. It was interesting to patch in LFOs of different frequencies into the top four channels while feeding themselves back into each other in the bottom half. Like with the audio experiment, with a slight tweak upstream, all havoc could break loose downstream, and it was important to use a light touch. What I found really interesting was to use basic LFOs (sine, triangle, pulse) of a related tempo ($\frac{1}{2}$, $\frac{1}{4}$

time) and mix/feedback/tweak. Using it on a 1V/Oct input for a VCO, to easily hear the resulting pitch change, or as the CV input on a VCA for the same reason, was interesting and using 814 as a controller in this way, to sculpt the modulation, made me think that maybe ADDAC System's hubris in suggesting a 24x24 stereo version, multiple 814's all chained up, might not be so far fetched.

While it might seem at first that a 6x6 (or larger) stereo matrix mixer might be overkill if your system doesn't take up an entire wall, merely because it's bigger than most, the endless amounts of feedback and routing possibilities means that 814 can find a home in any stereo lover's rig.

- Evan Morrow

Price: \$419



**Cuisin
Floating Knobs**
floatingknobs.com

I like to think I'm unbiased, non-denominational—agnostic, perhaps—when it comes to screens on modules; I like them when they make sense, but would rather not have to look at some tiny, sad little screen if I don't have to. Where they most definitely make sense is on something where visuals are the main component (like the Mordax DATA) and on a complex module or device where there are a lot of options, tweaking, customizing, or setup that needs to take place. In terms of modules, I'm thinking of things like any of ALM's Pam's, Five12's Vector Sequencer, the Expert Sleeper's Disting modules, the XOR NerdSeq Tracker, and on and on. Many modules and devices have them, because they need them; they won't work without them. Conversely, not many that do need them go without.

Cuisin, the first offering from Berlin-based Floating Knobs, is one that, at first glance, I thought would do very well with

a screen. I feel that anything—especially something as potentially deep as a sequencer; one that has more than one necessary layer to its operation as Cuisin does—where you are tasked to use color identification (of the LEDs on the keys in this case) to know which function is which, what is active or not, or what track or editing state you're in, is an uphill battle. Color coding memorization is not my favorite way to work with a sequencer—or any module, really—as it usually requires much referencing of a manual, a cheat sheet, luck, or all three. Floating Knobs acknowledges the need for referencing Cuisin's operation throughout their manual, and while this way of working is not a 100% deal breaker for me, I need some convincing it's worth the effort and the brain space it will inevitably take up. One major thing that Cuisin has going for it is that it looks awesome; cool, sleek, mysterious, and with those trendy old-school computer keys that are making the rounds. Trendy or not, I like those keys quite a bit, as well as Cuisin's overall look. As this is Floating Knob's first release, I have to say they did a great job in the visual design department. I was curious to see if they could win me over in the UX department as well; it looks fun enough. Cuisin is made of FR4 PCB material and can be used as a desktop device or Eurorack module. It consists of sixteen of those computer keyboard style switches, laid out in a 4x4 grid, which function as the main interactive/playing area, and are located on the right side of Cuisin along with four CV and eight Gate outputs. The control area is on the left side, featuring both a Play/Stop and Record button, situated above a mixture of Transport controls: Track, Edit, Keys, Euclid, Pattern, Copy, Paste, Clear, Clock Div/Mult, and Loop. Along with an endless encoder knob, a Performance Mode toggle, four Gate Inputs, a small LED page indication/selection area, and MIDI in/out, a Shift button completes the tour. From an ergonomic standpoint, I like the layout of the whole deal; well-spaced with plenty of room for navigation, and laid out well for playing and navigation. Floating Knobs claims that Cuisin is made to be played seamlessly with just one hand, that the whole deal is made for intuitive and fluid play, but my experience was a mixed bag in this department, though with the color

coding and multi-button presses needed at times, it did sometimes feel like I was playing with only one hand, with the other tied behind my back.

I decided to test Cuisine primarily with my modular, via the CV/Gate outputs, not diving into the MIDI functionality, as this is my typical performance style. This decision was another mixed bag as some of the deeper functionality (velocity control, accent, etc.) is only available via MIDI.

Cuisine organizes sequences within sixteen banks, where up to twelve tracks can each have twelve patterns. I was curious how recall is on all of this, as again, without a screen, there's no way to see what's what, and where what's what is at. If you use all sixteen banks and want to utilize Cuisine to its absolute fullest, to remember the details and location of each bank, pattern, and sequence, that information would need to be stored somewhere. I did this on a cheat sheet, which was next to my computer displaying Cuisine's descriptive 106-page manual.

You can use Cuisine to output sequences of three types: Note, Drum, and Modulation (MIDI only); and the type determines what kind of voltage Cuisine outputs. Going through the quick start steps as described in the manual to get a rhythm track going, and using Modbap's Trinity, is easy enough. Using Track 5 (it's recommended Tracks 1-4 are to be used for note/CV, Tracks 5-8 for drum tracks, and 9-12 for modulation) and following the directions, I did indeed easily get a four-on-the-floor kick going. Mimicking the exact same steps for a snare with Track 6, and I was starting to get the hang of Cuisine's basic setup. Additional drum tracks were a breeze, and using the computer-style keys to program the steps is nice and tactile. The little LED squares on each light up differently depending on what's going on, and it's intuitive and familiar enough if you've ever used a pattern-based synth/sequencer before. You can adjust sequence length (up to 64 steps) and can have different page amounts for each track, which makes it easy to give variation to one element (like a snare) while easily keeping the other track output lengths and patterns the same. You can also clock each track from different sources (very cool!), and clock each at a division/multiplication of the clock, which can create a lot of potential for complexity.

You can copy, paste, change/create patterns, select Euclidean patterns (pretty fun for performance variety), and a lot of the usual things you expect with a sequencer. Once I got used to the first few steps and had Cuisine moving, the rest of the performance-style operations were pretty easily learned and comfortable, and the fear of the color coding was retreating a bit. Still, some of the configuration borders on the ridiculous. From the manual for determining the tempo:

"Add and count the illuminated LED colour representations per column to establish the BPM Value. Green = 1 (for digits 1-4) Yellow = 2 (for digits 5-8) Red = 3 (for digits 9) Unlit = No Count."

Easier to just clock it from something else than try breaking the mathematical color code! Or so I thought. I couldn't for the life of me figure out how to use Pam's to clock Cuisine, but after a brief and pleasant exchange with Floating Knobs' Dorian Largen, who explained how to do it, (this process wasn't specified in the manual at the time) I was clocking Cuisine with everything I could throw at it, and the steps to do this went along with how the rest of Cuisine's operating procedure works, to where I felt like I maybe should have been able to figure it out on my own. While external clocking initially eluded me, some functions were again pretty intuitive, once I learned how to do them, like adjusting sequence length and location. Press Loop to enter Loop Mode, and press and hold two keys in succession to set the loop note range. The first key held (signified by the green LED) is the start point, and the second key held sets the end point (yellow LED). If you choose the end point to start before the beginning point, the sequence plays in reverse. This, as are most of the parameter changes in Cuisine, can be recorded, and is a cool way to bring about sequence variation. The loop length is the same across all pattern pages, however, which is something I would love to see changed so that even more variation could be achieved. Still, tracks can move independently of one another, so polyrhythms, and more experimental rhythmic'ing are possible. In note mode, the changing of CV values/notes was easy; enter Key Mode, hold down a key on the keyboard, select the note you'd like and there you go. I would prefer to be able to hold a given key and

turn the knob to select the notes instead—I think it would be quicker and a bit more fun—but that's just a preference thing, and something I could theoretically see happen since Cuisine is open source. As soon as I learn to program...

You can generate sequence ideas through Euclidean mode where steps can be determined for you, and after you determine the settings on the three pages of parameter settings for this mode (you can remember those, right?!) you're off. Once I got the hang of this, it really wasn't that bad—I'm poking fun here a bit—and it was a fast and fun way to change things up and add variation to an existing sequence.

While I disagree with Cuisine being a "one-hand" operation, once you get the flow it does lend itself nicely to actually playing, and by flipping the toggle (every synthesists most defiant gesture!) into Performance mode, you can really stretch Cuisine's operation, starting and stopping tracks manually, changing scales, transposing, and recording on the fly. Being able to use one sequencer for multiple melodies, a rhythm track, and (MIDI-enabled) CV control offers up a lot of potential, and Cuisine—caveats and all—is more playable than most.

Overall, I found Cuisine worked best as a sequencer where I don't have to access the more advanced functions much. As a drum machine, with tracks 5-8 triggering various percussion modules, it was fun (and mostly easy) to go from sound to sound, mess with the timing, and mix things up in terms of active steps and patterning. There's really a lot you can arrange, rearrange, and mutate in terms of rhythms here, and ditto for using Cuisine for melodies. Modulation-wise, that's all MIDI, and again, I didn't go that route, but I imagine it would be the same.

I can't tell if I think Cuisine is a deep analog-style sequencer with bonus MIDI connectivity, which is how I used it, or if Cuisine really wants to be everything; a fully fledged digital sequencer with all the bells, whistles, and abilities to tweak until your heart's content, but with the easy user interface of a vintage-style sequencer (meaning no screen). And yes, while you can configure it mostly how you'd like, it can be tedious with a lot of back and forth manual lookup, and the vintage one-knob-per-function style ease, while close, isn't

quite there on the whole, especially when it comes to those advanced system/global type features.

With its open source architecture, and a responsive and obviously passionate designer/company, Cuisine promises to reward those who make the plunge. I definitely found the color coding ID to be a drag at first, but that feeling evaporated rather quickly. The way that Cuisine operates is intuitive for the important, playable parts, to the point that after a week or so of using it on a daily basis (and after stepping away for a few days and coming back to it without forgetting it all—not always a given with modules that rely on methods like this) the color ID wasn't much of a problem, and I did appreciate not having to rely on a screen. Even more important, I found a pretty good groove with Cuisine and enjoyed its workflow. It's not quite one-knob-per-function, but my brain also wasn't taxed trying to remember things. Still, a cheat sheet taped to the faceplate for stored banks/patterns/etc. was helpful.

I assume Cuisine will have its legion of followers, those who will embrace the red, green, and gold eyes of those computer keys, who once they get it set up the way they like and are able to ditch the manual, will be rewarded with a fun and flexible sequencer.

