books & ideas

Hacking Through Contemporary Electronic Music

An interview with Nicolas Collins

By Clément Canonne

With electronic music comes the possibility of hacking instruments. How does hacking affect musical instruments and the ways of playing them? In this interview, Nic Collins, a pioneer in musical hacking, describes his journey at the crossroads of experimental music, computer music and sound art.

Nicolas Collins is Professor at the School of the Art Institute of Chicago. Influenced by Alvin Lucier, David Tudor and punk culture, his work is at the intersection of experimental music, computer music, and sound art. During his career, he invented numerous musical devices by hijacking or altering existing technologies: CD players that play the sound produced by a disc when it is paused (*Broken Light*, 1991); attached to a trombone, a signal processing system that combines a digital reverb and a Commodore 64 motherboard (*Tobabo Fonio*, 1986); or discarded electronic circuits "reanimated" by probes that interact with other electronic components to create feedback (Salvage, 2008). He also wrote *Handmade Electronic Music: The Art of Hardware Hacking* (Routledge, 2009), an influential introduction to the world of musical hacking.

Books&Ideas: How and when did you become interested in music?

Nicolas Collins: Both my parents were art-oriented, so I grew up in New York in the 60s with a deep immersion in the art world—that was where they took their children instead of the circus. It was galleries of avant-garde art, Jean Tinguely and stuff like that; they were very interested in technological art. I got interested in music in high school, it was from 68 to 72—I think it may have had as much to do with the idea of being anti-something as for-something. I liked the idea of the avant-garde: experimental music that was against the status quo.

But then I branched into electronics, and it just sort of happened, I got a tape recorder to make copies of records, and it had a funny switch in it that made it feedbacked, so it turned into this instrument. I built my very first oscillator circuit by finding information in some magazines—you know, it was before the Internet.

So I ended up studying music in Wesleyan University, and the first time I met with my advisor in the Music Department, he said: "Do you know Alvin Lucier? You said you did electronic music"… And I didn't know him. I was from New York, I thought I knew everything. I knew Cage's music, but I didn't know Lucier's. And my advisor said: "Oh, you should meet him, he makes music with bats". And I thought: "Wow, that is like so far beyond anything experimental I thought of, I have to meet this guy". I thought it would be like to meet the Che Guevara of music.

I worked with him for years, and he was a very big influence because… Composers like Lucier, at that time, could make the case that you could make music about anything. It doesn't have to be about Beethoven, it doesn't have to be about Mahler or Schönberg, it doesn't have to come from just one stream. So here is a composer who's making music based on architecture, biology, neuroscience. And of course, for someone who didn't have a strong background, that was very liberating… It was a catharsis. And I think we all misunderstood that lesson, because I think in the end, there is still something fundamental about musicality. In other words, Lucier is very careful to say in his pieces, like *I Am Sitting in a Room*, that it is not a demonstration of a physical fact. He doesn't want to do science. And the way those pieces work, and the way they last for 50 years, it's because they have a poetic quality, they're not just science. And I think in the 70s, sometimes, there was a confusion: people thought they could do didactic works, but it didn't mean "music". But, you know, we learned that. The point was that it was a very liberating feeling and it made me think that I could become a composer even though my background was very strange. That was what pushed me on the road.

B&I: How did you start working with electronic circuits?

Nic Collins: Lucier famously said in an interview: "I'm not interested in electronic circuits because they're two-dimensional, and sound is three-dimensional". But he encouraged his students to learn circuitry and computer programming—because even in 1972, he said: "This is the future". So he invited David Tudor, he introduced us to those people; he thought that was important for our education.