- Ellison Wolf

Price: \$489



Cycle 5
Joranalogue
joranalogue.com

After the behemoth of a module that was Collide 4, Joranalogue's recent collaboration with Hainbach (Waveform, issue 14), the next module up for a gander

is Cycle 5, their new vari-wave oscillator. While it might seem a little...well, little, by comparison, Cycle 5 punches well above its weight, and its simple premise and slim 6HP width belie its very usable functionality.

A triangle core VCO with an Audio/Low toggle so that it can also be used as a modulation source, Cycle 5 simultaneously offers sine, triangle, saw, pulse, and variable outputs as well as 2 x V/Oct inputs, a Reset input for hard syncing capability, and a CV in for modulation of the wave variations. A 7-octave control (as opposed to a more familiar "Coarse" tuning knob found on most VCOs) with a Fine control for precise tuning of the oscillator, a Variable wave control, which smoothly morphs from waveshape to waveshape (and controls the PW for the pulse output), and a switch to add 5ths, adding seven semitones to the current pitch, rounds out the controls on offer.

Sometimes it takes a minute (or more) to fully grasp a Joranalogue module. Even though they are all analog and offer one-knob-per-functionality, some of their offerings involve deep theory (Orbit 3), or just a ton of jacks and knobs that can be intimidating (Morph 4). This depth of functionality is a real testament to their dedication to pushing the analog realm, and like the slimmer of Joranalogue's modules, even something as seemingly simple as Cycle 5 doesn't get built without a few tricks up its sleeve.

I'm a big fan of VCOs with multiple 1V/Oct CV inputs. Sometimes you want to get a sequence going, and then modulate, transpose or warble that, and Cycle 5 has that, so right away I'm in. One thing to note is how stable the tuning is on Cycle 5. It's not surprising, this penchant for precision (in this case in terms of tuning) as one of the most solid characteristics for any Joranalogue module is precision, along with a fierce focus and attention to detail, and having a reliable and stable VCO is a gold star. With the Fine tune control in the center position, Cycle 5 is tuned to C, so for a starting point (and if you're jamming in C) you're in good shape to deviate—or not—from there. Cycle 5 comes calibrated from the factory, but should it need adjustment, there are small trimmers for Pitch and V/Oct on the front of the module.

Having the four classic waveshapes available simultaneously offers a lot of flexibility, but is really valuable when used at the same time and mixed to taste. Throw in the Vari output as well, and with some slow moving CV for modulation, you can get amazingly thick, slowly mutating generative drones, like swimming in a pool filled with molasses. Speed up the tempo with a tasty bassline and you really have a lot of options to tweak the sound as you see fit. I got some excellent acid-y adjacent bass sounds that sat really well in a dense rhythm patch. Running it through Joranalogue's excellent Filter 8 to dial in the desired frequency range, and Cycle 5 flexed pretty hard.

While so many current VCOs use a "VCO in-a-box" chip like the CEM3340 (or a copy of it) or the SSI2130, Cycle 5 uses neither, only opamps and discrete components, and is a Joranalogue-designed circuit built from the ground up. Maybe it's not inherent when comparing its triangle output to another VCO (unless there are anomalies they should sound identical at the same frequency), but even if the behavior of Cycle 5 differentiates just a slight from the operation of other VCOs because of this longhand circuit design, it makes Cycle 5 that much more unique, and for a farm-to-table person such as myself, I appreciate building anything from scratch—limitations and all—from the ground up.

Some highlights of Cycle 5 are morphing the Vari output at audio rate, which brings about AM type of sounds, and self patching, which allows the creation of more complex shapes other than the standard offerings of the four main outputs. I really like the Octave switch, which is fast and easy, and as stated, it's easy to transpose a sequence with either of the two 1V/Oct inputs. On top of that, Cycle 5's sine wave is clean, it's use as a CV source in LFO mode with the multiple outputs is great, and the morphing capability of the variable waveshape output—along with the usual precision and high build quality of all Joranalogue modules—makes Cycle 5 a solid and versatile VCO/LFO.

- Evan Morrow

Price: \$199



Kastle 2 Wave Bard & Kastle 2 FX Wizard Bastl bastl-instruments.com

The Kastle series of devices from Bastl are small and strangely enticing things. Something about the size and scale of them is alluring; they run on 3xAA batteries (or USB-C), and take up just a slightly larger space in your front shirt pocket than that cherished copy of the Reader's Digest (Simpson's reference). Even though they're digital, they play like old school analog machines, albeit pretty small ones, and you can patch them all up. Speaking of patching, it might be best to lay off that second cup of your chosen caffeinated beverage as the jumper cables that are used for patching are not for the twitchy of hands. I do think they work well, size be damned, and one thing I hadn't thought of until patching them all up is how well they keep cable clutter to a minimum-needed when dealing with small devices, as they are. Still, the patch points are like, barely over 1mm square, so hopefully you like precision movements. Because of the size and placement of the patch field (at the center of each unit—both units are laid out the same) it's easy enough to reach all the controls, even when fully patched, so that's nice. Starting with Wave Bard, Bastl calls this a "portable sample player," and technically, yes, it is that, but I would find "(portable) crazy mayhem rhythm machine" perhaps even more apt. Like so many good things

in life, Wave Bard can indeed be sane, but it wants so so bad to let loose and be crazy, and who's to say no to that? It's akin to drinking way too much caffeine to function, where synapses are pushed or missed altogether, where what would normally resemble a clear, coherent thought process turning into a jumbled mashup of passed down family recipes, house color descriptions, and decades-old to-do lists, rendered nearly incomprehensible. While this type of functioning absolutely does not work well in the medical, automotive, or engineering fields, when it comes to rhythms and synthesis in general...well, it can be exactly what the doctor, mechanic, or engineer ordered.

With controls over (Shift function are in all caps) Pitch mod/INPUT, Sample Mod/FX, LFO Mod/RHTHM, (Sample) Length/ (Sample) MOD, Pitch/VOLUME, Sample/FILTER, LFO/TEMPO, and the first three with CV inputs, there's a lot to tweak by hand or modulation. In terms of that modulation, there's an LFO (triangle or square) that can be synced to the tempo or live in free mode, and there are also Gate, ENV, and a randomized rompler CV outputs to patch around, with many ways to route random voltages throughout; there's no lack of modulation opportunities or sources here. You can also sync Bard with other instruments (Bastl or otherwise) both to and fro, via 3.5mm TRS inputs as well as a pair of jumper ins and outs. If you so desire, with an alligator clip you can also inject external CV into any of the patch points, bridging a 3.5mm cable with Wave Bard's jumper cables for more integration of modulation. In case you're still feeling like you want more, there's a companion web editor that expands on the Wave Bard's features where you can create custom scales and rhythm patterns and load samples, too (there are up to thirty-two banks of eight samples per bank, and the samples can be up to eighty-nine seconds at 44kHz (longer with lower sample rates)).

There are all sorts of advanced type features that deal with the web app—which is easy and efficient—or syncing, etc., but even when you just use what's on the surface, getting a grip on the Shift functions, id'ing the inputs vs. outputs (framed in white), and getting the jumpers in place, it's not hard to get fast and furious

with Wave Bard and get jamming. And with the white text on the black faceplate, it makes everything pretty easy to read, even if at times there are so many options that it can seem confusing.

It's all about setting a tempo and then getting your hands and fingers dirty, patching things up with the LFO, Gate, ENV or CV, and modulating/intertwining everything so that the samples, banks, and lengths mutate to form unique and unexpected rhythm tracks, and you can also use the onboard rhythm generator to do that and tweak the patterns via Gate, CV, or Reset. It feels like an endless supply of rhythms and rhythmic ideas, and the size and functionality of it all makes it feel very experimental in the way that testing out circuits on a perf board feels.

In terms of identifying where you're at, when the bank changes, the light up symbols at the top of Wave Bard change, and ditto for the LFO. Also, three little bird images surrounding the Pitch/VOLUME, Length/MOD, and Sample/FILTER controls signify that these are the real time controls for tweaking. If you don't have a pattern/rhythm going already, you can check out each sample by quickly pressing the Shift button, and with the Length control you can play around with the sample length, and even reverse the sample and get all sorts of groovy beats. I'm sure you can use Wave Bard as a typical-esque drum machine (and you could load melodies in here as well), but in no way did I bother with any of that—it's way too weird for any sort of normalcy; it excels at weird. It's an idea machine. Modulating all the inputs; the LFO mod, Sample, Sample Mod, Bank and Reset, and you never know what you'll get, and add some of the built-in effects (filter, chorus/flanger, and delay—the last two of which are in stereo and sound great in cans), and Wave Bard shows its full colors. The strangest part about the whole deal is that not only did I not feel lost most of the time as I thought I would (such a small package, so much going on...), but I actually felt like I knew what I was doing most of the time. Even with the rompler/randomness/etc. all happening; it wasn't as random and out of my control as I thought it would be. Once a beat was going, Wave Bard was so hands on, there was more than enough to keep things interesting.

Auditioning the included banks, and there was plenty to keep me occupied for a good long while. But still...maybe two Kastles for twice the fun?

Exactly. Pairing Wave Bard with FX Wizard is the real deal, and once you know the architecture of one, you can navigate the other pretty easily. Where Wave Bard has white birds encompassing the three main real-time controls (Pitch, Length, and Sample), FX Wizard has a white rabbit, signifying the same immediate control for Time/VOLUME, FX Amount/MOD, and Feedback/FILTER (I loooove the filter on this, BTW). FX Wizard has nine different effects with which to obliterate, or—hesitantly—tastefully decorate your sound: Delay, Flanger, Freezer, Panner, Crusher, Slicer, Pitcher, Replayer, and Shifter. Same as Wave Bard, changing the effect changes the LED colors at the top to signify what effect you're in, and also as with Wave Bard, you can modulate most everything here with both negative and positive voltage.