So I continued to work with trying to build my own circuits in the 70s—you know, it was a little more difficult then, there was less information. But it was a post-Cage aesthetic, in which we accepted accidents and indeterminacy. So a circuit that didn't behave like a Moog, because it was glitchy or unstable, would work in our music. It might not work to play Bach, but it worked for the strange, post-cagean ideas. This is why when I was a student, I worked with feedback a lot, because with feedback, you don't have to make a decision, you just turn up the volume, and the world makes a decision. It's not my job to pick the pitch, and I just can manipulate by going from one to another that are just sort of given. And we were also always interested in live performance, I think that was the legacy of growing up on pop music, for my generation. My friends were not interested in doing studio work, we weren't interested in making tapes, we wanted to get on stage and play.

So what happened was that there was a big shift at the beginning of the 80s to the personal computer as the basis for live electronic music. MIDI was a very powerful tool, everything became much cheaper, you started to get application software, so you didn't have to write you own code yourself. So it was a big liberation. But at the same time, MIDI was designed for the commercial music market, it was designed to sell synthesizers to people who did what we might call "normal" music. And normal music is based on notes. And a lot of what people were doing in my world didn't have to do with playing notes and harmonies and melodies. We had other ideas about crafting sounds. But the MIDI system was not so good for that. So my friends who were working with computers were spending a lot of time kind of finding backdoors in MIDI equipment, so that you can do strange things with the synths. So in the 1980s, I worked with multiple technologies: I used computers for things that computers do well, which is mostly control; I used circuits for the things that circuits did well, which is making strange noises, noises that weren't synthesizer sounds; and because my music was based on performance, I worked with musicians, because I needed players. I worked with musicians playing circuitry that I would build, but also with their musical instruments.

The thing was that, at the time, for the chamber music ensemble who would play contemporary music, there was still a lot of resistance to open form music. Even in the 80s, Cage was kind of a hot topic. Not everybody thought he was serious. And I think a lot of musicians who came out of conservatories basically either didn't know how to improvise or they didn't trust themselves doing improvisation. And so I ended up working with musicians from the improvised music world. They weren't a lot of people working with electronics but unlike a lot of the classical musicians, the improvisers were open to it. They would say: "Oh, that's cool, that's different", rather than "Oh, I don't know".

B&I: What kind of music were you making with those improvisers?

Nic Collins: I built this instrument that was based on hacking an early digital reverb—I literally stuck a C64 computer inside a digital reverb and made connections between the two, and I essentially made a DSP for the C64 by using the signal processing capabilities of the reverb and just hand shaking to the Commodore for control. And it was very good for instantaneous looping, sampling and transformation. It's like the looper pedals they sell now but it was 30 years ago. I liked the sound vocabulary of the transformations, but I could have done those in the studio, non real-time. But I loved the idea of being able to do it fast. I loved the idea of sampling radio on stage, because it gave you this tension of… you know, it's now, I need it now! So the idea was that it was fast and it was live. So I built up this system and to control it—again because I wanted something big—I decided that I needed a big sample, and I thought: Oh, a trombone! You know, a stupid joke! And I connected the trombone to half a mouse—a data entry wheel, a shaft encoder—and then I put a keypad on the trombone with 24 buttons, and then I could click and drag, just like on a computer screen, to change any parameter of the program: change the pitch, change the length, change the program, change the filter.

So in a way, the trombone was just a mouse! But I didn't have to look at a computer screen, which meant I could be on a stage, I could concentrate on the other musicians, or on the audience. I realized it had this intimacy on stage, but even though it was obviously an electronic instrument—the sounds were electronic, I never blew into the instrument—it had this acoustic presence. So I immediately started working with improvisers. I said: "Look, can we just try something?" And improvisers are funny because they don't say: "Let's go to the studio and try it out"; they say: "Oh, ok, I booked a gig, I'll meet you at 8 for sound check". So it's a trial by fire as we say in English. I started doing that in 1987 or 1988 and that's what really opened up improvised music for me, because it gave me for the first time of my life an instrument.

B&I: Does this mean you don't see circuits as fully-fledged instruments?