Tormenting the rhythms created in Wave Bard through FX Wizard's magical power was highly entertaining. The Freezer, Slicer, and Replayer were the most interesting to me—especially when in Stereo mode—and on both units I loved messing with the onboard filters. It became second nature pretty quickly using the Shift button to access these (they're in the same place on both devices, which helps), and likewise with the rest of the controls, it was all very quick to dial in everything. Getting deeper with the web app is very intuitive and easy to use—its basic layout is very user friendly—and being able to load your own samples and create your own scales and rhythms only makes this even more fun and versatile. Again, the app is nicely done, and it was fast work to load in some samples, organize them, and download the file and upload it into Wave Bard to hack it with, and it's super easy to alter scales and rhythms. One of the samples I loaded was a stacked vocal harmony of a song I recorded eons ago, about ten seconds long at regular speed. I triggered it with the LFO, and using the CV out to slightly modulate the Pitch, it became really moody, and had a strange melodic beat/groove, something I never would have stumbled across on my own, that was quite great that made me rethink the song in

general, and gave me the idea to use it as a foundation for rethinking and reimaging what the song could be. I even harangued some non-musician worker bees sharing the co-working space I was in and convinced them to don headphones for a listen, as I twisted this or that. All gave it a decent listen, and one even bopped their head a bit. Overall, it was a much better response than I'd ever had with my "regular" music. One person, who always brings her very old, yet still friendly beagle into the office, even commented on how "cute" and small the Wave Bard was. Small, yes, but the POWER it wields is mighty (I almost said), mightier than any sword! However mighty they already are, to get the most of the ins and outs of both units you'll need to pick up a TRS splitter cable to interface with your modular and other devices.

This new series of the Kastle devices is a huge jump forward from the initial (and 1.5) devices. More features, larger, more playable surfaces, and with molded plastic enclosures with some cool Bastl-y designs on the side (instead of the FR-4 PCB enclosures of the previous Kastle's), these are no "cute" toys; they have serious musical power. I'm extremely interested to see what else will be conjured up in this format to pair with these fun little boxes. With Bastl, you just never know what you'll get, and that's part of the fun, if not entirely the focus.

- Ian Rapp

Price: \$194 each



ML:2m
Circuit Happy
circuithappy.com

There's nothing worse than sitting down for a music making session only to have it

turn into a tech debugging session. Even if it's a successful one and the bugs get fixed, any time taken away from actual creative pursuits due to tech reasons makes me batty. Whether it's tracking down the source of a loud buzz, hunting down a missing manual, or spending time trying to figure out how to make machines play well together, there are many, many times I feel like my music making hobby is actually more of a tech troubleshooting hobby, the main product being utter frustration. Synchronization of electronic instruments is perhaps the most hair tearing of them all. Try as I might to minimize these aspects of electronic music making, they still find a way in, which is why any time an easy solution to any of these types of problems presents itself, I grab on and never let go.

We positively reviewed Circuit Happy's Missing Link Jr. (Waveform, Issue 11), their tabletop device that connects your DAW to devices via Ableton Link and were very pleased with its plug and play with ease along with its web editing capabilities. Still, with my workflow being more modular than tabletop device based, I knew even then that a module version would work better for me and was excited to review their new Eurorack module, ML:2m. The updated version of the ML:2, at only 2HP, ML:2m is still small, retains the ease of use as its predecessor, and has some very cool additions/updates. Since it's a module and always in my case, it's one less thing I need to think about if I'm traveling with my setup. And with the addition of the MIDI out on this version, ML:2m is a small, all-in-one sync situation solution that works as easily and as well as you could want.

There are, of course, various modules that can support Ableton/module/device clocking/integration, but I'm not sure there are any that safely perform the process the way that ML:2m does. If you are recording, performing, or just experimenting for your own hoo-ha, you want to make sure the connection between DAW and modular is stable, secure, easy, and can continue uninterrupted. ML:2m does this by providing the ability to create your own Wi-Fi access point to hook up to so that you are never at the mercy of a bad, intermittent, or downright cheap internet connection. Create your own network with ML:2m (via a 2.54 Wi-Fi GHz

connection), connect to it, and you're good. I don't even bother with an external Wi-Fi connection (even though ML:2m lets you connect this way as well), and as long as my DAW and rig aren't too far—away like three houses down—I've never had a problem.

There are minimal controls on ML:2m, all of which light up for easy visibility, even in a dark space. There's a Wi-Fi indicator that signals your connectivity status, a Play/Pause button, +/- buttons (for adjusting tempo), and a Tap Tempo button. Long pressing the Tap button gains entrance to the secondary function of the +/- buttons, which adjust a Shuffle level. Since there's no screen on ML:2m, most of the inner tweaking takes place in Circuit Happy's web-based Control Panel app. Since you're probably using a computer anyway, this works great. As for outputs, there are two configurable ones, A&B, which, like with the initial ML:2 module, you can use to clock other devices/modules. With configurable PPQN settings, Trigger Reset for each loop, using at Loop Start or Stop, and also settings for DIN-Sync style Run/Stop Gate functionality, L:2m is versatile. ML:2m also has the ability to sync to MIDI devices by changing into MIDI Mode, and using a stereo to dual mono cable for Output A to split the signal into CV clock and reset. This is a great new feature that allows even more platforms to the party, and if you're just taking a basic clock from ML:2m to go into your sequencer or Pam's or something like that, then you're able to sync up your MIDI devices, your Elektron workforce, an external sequencer, 808 clone, or whatever, as well. It's a pretty seamless workflow, and effective as well, with minimal cabling and setup.

Part of testing something like this is to create problems, in this case to see how far the connection will stretch while still being musically useful, and so I planted ML:2m in my basement rig (sitting conveniently next to my Pamela's New Workout) and ran Ableton on my laptop, moving it around. First, I moved my computer to the far end of the room about 20 feet away, an easy first test. Then I moved my laptop upstairs, and finally outside in the backyard. I had to employ a helper and use a walkie-talkie system to make sure start/stop were still happening—it was a little too hard to tell if there were any latency issues, even though we cranked everything

and strained to hear each—and I was impressed by the connection.

How tight was the synchronization? That is the main issue/question, and testing this by layering a MIDI snare hit in Ableton with a kick on Modbap's Trinity, and listening for any lag (adjusting the snare length in Ableton to match the kick length), for any over or underlap, and there was a little bit, signaling that the syncing needed adjustment. ML:2m has safeguards if there is any sort of timing issue when clocking, using delay compensation, and adding (or subtracting, really) a value of -22 in the latency box (via the browser app) and the syncing was perfect. Changing tempo on either Ableton or by tapping the tempo on ML:2m was instant, and the syncing remained solid as well. Actually, all changes; PPQN settings, trigger length settings, etc., all happened nearly instantaneously and remained solid quickly and eternally, with settings saved in the web browser system.

Even if you don't use Ableton or another Link-enabled DAW or device (there are over 200 such products that can use Link), ML:2m can be used as a clock generator module and can still connect wirelessly with other Missing Link connected devices. When we reviewed the Junior, we had two sent to us and it made wireless jamming a breeze, using three small Eurorack rigs, a drum machine, a Korg sequencer, a Sequential Pro 3 running an arpeggio and two laptops. I actually think this is where the whole line of Missing Link's strong core resides: in the ability to make interdisciplinary jamming without long cable runs easy and enjoyable.

There's a recently released "Rhythm Explorer" firmware, which has more options for the output, and by selecting either Free or Euclidean, both A and B outputs can be stylized for your enjoyment with the number of Steps, Pulses, Rotation, Chance, and Jitter as options for both outs. Along with the Loop Size/Beat setting in the app, you now have a configurable rhythm generator that's fun to play with. Paired with the Winter Plankton's ZAPS (Waveform, Issue 12), the rhythms could go from standard to, indeed, exploratory. Most of the time I use ML:2m as more of a gateway from my DAW to my modular and don't necessarily need this kind of functionality from it, but maybe it hints at

some of the future plans for the Missing Link family, and for sure you can see the ways it can evolve. Either way, the new mode is a nice addition and fun to mess around with.

- Ellison Wolf

Price: \$249



Ferrous Landscape & Evcshen landscape.fm

In my earlier years as a drummer and improviser, I was obsessed with Gerry Hemingway's *Electro-Acoustic Solo Works (84-95)* where he blended percussion and electronics to compose a body of work. Following this inspiration, I spent the next decade exploring unconventional ways of playing cymbals and drums with found objects, homemade instruments, tape players, contact mics, and speakers. Admittedly, the experimentation process at times wasn't the most "musical," but more importantly, it activated my curiosity and imparted to me the importance of playful exploration, in music and in life. When this curious spinning magnetic polyphonic string resonator named Ferrous fell into my hands, I instantly experienced that familiar desire to be playful, and quickly arrived at sounds that, to me, were undefined and new. A true gift. The Ferrous is a collaboration between Landscape and SF-based sound artist/instrument maker Evcshen (Victoria Shen). The body is made from birch ply and the top interface from their signature light green PCB/fiberglass material, with beautiful gold traces throughout. The mechanical variable speed wheel inside is a repurposed hard drive motor housing an array of neodymium magnets. Turn it on, the disc spins. Hover it over a steel stringed instrument like a guitar, piano or zither, and suddenly the strings start resonating and produce a range of sounds from ethereal beauty to dark and haunting. It's quite a simple device, but between the

choice of instrument, object, proximity, speed, and velocity of acceleration or deceleration, the possibilities become infinite. The documentation expands well on examples like these, as well as Ferrous' polyphony concept, coined as "magnetic strumming," defined by a string resonating at a fundamental tone but also producing additive harmonics. Polyphony, however, is just the beginning of its sound world. Ferrous has four different methods for motor control: an on/off variable dial, a low profile momentary/pulse button, the touch plate, and CV input (yeah that's right, control from a modular!) The on/off variable dial allows defining very specific, constant speeds, while in contrast, the pulse button will slowly ramp up speed, which is effective for bursts of speed velocity (kind of like the pulse setting on a food processor). The touch plate is quite responsive, though I wasn't able to achieve the full range of speed, and the CV input is an excellent twist. In my first CV attempt, I connected a XAOC Devices Zadar envelope generator and selected a random sample and hold-like modulation, and the magnetic disk responded accordingly. Suddenly I'm in a modular, electro-acoustic, CV controlled world. Sequencer, LFO, ADSR, keyboard? The opportunities here for integrating control and sound source into a cohesive ecosystem are really vast.