Nic Collins: You know, there was always this idea in my circle that the circuit actually wasn't just the sound instrument, but that there was an element of a score in it. The circuit implies the piece. So very often, you'd make one circuit and you would only use it for one composition, as it were. For example, I have this piece called *The Royal Touch*, which is based on a dead circuit board. Now, I don't know what's on the other side of the circuit board, this came from the garbage, this was not designed. I think it's an input channel from an old mixer, it came out of the garbage at my school. I know that on the other side there are resistors and capacitors and integrated circuits, but I don't know what's what. So what I do is: I just push small leads around until—usually you just get a whole bunch of glitchy sounds, like putting a

jack in and out of a socket—so I push it around and then suddenly you'll hear a very solid pitch, and you try to sustain it but your hands are moving a little bit, and it'll drop off, and then you move like a fraction of a millimeter, you're kind of rolling your finger trying to get the thing back. And literally, that's it! Now here is the thing: the oscillator tuning is a function of two components: One is this resistor element enchased between these points (on the board); and then, connected to the circuit, each voice has what is called a capacitor. And the capacitor sets the range of the oscillator. So what I do is that I tune this circuit by putting into a little socket one capacitor for each voice, so that I know that one of these voices will always be too high to hear, one will always be so low as to basically be a rhythm, and the others in between, and when they collide and interact on the board, they do things sort of like a ring modulator, they modulate and they create side bands and other things like that. So I have this knowledge that each one represents a range of frequencies. I don't know which one is which, but I know that statistically, I'm going to get a full distribution of pitches, and I'm going to get certain types of modulations. And really, it's just a question of how much work do you have to do to have something that you like: How often can you work it continuously and how often do you need to pick the thing up, shake it up, and put it down in the board in a different place, to kind of reset. It does require what we might call "technique", it's not like playing a Bach partita, but you do learn from playing it!

But even if you can learn from playing it, a circuit is not really an instrument… It's like asking a drummer: "Have you ever thought of doing a 3-week tour of concerts, improvising with these other musicians, with just a triangle?" A lot of my circuits are like a triangle. In the right context, it's the perfect instrument, but do you want to hear it a whole night of solo triangle music? I have built circuits that make incredibly beautiful sounds but I would have to say that, generally speaking, they have a very limited sound range. When people build analog synthesizers, they have several different modules, so that you can have variety. But I only have 4 or 5 "drums", and they're actually more similar than the parts of the drums. And the way of playing them doesn't really give me, as a performer, enough variation. Here's the problem: Real musical instruments are amazingly nuanced. You get somebody out there with a guitar and with their voice—I even know people who do solo snare drum performance, and you get so much range, so much flexibility. And I'm sorry, I've been building circuits since I was 17 years old, and I'm a pretty good builder, but I will never be able to build a circuit that will have the expressivity of a snare drum. I don't have that ability. I simply don't feel comfortable doing that.

So this trombone instrument was the first thing that actually behaved like an instrument. That is one day I could play wedding with it and the next day a Barmitzva. So it was really my introduction to being an instrumentalist. What happened when I would play with musicians on stage is that I would grab the very first noises they'd make, maybe just tuning or taping the keys and then I would grab one second of their sound but I'd make 2 minutes of variations on it. Part of me was very attracted to DJ culture, from rather early on… You know, I started listening early hip-hop DJs in 1980, when they were just beginning to

emerge so to say in the consciousness of the white world. And I really wanted to be a DJ, but the problem was that it was a lot of equipment and I had all this other equipment that I had to carry for the other pieces, so you know, there wasn't like I could carry one suitcase of electronics for the electronic pieces, and then, two turntables and a box of records. So with the trombone instrument, I was basically deejaying with the records that the other musicians were making.