To expand on this idea, I connected a microphone to an envelope follower on my ARP 2600m and then connected that output to the Ferrous. This enabled the gain from the microphone signal to control the speed of the magnetic disc. In turn, as Ferrous causes an instrument to resonate louder, the microphone picks up more signal, causing the CV control to increase and creating a nice symbiotic, CV feedback-like relationship that is really fun to manipulate. Taking prompts from the Ferrous manual, I sandwiched two neodymium magnets on the edge of my 22" ride cymbal. At low speeds, the Ferrous shook a bit, what with negotiating such an opposing magnetic field, and the cymbal started to wobble and flutter. I held the mic up close and heard a beautiful drone beginning through the ARP's built-in speakers. As the sound built up, the magnetic disc speed increased as the cymbal again started to flutter faster, until it resonated with a metallic moan, pitch

bending and constantly shifting from low to high, loud to soft, while I moved the proximity of the mic to manipulate the intensity of the signal of both audio and CV. This envelope patch is simple and certainly nothing new, but when paired with the Ferrous, the results are just beautiful.

Next, I attached a magnet to both sides of a gong in a position I was sure would respond well after having first explored it with a mallet. The most challenging part of this was trying to hover over the magnets without getting too close to the gong, but still close enough to enable a reaction. Moving on to acoustic guitar, using the pulse button yielded the most compelling results as it swept through the harmonics, creating a cascade of haunting, ethereal sounds. Opening up my old Everett upright piano, I held down the sustain pedal and placed the Ferrous as close to the larger wound strings (C3 and below) as I could, and set the Ferrous to a consistent low speed. This really activated the string, and wow, it was really loud! Mic'ing the string on the lower section of the piano, away from the Ferrous, allowed me to capture sounds in a recording with little to no motor noise and made me want to dedicate an entire score to this kind of sound world. Soon, every steel surface and object in my studio was eventually vetted and explored with the Ferrous.

On top of my own explorations, I've enjoyed seeing how the community of users are also continuing to find new use cases for Ferrous. For example, I saw that Hainbach discovered that it can demagnetize a tape signal by running over a long, exposed tape loop, whereupon it created a cacophony of sound wherever it crossed paths with the Ferrous.

Ferrous comes with a 9 volt rechargeable battery (via USB C) and I've found battery consumption is efficient and so far a non-issue. There are rubber feet that can be mounted to the face where the front plate screws reside and these act as bumpers to prevent the magnetic disc from colliding with your instrument or allow it to sit face down on a fretboard or resonating surface. Of course, this could interfere with the quality of the sound production, but it's on the user to be creative and use ingenuity to solve these challenges. Compared to the Ferrous's counterpart, the EBow, the biggest downside is probably the motor

noise, which objectively is quiet, but can be detected if the instrument is being amplified with a microphone. Hence, creative implementation of pickups will likely be your friend here.

Do make note: Ferrous spins fast, it's magnetic, and the disc is fully exposed. Though I feel completely safe using it, at times it can collide with your instrument. So far, I've experienced no damage, but take precautions that there are no loose magnets nearby when you're experimenting. Ferrous is a wonderful tool. It can augment your arsenal of instruments and create new ones you didn't even know existed. Start exploring, enjoy playing around, make mistakes, and record all of it.

- Alex Vittum

Price: \$225



Labyrinth
Moog
moogmusic.com

I've been messing around with synthesizers long enough to remember Moog products before Eurorack existed, and I recall how strange it was when Moog transitioned to the Eurorack format. It was similar to moments like when Electro-Harmonix shifted to the 9V DC/tip-negative format that Boss standardized, or when Apple finally moved to USB-C—remarkable, but we all knew it was inevitable. And it made for a better world. So it's been about ten years, and throughout this time, Moog has applied the synthesis technology they pioneered fifty years ago in various ways to the Eurorack format and some, like the DFAM, have brought to life new elements and have even become iconic. But none of them have quite broken the mold in the way the Labyrinth does, an instrument that deliberately steers away from Moog's established design paradigms.

On the surface, it's a familiar Moog format: a semi-modular synthesizer in a 60hp Eurorack-compatible chassis, sharing physical characteristics with earlier

instruments like the Mother-32, including a patch bay, mirror-top knobs, and wooden side panels. However, looking deeper, Labyrinth expands on Moog's traditional architecture.

Moog describes this synth as a "parallel generative analog synthesizer." At its core is a distinctive generative sequencer, an element that sets it apart and makes it both engaging and inspiring. Generative synthesis has become a buzzword lately, with tons of products entering the space, yet few truly address the question: How can you create something compelling without a traditional sequencer? Something that incorporates randomness without actually sounding random?

Labyrinth solves this puzzle and achieves its generative magic through a dual 8-step sequencer that creates evolving patterns and melodies and each sequence can be allowed to evolve using the Corrupt control, which determines how much a pattern changes with each cycle. While the sequencer is influenced by the user, it doesn't function like a traditional step sequencer; instead, interaction comes via the Bit Flip function, which allows you to toggle active steps—green for on, red for off. You can further interact with the sequencer via the CV Range controls for Seq1 and Seq2 to adjust the pitch range.

Pressing the Run button initiates a melody based on one of fifteen selectable musical scales. As the sequence runs, it evolves in real time. Users can flip bits, change the pattern length, and save a pattern when it lands in a sweet spot. Rhythmically, you can define where each step starts, adjust step length, or chain the two sequencers to create up to 16 steps.

Saving a sequence is as easy as holding down the Buffer button and if you want to return to that saved state mid-jam, you just tap Buffer again. The EG Trig Mix lets you dial in how much of each sequence is present (more on this later), while the patchbay offers full access to individual outputs of the sequences, enabling integration with other modular gear. I had a blast sending sequences to other synths and layering them with the Labyrinth.

The tempo is adjustable via the Tempo knob, which controls the internal clock for both sequencers, and alternatively, Seq1 and Seq2 can each be clocked externally through dedicated Clock 1 and Clock 2 inputs on the patchbay.

At the core of Labyrinth's sound engine are

two oscillators: VCO Frequency and Mod VCO Frequency. This setup nods to the Buchla 208C, where the VCO Frequency acts as the main oscillator covering the full audible range, while the Mod VCO Frequency is primarily intended as an LFO. However, the Mod VCO can also reach into the audible range, making it useful for low-frequency melodies or percussive sounds. Both oscillators can be modulated via EG1 or a sequence and things can get even more interesting when you bring in the Ring Mod output and the MOD-VCO FM AMT control, which unlocks more complex and harmonically rich tones. There's also a variable-tone noise generator. All of these sound sources—both oscillators, the ring mod, and the noise generator—are then summed in the Labyrinth's mixer.

Next in the signal chain are the VCW (Voltage Controlled Wavefolder) and VCF. You can arrange them in different ways, either placing the VCF before the VCW or vice versa and they can also be run in parallel, with each path independently controlled via knobs or CV. You can then blend the output of each path to shape how much of each signal reaches the final mix. The VCW is a new addition to Moog nomenclature, and it features two main controls: Fold and Bias. While simple on the surface, these parameters allow for the creation of rich, resonant, and harmonically complex textures. The VCF is a 2-pole state-variable filter that also includes Cutoff and Resonance knobs, and enables smooth crossfading between lowpass and bandpass modes using the Filter Mode control. Of these, VCF Cutoff is the only one that accepts CV input, and you can also modulate the cutoff using EG1 CV or SEQ2. Similarly, the VCW Fold control can be modulated by EG1 CV or SEQ1, offering dynamic, evolving timbres over time.

U Mix is a utility mixer allowing the creation of a submix with use of the patchbay and you're able to send separate audio to the VCW path, or even separate the two oscillators into two separate signal paths for a duophonic instrument.

The only traditional envelope control on the Labyrinth is decay, but there's another unique feature that adds depth to the envelope section, the EG Trig Mix. This clever and deceptively simple control introduces a creative and complex layer to how the synth handles rhythm. The

manual describes EG Trig Mix as a "rhythmic balance control, determining which stream of triggers is sent to the envelope generators." It goes on to explain that it really shines when you're working with sequences of different rhythms or lengths, and this is indeed true. Functionally, EG Trig Mix blends between the triggers of SEQ1 and SEQ2, adding to the magic randomness of the Labyrinth and blurring the lines between sequencer and synth functions.

One of my favorite ways to use it is to keep EG Trig Mix set to SEQ1 while running a steady arpeggiated pattern or groove, then occasionally shift it toward SEQ2 every few phrases with an evolving pattern. The result is an always-changing line that feels random, yet controlled.

Labyrinth's patch bay is pretty standard fare for Moog and provides a wide array of access points for patching, making it easy to unlock new creative possibilities through experimentation. A couple of ways I've found it especially useful is by sending the Mod VCO out to the BIT FLIP CV input to toggle sequencer bits on and off, and routing external audio into the system to blend with the Labyrinth.

This brings me to my favorite way to use the Labyrinth: pairing it with a drone synth, in my case the SOMA Lyra 8. Drone instruments complement the Labyrinth beautifully, with the drones providing rich, resonant pads as a sonic bed, while the Labyrinth shapes rhythmic patterns and beat-driven motifs on top.

Routing the drones directly into the Labyrinth, you can manipulate it via CV across multiple parameters. Adding analog delay and reverb into the mix, and you've got everything you need to craft sharp, striking, and immersive soundscapes.

Labyrinth is a refreshing evolution of Moog's legacy, blending tradition with innovation in their Eurorack-friendly format. Its generative sequencer balances randomness and control, while the unique envelope tools enhance its rhythmic possibilities. With its versatile signal path, wavefolding, and rich patch bay, Labyrinth invites endless sonic exploration, whether you're working within its own system or integrating external sources. When paired with ambient drone synths or modular gear, the Labyrinth shines as both a rhythm generator and a textural sculptor.

- Graig Markel

Price: \$599



Subsix Submarine submarinepickup.com

UK-based company Submarine was founded by musician and engineer Pete Roe, and after a few other successful pickup releases, they have now unleashed a hexaphonic pickup, the Subsix. As you might gather from the name, a hexaphonic pickup is one that isolates the signal from each individual string, allowing you to experiment with the sound in truly innovative and potentially oddball ways. The pickup is passive, meaning no batteries are needed, and installation is a breeze. Once it's installed, you can plug it into an audio interface, mixer, pedals, and/or amps.

The pickup has a die-cast body and is chrome-plated, sliding under the strings without the need for any drilling or soldering. While it's simple to install, I recommend watching the instructional video on their website instead of trying to figure it out yourself. As someone who's not mechanically adept in the slightest, I was able to mount it to my acoustic and electric guitar quite easily. One thing to note is that you might have trouble sliding it under the strings if your action is low, so it's a good idea to review the pickup specifications on the website to ensure it will fit your instrument. Once I fitted it under the strings of a guitar with slightly higher action, I was able to quickly adjust the pickup height, and everything worked perfectly.

The pickup has two minijack outputs, each connecting to a custom cable with three audio channels that can go into a mixer, audio interface, pedals, or really anything that can take at least six inputs. Once you are plugged in, the six microminiature copper coils allow you to isolate your individual guitar strings, which is where all the fun happens.

Submarine offers some suggestions on ways to use the hexaphonic pickup, and for me, the best starting point was simply to play around with EQ and panning on all the strings. Plugging into a mixer with headphones, it was easy to find what frequencies could use adjusting and then

pan the strings to get a panoramic stereo sound. When using distortion or fuzz, being able to adjust the EQ by string can also be handy to either tighten up the sound or make things even fuzzier.

Running the pickup through octave and modulation effects is also a cool way to enhance, freshen, or warp your sound. I ran it through a sub-octave pedal where it was only hitting the low E string. While playing chords might be a bit too much, using the low string as a bass string while keeping the other strings in normal pitch was fun and a cool way to open up some new possibilities.

The manufacturer also suggests trying it with delay and modulation pedals, which I did, and again, it was easy to find a lot of great and interesting sounds out of it. Hooking up a flanger or phaser pedal to the pickup and then picking which string would get all warbly, while also adjusting the EQ and panning, created a lot of intriguing and unusual sounds that would be perfect for the experimental-minded.

For studio engineers, the ability to separate out the strings could inspire a lot of new ideas as well as make some editing and fixes easier. I am not much of a home recorder, so I didn't test it out in a recording setting, but based on how easy it was to use in a live setting, it should also be a snap to use in a studio setting. Various old reggae/dub engineers used to separate out the strings for different mixing, and that process must have been extremely complicated, while Submarine figured out a simple solution for the plug-and-play folks.

Extremely well-designed and easy to use, Submarine's latest pickup is a great tool to inspire new ideas and find unique sounds. The possibilities seem limitless, and you don't have to be a mad scientist to figure it out. Regardless of one's technical expertise, one should be able to find awesome and creative uses for it after a few minutes. Besides the benefits of having complete control of your instrument, it's also a very fun tool that will encourage musical exploration.

- Tom Ojendyk
Price: \$303



μο_C SE
Tall Dog Electronics
Tall-dog.com

Though not my first dance with multi-purpose digital modules—I've logged countless hours and patches with various incarnations of Expert Sleepers Distings, ALM's Pamela, U-He's CVilization, and probably a few others I'm forgetting here—this is my first ever foray into one of my favorite-named modules, Ornament & Crime (aka o_C). The open-source project by collaborators Patrick Dowling, mxmxmlx, and Tim Churches, which has been around for quite some time, it's a module that has a learning curve to it, though not a very steep one (menu and all), and it's a great way to have a large arsenal of useful features in your rack without needing a module for each one. It also allows for trying out things you might not have otherwise done, since there are so many options on tap, though we all know, while it's great to tout a module for the ability to do 10s, or 100s, or 1000s of things, for the most part, you can only use one or two functions at a time, with like, 998 or so algorithms waiting on standby. In the case of o_C, it has four identical channels, so you have the ability to have it do up to four things at once.

This particular version of o_C came by way of Western Massachusetts, via Tall Dog Electronics, an outfit who specializes in digital, open source modules. Along with o_C, they have some of the more popular Mutable Instruments, all in micro form, along with some other bits and bobs. The 8HP μο_C I received for testing was a Revision D, and had a nice build quality, with a gold/black faceplate. As μο_C is a digital module, it has various firmware editions available to tailor your use to it,

and the number of applications that it contains has changed throughout its evolution and differs via each firmware. The Tall Dog came with thirteen distinct functions available, from a quantizing shift register (the original purpose of the module so many iterations ago), to pitch and chord quantizers, to LFOs, to various envelope generators.

After going through the paces and spending some time thinking about this module, I realized I've never reviewed a module that was open source and where the heart of it was designed by another entity, with more than a few manufacturers offering up the same module; it's an interesting aspect to ponder. Interesting in a meta sense as well, as some of the algorithms are based on various "easter eggs" and hard-to-reach Mutable Instruments algorithms found (or not) on some of their modules.

The Tall Dog *μo_C* is laid out simply enough with the text-based OLED screen at the top, two encoders and two small buttons for selections below it, and four identical channels of Trig/CV/Output for each. While it's not complicated to use, having the manual nearby is helpful when firing it up for the first time to help figure out navigation and how to edit the details, which is really where *o_C* shines. You can go deeper into the minutiae here than you can with most modules of this sort, as it's highly customizable. This lets you be efficient with what apps are on the firmware and lets you tweak the parameters for your individual needs. Most modules like this live in a fixed system, so being able to craft and build *o_C*, so to speak, to how you need it is a real plus.

While the original *o_C* firmware offers twelve apps, some of these, like *Quadraturia* (up to four LFOs) I've got pretty well covered in my rig via the Xaoc Batumi and Five12's QV-L, so I decided to pick the three algos I most needed, in this case *μo_C*'s raison d'être, *CopierMaschine* (a four-stage analogue shift register), *Quantermain* (quad pitch quantiser), and *Dialectic Ping Pong*, a bouncing ball EG simulator.

I've always been a bit enamored with shift registers, and even though the right side of my brain is always telling me that it's just a quantized sample and hold, the left side of my brain knows that's not entirely true.

With a sequence running as the CV input and with a gate patched in as well, and patching just a couple of outputs from *CopierMaschine* into a couple of VCOs for melodic purposes, you can easily and instantly get related patterns that are both musical and interesting. Moving, shifting, changing...it's reminiscent of a Turing Machine, but you're also able to freeze your pattern by patching in a high gate into input 2, so if you find something you like, you're able to loop it and tweak around either through *o_C* or whatever it's patched into. Transposing, changing the scale quantization, switching octaves, as well as the buffer index, which changes the pattern of the notes, but retains the notes; are all great generative ways to mix things up. There are more ways to dig in, and you can customize the CV in as well to modulate any of the parameters. On top of that, there are all sorts of internal CV sources, so no patching is even needed. This type of detailing and flexibility can be pretty immense, and a lot of times it felt like it was never ending, mostly in a good way. Any time I thought *I wish I could...* I'd find that I could. Whether it was for melody or modulation, *CopierMaschine* is vast and can be really complex, and it made me think that though I love set and forget modulation, I also tend to be lazy and rely on random modulation for variation, instead of intentional tweaks and changes. Watching the voltage changes and movement on the screen pitched in some eye candy as well.

It's strange how a lot of the algorithms on *o_C* are related, and I thought of this when I found myself using *Quantermain*, a quad quantiser, a lot. Again, you can patch in a CV and quantize it to the nth degree and tweak to taste, but as is the case with *CopierMaschine* there are numerous internal CV configurations to use, which means it's another way to generate random modulation. With four distinct channels of customizable quantization, it isn't hard to see how valuable this can be, and as before, you're able to CV control pretty much all of the parameters you'd want to for some hands off modulation changes. There are so many ways to generate melodies and I really liked using all four outputs for stacked melodic pads, when, with some added reverb and delay, brought everything from bugs in a cave to what sounded like listening to an upset stomach

from the inside. Again, *Quantermain* is dense and extremely customizable and there's no end to the tweaking that can be had, but I found it really valuable to find that sweet spot, patch in some CV to change things around, and move on. You can even do some self patching for this.

o_C is a great module to have in your rack, which explains why years after its release it's still being used by so many. The Tall Dog version of *o_C* was flawless to use and I'm really glad they sent it along.

- Ian Rapp

Price: \$269

CONTINUED FROM PAGE 51

effortless, using the Scan function, where it looks for transients to mark transitions. Playing in Slice mode, especially with audio I captured (random bird calls and a Sprinter van that was backing up with its backup warning surprisingly loud), was a powerful and satisfying way to make strange melodies. Using the Loop mode for live looping also proved fruitful, even as less an instrument and more of a sketch pad. There's no overdub feature, so you need to add a new track for each idea, but with sixteen slots for this, there's plenty of room to stretch out. It isn't quite as flowy as being able to overdub and noodle endlessly on a single track, but for getting ideas down and building on them, it works pretty well.

Other things I'd like to see which I haven't mentioned yet, the first of which I hope will be coming soon, is an undo function; I really miss that one. I'd also love the ability to record automation, and to mute and solo samples and individual sample tracks in the sequencer.

I always like 1010 products, but Bento even more so. Again, it's not fully bloomed, but what's already in place is impressive, and I really love the hardware side of it; it just feels right. I've worked (or tried, rather) on quite a few other machines in this realm and none have had the ease of workflow or comfort of playing that Bento has, especially for how much it offers, and promises to offer. It seems like the sky (or CPU, really) is the limit here, and I'm super excited to see what 1010 does here, and to grow with Bento.

- Ellison Wolf

Price: \$899



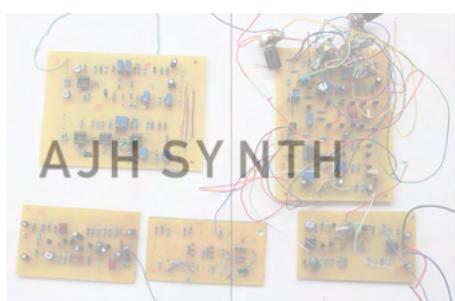
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learn on your own. Something about that makes it more fascinating.

It feels like true exploration.