Someone once who said that I was responsible for slowing down improvised music, because everything I did was a question of extending. And what it meant was that in improvisation, it used to be that as soon you did something, you could move away. And now you couldn't because it was still there, it was left. You know, my education took place during the minimalist era, when minimalist was really a strong force in the music field. Things were slow. The trombone extended things—it basically slowed things down. And the thing is that most of the systems I build suffered from too much beauty! There was almost a quality of like Muzzak or easy-listening music to a lot of what I did… But I wasn't, you know, like a meditative, Californian-mind type of person. I was a New-Yorker and there was always a certain tension where I'd have to figure how to get edge in my work. And when I improvised with other players, of course, that was easy, because the other musicians could do something sudden. But I could never kind of initiate an aggressive act. And I think that this nagged me. And what was interesting about getting involved in circuitry in a more intense way, for the second time of my life, was that it allowed me to work with, shall we say, more aggressive sounds and less beautiful sounds.

B&I: Were you trying to find a way to be directly in contact with the sound?

Nic Collins: Exactly. And this newfound interest in DIY and circuits is also strongly linked to the teaching job at the School of the Art Institute of Chicago, which had a department called Sound—not Music but Sound. It was a very digitally oriented school, everyone was using computers. You know, what I always like to say is that command-X/command-V is the most powerful tool an artist can have. Suddenly you have one pencil that you can use to edit words, edit films, edits videos, edit sounds, edit website code, edit illustrations… It's amazing! But at the same time is a very non-physical thing. And artists, unlike composers, generally speaking, even digital artists, they always started messy. Everyone who decides to go to art school started out scribbling, they started out drawing on a kitchen table. Maybe that will change, maybe in 10 years we'll finally have a generation of kids who never touched paper. So in my student years, I saw this kind of schizophrenia where they were very electronically-oriented sonically, everything they heard was through earbuds or speakers, none of them played acoustic instruments, none of them listened to concerts of acoustic music, if they went to music it was always clubs, so they were immersed in electronic sounds but they wanted to do something with their hands. You know, it's like these guys had a digital hangover: they woke up one morning and said: "Too much computer, give me a circuit!" And I gave them a circuit. I always had little bits of circuitry and I was doing minor hacks on things: no mixer or effect processors that came into my house remained unmodified for more than 30 seconds, I just

opened them up instantly and I always did something. But my attention was focused on softwares, that's where you can really work and get things down. So I looked back at what I knew about circuitry and I thought: What of this is relevant today? So I was looking for things computers do badly. You know, I'm sorry if this offenses people, but there's really no point to try building your own analog synthesizer from scratch. I mean, come on: A/ you can get beautiful synthesizer emulators that run on your computer and you don't have to carry an extra piece of luggage and: B/ there are wonderful designers making these modules and they're not terribly expensive so why not just buy them? But there are things that computers do badly, and performance instrument is one thing. So I did this class which was mostly performable circuits, things that you can really interact with directly, things that you would touch with your skin. And the other thing was that we made unusual microphones. Because, again, all of my students—and everybody else in the world—were working with sample based music creation, and some of the samples were computer-generated sounds, but a lot of them originated from the acoustic world. They have to get from the acoustic world into the electronic world. And if you can design you own microphones… It's like designing your own hears, you can change the way you hear those sounds. And some of these mics are exceedingly simple and inexpensive to build, so why not? Also, if you build a mike for two euros, you're much more willing to do something like put it in the middle of the street and record what it sounds like to have a garbage trunk run over a mike, you won't do that with a Neumann, unless you're a very rich person.

B&I: The subtitle of your book is "The Art of Hardware Hacking". In what sense can your practice be described as hacking?

Nic Collins: Hacking, in American English, always had a meaning of sort of improvisatory solutions. And you use it in a number of ways, you can say: "I was hacking around the house", which means I was doing little repair, like "fiddling" or "tinkering", which often means a kind of work that's not hugely productive or isn't very expert. Our vocabularies are rich with words like this because it's a very human activity.

There is a thing about hacking and power that I think is very important. Most of the time, hacking seems to be connected with power, one way or the other. When you hack the telephone system, the telephone system is a very powerful thing. In 1970, to be able to make a free long-distance telephone call from New-York to England, wow, it was probably the equivalent of a hundred euros at that time. This is like significant power. When you got access to a big computer system for an insurance company, that was a million dollars computer system with all these data in it, it represented power.