I think about working with electronics in terms of being part of a lineage of general knowledge; what we know is possible and what we can imagine because of that. There's this continued through line of human history, something about working with electronics, that kind of makes me think about that. You can think about it in relation to any craft or process, like cooking or woodworking, but with electronics, there still is that essential mystery; it's all around us. We're talking through electronics right now, and it's still kind of a mystery. Even thinking about the history of synthesizers and where we are; there is a lineage happening. I like thinking about it in terms of that sort of scale, the first synthesizers, or the theremin... We're part of that history.

lorre-mill.com



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when the first software synths started coming out; they were too perfect, just bland and characterless. It was only when they started modeling all the stuff that doesn't work right that they started sounding good.

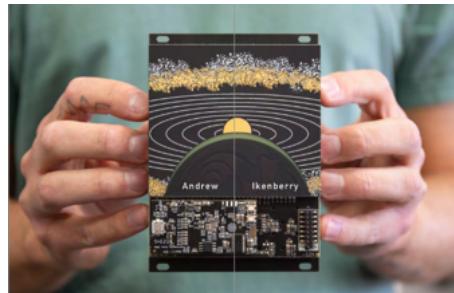
That's similar to what we were talking about with the oscillators and their imperfections, and how when you stack the irregularities, that's when you get the magic. Since most of your modules are analog, and you don't have to worry about processors constantly changing or becoming obsolete, I'm curious if you've had to change any of the manufacturing for some of your earlier modules at all?

The fundamental designs are unchanged; however, occasionally we find that parts we'd used get discontinued. We usually get advanced warning of that, and so we just buy up ten years worth of parts.

Your career trajectory isn't very standard; it would have been hard to see coming, but I also think it shows how you can apply knowledge across various spectrums to build successful businesses in different fields. Do you find that your experience across different industries that dissimilar?

Coming from the fireplace company, whenever you got an email from a customer, you thought, "What's gone wrong?" Usually, something got broken, something wasn't right or whatever. When I first got into the (Eurorack) industry, I started getting emails, like, "I've just got your MiniMod system, and just wanted to say I'm really enjoying it and it sounds great." It's amazing how often that happens. Being from the sort of commercial side of things, we used to do trade shows and every other company was a competitor, an enemy. When I first got into (modular), I thought I'd just like to go into a business where everyone's friendly, and that's what it is in this community, even with other manufacturers. It's not a competition; we all do our own thing. We all have slightly different tastes and therefore each has a different take on what the perfect modular system should be. It's so refreshing.

ajhsynth.com



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workshops in schools and doing community programs for teaching people about synthesizers, modular synthesizers, desktop devices, etc. I'd see them every year at NAMM, and in 2020, we had our first booth that showed off the Daisy. Tobias saw it and he kept coming over to the booth and talking to us, asking us all these questions, and then a few months went by and he wanted to have a meeting. That's when he showed us this PowerPoint deck, and it's this whole Chompi product. They had it down to a T; they knew exactly what they wanted to make right off the bat, and he thought the Daisy could power it, and that we could make this product exist in a way that he didn't think was possible prior. For the first design, we actually did all of the engineering work for them; the board layout, the firmware and everything that we were already familiar with, and then they handled everything else. They were telling us what to do, and we implemented it for them. Then their Kickstarter went viral, and the rest is history. He told me that it was the Daisy that made it seem like it was possible, and that's exactly the thing that really lights that fire for me, lowering the barrier to entry, so that the instrument designers of the future are not hampered by their technical prowess or proficiency. Tobias is great at Pure Data; he knows how audio technology works, but he's not going to write the C++ code to do the sample playback. I'm not going to write the C++ code to do the sample playback! But should that be what stops you from making a Chompi instrument, which stops Chompi from existing? Absolutely not. So for me, this is just a dream story of what's possible with this technology. We were lucky that he had the impetus to come up with the plan and let us be a part of the process.

How was manufacturing the Chompi? Had you done anything like that, using PCB material as an enclosure? Was that your first instrument with a keyboard?

It was definitely a learning experience, and the scale was pretty large. It was a lot of mechanical assembly. We've done a lot of pedals over the years, but pedals are still very different from a desktop synthesizer, especially when it uses the PCBs on every side, which was the thing that Chompi did. It's a beautiful enclosure, but it takes a really long time to put together, and so building those at scale was a pretty big learning experience for us. Not completely out of the wheelhouse, but the scale was a little different and once the Kickstarter exploded like it did, we hired a small Chompi team to handle the manufacturing process specifically for that product.

Was the process different for Replay, the Daisy-powered Vongon synth that you manufactured?

Very similar. You learn certain tips and tricks to use for everything that's in an enclosure, and there are things we would do differently for things that go in an enclosure that we wouldn't otherwise. For example, for Eurorack modules, we don't have to perform multiple functional tests at different stages. Once you talk about a desktop device, you need to implement a lot more stages of QC, and so for us, one of the big learning things for all these devices was that you need to test it as a circuit board, and then you need to test it in the case, and then you need to test it in the case with the screen on top of it. You need to test it at every stage where something changes.

I actually took the Replay apart because I was curious to see what was inside, and it was interesting to see the assembly, and even the keyboard switches, those gaming switches, because I wasn't familiar with those at all. Have you ever had conversations about building a Qu-Bit synth?

That's always been a dream of ours. The big question has been, "What do we do? What is the concept that we want to put out there?" We talk about it fairly often, so I don't think it'll be too long before you see

us come out with something like that, but what can we add that's new, that's unique? That's what we need to figure out.

Obviously when you do come up with a Qu-Bit synth the Daisy will be powering it. Have you come across any modules or instruments by manufacturers that you didn't know were using the Daisy?

It happens all the time. Recently, I was on Instagram, and saw that Taylor Deupree, from the 12k record label, who's a good friend of mine, had just gotten this pedal called LAPS by Puremagnetik. He was talking about how it's this cool tape looper thing, and I was like, "They should have used the Daisy. I should hit up Puremagnetik and tell them to use the Daisy." I went on their Instagram, and it turns out they already used the Daisy, that's what was inside of the pedal. That was such a magical experience for me.

I guess that makes sense why you're running one whole side of your operation making Daisies all day. Do you think there's a future where the technology gets to the point where maybe you can make the Daisy even smaller? Like barely more than an embedded chip?

It is. If you look at something like the Raspberry Pi Compute module, they're using very tiny mezzanine style connectors, which enable it to be really slim, and you can get like a hundred pins in the same area that the Daisy only gets forty. These are conversations we're having, and on upcoming Daisy designs we're working on, we are doing stuff like that, but we don't want to necessarily lose this form factor for the audience that it targets.

The DIY audience? Converts from analog through-hole design to exploring digital?

Exactly. We'll always have that, but we'll also have additional things that cater more to people who are only doing automated assembly and they need that high-density pin count. What we're working on right now is called the Seed III. The first question I think a lot of people are going to have is, "Where's the Seed II?" (laughs) We're kind of skipping the Seed II. We

currently do have a form factor that's called the Seed II DFM, which stands for Design for Manufacture, and it's something that's specifically designed for ease of assembly. It's a matte black board with 1.27 millimeter pitch headers so they're really small, and it's much easier to design a product with it, because you don't have to hand solder all of the headers on it. The biggest improvement with the Seed III is that it's going to have a much higher quality audio codec; the fidelity of the audio is vastly beyond what we currently have on offer on the Seed I. It can do 192kHz on both the in and the out, which is good, because the DFM can only do 192kHz on the out. It's also going to use USB-C, which is going to be a lot better for eliminating e-waste, and it's also going to have a matte black solder mask, which was highly requested by a lot of people.

How much time do you spend on the final evaluation before you take something into production?

It's a lot of hours spread out over a few weeks, because you need to do the physical hardware test, you need to measure THD (total harmonic distortion) and dynamic range and noise floor and all these things. That needs to happen with audio equipment. Then it needs to be used by various people in various ways, in all these unknown, unexpected scenarios. You don't expect it to ever fail; you never expect changing the audio codec to change things about the way the firmware runs, but it happens. That happened on the prior revision of the board we're working on right now. We try to send it to as many people as possible and use it internally on as many carrier boards as possible, with as many programming languages as possible, using different boot loaders, different sample rates, things like that. There's two components: traditional beta testing, which is not all that different from what you would do for a Eurorack module or a pedal, where you send it to your friends and say, "Do things you wouldn't normally do to this." Then, there are the physical measurements: Does it output the right voltages? What are the audio specs? How do they match up? Are they what we expected to see? Then the final component is that we do class A testing for every Daisy board, and that usually takes a few weeks.

We send that out to a lab, and they do their full test and give us all the paperwork. I'd say, once we have the final hardware, it probably takes about a month before we are ready to order production PCBs.

What other changes are in store for the Daisy with the new iteration?

One big pain point of the Daisy platform so far has been the documentation. "How do I get started with the Daisy? Where do I find the pin out? Where do I find this? Where do I find that?" We've created this whole website from scratch that is an entirely new support website for all our tutorials, our how-to guides, the pin out, the hardware documentation, the reference pages; it's all in one central location. This is going to be a huge boon for people getting started with the platform. They can just download the schematic right next to figuring out how to install the tool chain and downloading some binary files and examples.

I recently started messing around with the Daisy and Plug Data, and it reminded me of when I started learning how to make analog circuits; that feeling I had when I got an optical Theremin to work for the first time. It was fun and rewarding and it felt like I conquered something. It was that project broke down the barriers of electronics to a point where I could legitimately get excited about the possibilities. For such a long time electronics were such a mystery, and it's a theme we revisit in Waveform regularly. I'd tried programming before, in MS DOS way back when, and recently in C++, but nothing that I would consider actually realized. But with algorithm integration into the Daisy, I can see a future in experimenting with it in a way you don't necessarily have to understand everything all the way down to the bones. I was just wondering if you had any tips for people that might be afraid or nervous or trepidatious about diving into programming.

I would not consider myself a naturally technical person. I was not good at math or science in high school; I was too obsessed with music. But what I learned later on was that once I had a passion for a subject, it enabled me to spend the time to

force myself to learn it. I think this is such an important thing for everybody to understand, especially when we talk about STEM education. It's important to approach these topics with creative people from a place where they can understand it or feel passionate about it, and for me, inspiring people to learn the technical skill set is a huge reason that I feel so excited about Daisy. It's enabling people to do things that they wouldn't have ever been able to do prior, but it's also inspiring them to learn, to take the plunge into these vast, complicated topics that they wouldn't necessarily have had access to in the first place because it was too prohibitive. I'm hoping that Daisy is this entry point. You can take the Daisy as far as you want, you're not hindered by the platform. And just because you're a musician, or just because you didn't take calculus in high school, or just because you didn't do X, Y, or Z, you're never too old, you're never too limited in your knowledge to learn these skill sets. I'm always telling people, if I can do it, anybody can do it, and I truly mean that. When you look at something like Chompi, it doesn't matter about being the best engineer, it's about being the best instrument designer that's actually the harder skill. Making an instrument people want to use to make music is way harder than figuring out the circuits to do that. I think it's so important to get this message out there and to convince people to try. If you have the passion for it, do it; you shouldn't let technical proficiency stop you. The most fulfilling thing is seeing people make music with the tool that I've made. I get emails where people are talking about how it opened up new workflows, it opened up new worlds of sound. To know that artists are using this to make music that then influences and affects other people, that is really special to me.

How do you explain this to someone who has experience in various aspects of making music, but feels trepidatious about learning programming?

Using a data flow programming language like Max MSP or Pure Data is the same as setting up a pedal board; it's a signal flow, which is something musicians are inherently good at understanding. If it gets hard, you have the internet with Discord and forums and Wikis and YouTube.

There's never been a better time than now, especially if you want to make audio technology.

electro-smith.com, qubitelectronix.com, twohp.com



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There seems to be a throughline where you're constantly in pursuit of the next idea, the next process of how to make it work, whether as an artist, scholar, or synth designer.

When I was doing more installation art, a lot of stuff like that, that first flash, the first idea, I would immediately visualize what it could be, then I would start sketching in 3D to try and understand how it sits in space, what the view is from the other side. How could I fabricate that? How could I separate that into pieces? How can I make that puzzle? How can I make it happen? I'm still like that every time I think of something new, at least until I have a proof of concept working that I can foresee if it's working or not. Is this something? I just have to put it together fast. Once that spark comes in, my brain starts working and I can't stop until I have something. I demand a lot from myself; I'm a little bit of a perfectionist. I like to do deep dives into things, to really get myself into something, and that's something I've even had with modules, like throwing stuff into the trash; panels and PCBs that were done and ready to go, where at the last minute I found something that I had to change. After I think of something that makes it better, I can't put it out the way I had before I had the idea. If there's the idea, then I will go the extra step.

addacsystem.com

MUSIC REVIEWS

by Tom Ojendyk

Meredith Young-Sowers

Agartha: Personal Meditation Music

Important Records



After stumbling upon a cassette tape in a junk shop, Important Records did much sleuthing and was able to track Young-Sowers down. Originally released on cassette in the mid-80s, *Agartha: Personal Meditation Music* is now reissued as a mammoth 7-CD box-set. This is some prime new age music designed for meditation and chakra alignment, though one doesn't need to understand chakra to enjoy the music, and the liner notes give good background on the artist while also explaining the healing nature of the music. Most of the pieces are around thirty minutes of blissful, mellow, and mysterious electronic drones ripe for zoning out. New age music has certainly gotten a bad rap over the past few decades, and often times it was well-deserved due to the hucksters and snake oil salesmen involved, but *Agartha: Personal Meditation Music* transcends the stereotypes of and carries a similar feel to some of Brian Eno's music. It's very relaxed without any of the genre's cheesiness, and will most likely make you feel better after a full immersion into the music.

Various Artists

Testchamber

ModCaf

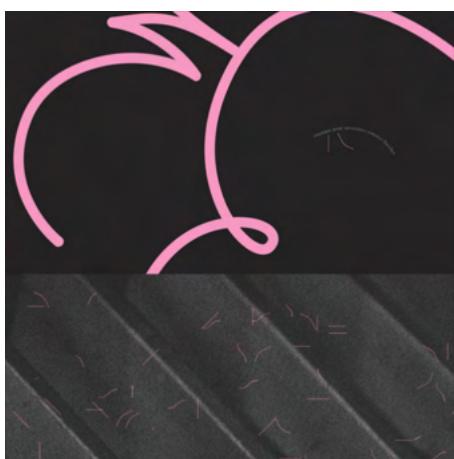


ModCaf, based in Aldershot, England, is a community group comprised of individuals interested in electronic and experimental music. This unique release features twenty-four group members who composed music specifically tailored to be recorded in a 1930s wind tunnel with a 24-foot fan that has been out of commission since 1996. Community members explored the space, tested its acoustics, and played the music live through loudspeakers. The performance was captured in 3D sound using a multichannel Soundfield microphone to fully embody the acoustical character of the location. Aside from mastering there was no additional mixing of the tracks. The excellent Adrian Utley collected the songs into this compilation album, and added an additional twelve tracks. While the music is diverse, each piece on *Testchamber* is thoughtful and rich, enhanced by the remarkable sound quality achieved through the unique recording process, resulting in an extraordinary listening experience.

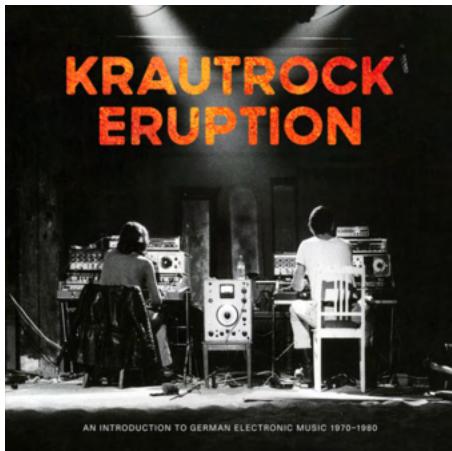
Tachycardie

Musique pour structures sorores Baschet

Un Je-Ne-Sais-Quoi



Tachycardie is the solo project by French drummer Jean-Baptiste Geoffroy and his latest release, *Musique pour structures sorores Baschet* was composed on Baschet Sound Structures. Created by the Baschet brothers in the 1950s, the sound structures were usually metal sheets folded into various shapes created largely for educational purposes, and were showcased around the world in various museums and workshops, and also appeared on several movie soundtracks. Originally, I thought the structures would sound only percussive, but Geoffroy coaxes a lot of intriguing and detailed sounds out of them. Mostly, the music is ambient and minimalist—as well as experimental—but it's still very approachable, which is what the Baschet brothers encouraged with their creations. The brothers passed away around a decade ago, but this great release is a fitting tribute to them and strongly recommended.



Various Artists
Krautrock Eruption: An Introduction To German Electronic Music
1970-1980
Bureau B

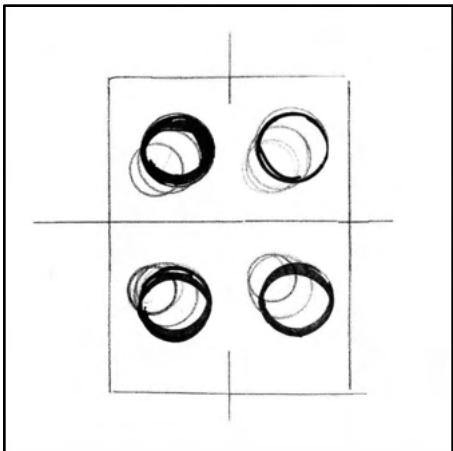
A companion piece to Wolfgang Seidel's book, *Krautrock Eruption: An Alternative History of German Underground in the 60's & 70s*, this double album release shines a light on some of the more underground and cosmic acts from that great era of music. Instead of just focusing on Can, Neu, Amon Düül 2, Kraftwerk, Tangerine Dream, et. al., *Krautrock Eruption* includes some amazing lesser known artists like Conrad Schnitzler, Harald Grosskopf, Gunter Schickert, Wolfgang Riechmann, Faust, Asmus Tiehtens, Pyrolator, and the Cluster crew. Seidel co-founded the rock band, Ton Steine Scherben, in 1970, and had a first-hand view of the birth of the German underground as it went from the 60s beat bands to the more radical and experimental 70s groups.

Interestingly, Seidel notes how the Monks (who were American GIs stationed in Frankfurt) were the originators of the motorik drum beat, and how a lot of the early musicians were rightful unhappy with the term Krautrock due to how it pigeonholed their music and wrongly tried to tie their music down based on national identity. The other obvious point, especially when you listen to this release, is that a good chunk of these bands simply did not rock. Nobody has ever fist-pumped or raised a lighter to a Cluster or Conrad Schnitzler song; that music was aiming for something more cerebral and even otherworldly than your standard 70's arena rock affair. Regardless of the term, this music is some of the best experimental music of the past fifty years, and it is impossible to overstate its influence over so many genres of music. Whether you're a new to the German scene, or well versed in it, this collection is very well curated and highly recommended.



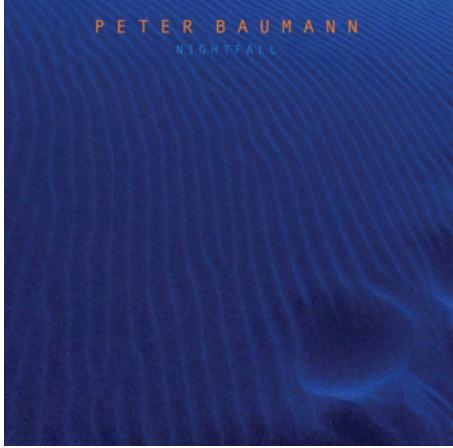
JakoJako
Tết 41
Mute

After the solid *Verve* EP from 2023, Berlin-based JakoJako (aka Sibel Koçer) is back with *Tết 41*, her first full-length on the illustrious Mute Records. and once again it's a beautiful collection of spacious and reflective tracks. Using a Eurorack setup and Waldorf Iridium Core, Koçer recorded the album in Vietnam during the Tết Lunar New Year celebrations, and book ends the record with some field recordings taken from the celebrations. The rest of the tracks on *Tết 41* are melodic and smooth, and by using a more minimal set up, Koçer was able to get the focus tight, yet moving. Each track has its own individual feel, but still, everything is united in a common musical vision. *Tết 41* is another awesome release by this very talented artist.