I think that one of the earliest aspect of hacking in American culture, before the telephone, are hot rod cars. The engine boxes of cars were designed very conservatively, and the hole for the cylinder had a lot of metal around it. And if you made this bigger, the engine

would be stronger, because it was more displacement on the engine. So they begin this movement of increasing the power of your car by doing this machining at home. This was like circuit bending: You take the toy and you do something that the factory doesn't want you to do. These engines represented power. In other words, there was more power in the engine that they gave you, because it was under-utilized. So when you were over-drilling this, it was like making free long-distance calls, you know: Suddenly you got the power yourself. But here is the thing: Whether it was the hot rod people, the phone people, or the computer hackers, they didn't always use the power. It's almost as though what was interesting for them was to expose the power.

Now my situation with hacking is very similar to the hot rod car persons. I learned a little bit of circuitry, I made a few simple circuits, but then I would finally buy something, I would buy a mixer or an effect pedal. And I would look at it and say: There is more in here than they're letting me have. So I would open it up and I would make a change to give me access to something that was there but I couldn't get otherwise.

One of the things I very often did when I bought something like a Maki mixer is, they would have very nice power supplies inside. So I would put a drill hole in the box and put a connector on it so I could use the power supply of the Maki to power some other circuit of mine. What this meant is that I didn't have to bring along on the road this second big power supply that I have for my circuit, I used the Maki, so that's was a question of simply taking something from it. However, at the same time, you'd read these articles, especially in the audio world, there was this journal called *The Audio Amateur*, and they would always be publishing articles about: "Here's an amplifier that you can buy, that's quite good, if you open it up, and you take out these two capacitors, and you put in these two better capacitor, you will have a better sound in the high end". So in that case, the hack was to improve something, not to turn a stereo into a 4-channel amp, but to improve something. So you know, when I take the power supply out of the Maki, I'm adding something. When I change the capacitors, I'm improving it. I think it's part of the same aesthetic.

B&I: What does the idea of "hacker ethic" mean to you?

Nic Collins: There is a big generational change between my father's generation and the generation of my students. My father was an academic, but he was a man who grew up in a world of mechanical things and the assumption that you have to understand your mechanical world to keep it going. I think that the assumption was that the world could be open. If you couldn't do it, your neighbor could. And now, we live in a world where the technology is either remote—where is the cloud? I have no idea—or it's closed—how often have you opened up your MacBook?

One of the things I get constantly in the workshops I'm organizing, is people using that cliché word "empowerment". They say "This was empowering because I never thought I

could open this thing". It's simple as that, you know, the fact that a lot of what we are doing in these workshops is opening something: we open a radio and we touch the circuit board; or we open a loudspeaker and we connect to it directly with a battery. It is about opening. And even when we build a circuit, in a sense, it's sort of like the opening process backwards. In other words, now, we understand what is inside the boxes that we buy. This may be naïve on my part, and as a New-Yorker, I'm bitter and twisted and cynical by nature, but I think that there is a political value to giving someone a sense of control over the material in their life, so you do not feel that you are always essentially a victim of something. So I think that one of the things about hacking that has some value that goes beyond just making weird noises is that it makes people aware of how things work, it either gives them a sense that they have a little bit more control over something that they otherwise couldn't, or it means that they don't have to believe what other people tell them. You know, like when you're having problem with the cable for your television and they say: "Oh, there is nothing that can be done because the cable junction at the next block is broken". And then you can finally say: "No! They can go to the cable junction, they can open a box, and they can put a jumper wire in!" And then they go: "Wow! How did you know that?" In other words, it means that you can challenge the people who depend on the closeness of the system for power… And which perhaps gets back to the power: As long as the power is enclosed and invisible, it's mysterious and has power over you. But when you get access to it, you know what the mechanism is, and you realize that it isn't, as it were, omniscient, that it has limitations.