Nickolas Mohanna
Speaker Rotations
bandcamp.com

New York-based musician and artist Nickolas Mohanna has been putting out notable releases for over a decade now, and his latest, *Speaker Rotations*, is a stunning collection of instrumental improvisations. Using guitar, trombone, and piano, each track sounds as if they were filtered through a hazy delay or reverb, lending the release a great sense of continuity. With the pieces gradually developing new themes as ideas are introduced, they slowly bleed into the next one, resulting in music that is expressive and deep, and listening with headphones unlocks a lot of the subtleties. Overall, *Speaker Rotations* is very hypnotic, and a great addition to Mohanna's catalog.



Peter Baumann
Nightfall
Bureau B

As one of the pioneers of the kosmiche/cosmic sound, Peter Baumann is best known for playing with the legendary Tangerine Dream in the 70s and for performing on some of their greatest albums. His first solo album since 2016's *Machines of Desire*, *Nightfall*, continues his hot streak with eight tracks of fantastic, introspective, and forward-thinking electronic music. Baumann's philosophical pursuits over the decades have informed his music through his curious nature, and the melodies and movements unfold in spectacular fashion. As one of the earlier proponents of electronic music, Baumann continues to innovate and develop as an artist rather than resting on his status; *Nightfall* is a testament to his enduring creativity and passion for exploring new sonic landscapes.

INTERVIEW WITH PETER BAUMANN

by Tom Ojendyk

Were you involved in the 1960s German beat scene? I know Edgar Froese (Tangerine Dream) had an early beat band called the Ones.

I was playing in a band called Burning Touch, of all names, and that was more like an alternative rock band. I played with them when I was fourteen, for about three or four years.

How did you go from that to electronic music?

We did a lot of experimenting and we were just kind of messing around with different kinds of sounds and recording it. I was having fun with the unusual.

Could you share some memories about how you joined Tangerine Dream and your initial experiences?

It was total coincidence. We were actually at an Emerson, Lake, and Palmer concert in Berlin and they were late. We were all sitting there, and I started to talk to the people around me, and just behind me was this guy with dark, long hair and he said "Hey, what do you do?" We started talking about music, what we liked, and what we did, and he asked for my address. A couple of weeks later, I got a little letter in my mailbox saying, "We are looking for a new keyboard player, why don't you give me a call?" I talked to Edgar, and he said to bring my keyboard and we'll meet in this basement. We started setting up, and I said, "What do we play?" And they said, "Just start playing." That was it. We played for about an hour and it was a very interesting, a very cool event. After that, he said, "We have a concert in two weeks. I'll see you there."

Did you see Tangerine Dream when they were kind of more of a rock band?

No. When I started in the band, Edgar was playing a lot of guitar and Christopher (Franke) was playing drums, but it was relatively unconventional.

When you started doing your solo music, did you feel like your approach to music changed?

No, not really. We had just finished tour, and I had some extra time so I just started to record. I had a little tape machine that I worked with and it was just basically playing by myself and developing tracks and just having fun.

In between your solo records, *Strangers of the Night* and *Machines of Desire*, there's a gap of about fifteen years. Did your musical perspective or approach change during that time?

In the 90s, I was in the studio for a couple of years in a row, producing a lot for my record company, Private Music. That was a fun time. Then I moved and lived in Mexico for a while, and there was no recording studio. I felt that I needed to focus somewhere else.

Where did you record the latest album and what kind of gear did you use?

We have a little house in the country and an apartment in the city and I had a studio (in each). I had exactly the same setup in both studios and was taking tracks back and forth, saving stuff in the Cloud, and keeping some sketches. I feel my way through, trying this, trying that, and whatever fits, I use more. I was working with Paul Haslinger on a project called Neuland, and there were some sketches left over. I developed them, and decided to do another record.

Do you have a kind of a method to how you compose? Do you use a lot of improvisation?

Sometimes I start with a rhythm, and sometimes I start with different path sounds. Sometimes I have a little theme that I develop, and sometimes I just improvise; there's really no method. It's a little unorganized, but when you work by yourself and you have all the time in the world, you just do whatever you

feel like. I find it very fascinating that things that you have in your head, that you think will work, don't work, and other things work that you didn't think would work. For me, it's a matter of feeling myself into every piece that I develop.

You have the Baumann Foundation and you've done a lot of philosophical work. Does that inform your music?

It basically supported the idea that most of human life is visceral and physical, and the way we think and abstract the world is really just an appendage to that. That emphasized for me, that I really did music completely out of a gut feeling. I've tried to do a little bit with vocals, but I like instrumental music much better because there's no prescription in terms of having a cognitive meaning behind it.

I recently heard that *Berlin Express EP* that you did in the early 80s. I like that one a lot, it kind of had almost a new wave, post punk feel.

Now you're going really far back! That was a fun project. I had a

studio in New York, and I don't even know how it came together, but in one evening we did it.

Do you have any thoughts on the current state of electronic music?

I remember when Tangerine Dream recorded *Phaedra* at Richard Branson's studio in Oxford. We had a 16-track machine and some tape delays. We had one digital delay and a phaser, those kinds of things. It was really old and analog; we would use tapes upside, down backwards, use the tape delays going into a big, huge plate reverb, etc. It's amazing how fast all of that has changed. It's a different world. Whenever I go on Spotify and look at electronic music, or any kind of ambient music, they have a hundred kinds of sub-channels; it's unbelievable. It's great that anybody can do music and upload it, but to find an audience these days, it's awfully tough. Even if we had done what we did with Tangerine Dream today, we probably couldn't find an audience. It's just luck of the draw. I have a couple of friends who do music, and they have 9-5 jobs, they can't make a living with music these days. It's more democratized, but you also pay the price for that.

The advertisement features a large, bold title "WAVEFORM" at the top, with "MAGAZINE" written below it in a smaller font. Below the title, several issues of the magazine are displayed, showing various electronic circuit boards and audio equipment on their covers. A large, stylized "SUBSCRIBE!" text is overlaid on the bottom left. At the bottom, the website "www.waveformmagazine.com" is prominently displayed.

SYNTH HACKS #15

MINI MIDI HACKS

BY DAVID BATTINO
BATMOSPHERE.COM

Around the time MIDI became old enough to order a beer, I asked co-inventor Dave Smith why he thought the format was so successful. “I always challenge people to come up with anything else that’s twenty years old and still in version 1.0,” he

laughed. “I also challenge them to find something that’s in every home studio, every professional studio, movie studio, and stage—all around the world—and for which something built twenty years ago will work with something that was built yesterday.”

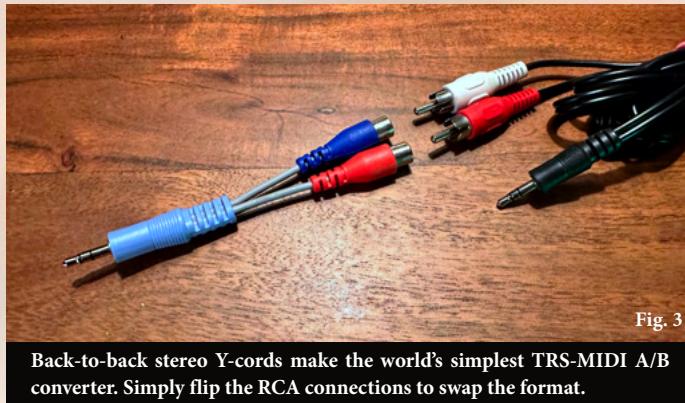
Fig. 1

Inserting an LED between pins 2 and 4 of a MIDI Out or Thru jack creates a handy gear light. Here I backlit the “UV” meter on my Funk Logic rack panel.

MIDI might be now over forty (and rolling out version 2.0), but here are five hardware hacks that still work well.

MIDI Gear Light: Got an unused MIDI Out or Thru jack? Plug an LED between pins 2 and 4 to light it up. Connect to pins 4 and 5 instead to make a data detector. The LED’s long leg goes to pin 4 (Figure 1).

MIDI Kill Switch: Crack open a MIDI cable, cut the wire from pin 5, and solder on a switch. (Or use two MIDI jacks.) Flipping the switch interrupts data to downstream devices. That’s a quick way to toggle a layered pad, disconnect modules that are always in omni mode, and prevent MIDI Start commands from triggering external sequencers. Just be sure you aren’t holding any notes before flipping the switch or they’ll miss the Note Off command and sustain forever! I built a kill switch into a monster toy and added LEDs to show the status (Figure 2).



I added two MIDI jacks to this monster, routing pin 5 (data) through a switch. That’s faster than unplugging a cable. See the circuit at Batmosphere.com/midi.

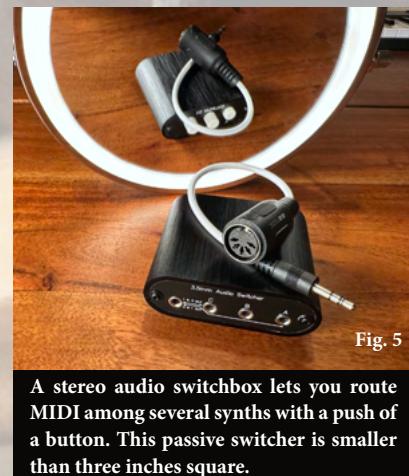
TRS-MIDI Converter: One hiccup in MIDI history is when manufacturers replaced the bulky DIN socket with a TRS miniphone jack before agreeing whether the tip or ring should carry the data. The MIDI Manufacturers Association eventually chose TRS-A (tip) format, but there’s a good chance any two pieces of gear won’t communicate. An easy fix is to connect two TRS-to-RCA Y-cables. If you play a note and your module doesn’t respond, simply flip



Although the MIDI spec proclaims, “One output shall drive one and only one input,” a headphone mult can work as a MIDI splitter to layer multiple synths.

the RCA plugs so red goes to white or vice-versa (Figure 3). **Mini MIDI Splitter:** Routing a TRS-MIDI signal through a headphone mult (Figure 4) is an easy way to control multiple sound modules that don’t have MIDI Thru ports. It’s a gross violation of the MIDI spec, but I’ve used it to play up to four synths in parallel from a single controller.

Simple Switcher: For more control, an audio output switcher (Figure 5) lets you redirect TRS-MIDI to one of several connected synths with a quick button push, and I discovered I could mash multiple buttons to layer the synths. Cheers to Dave Smith and the MIDI designers for giving us such a versatile technology!



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