and a zero, and a one . . .

Arne Eigenfeldt

puts the *algo* back in *rhythm*

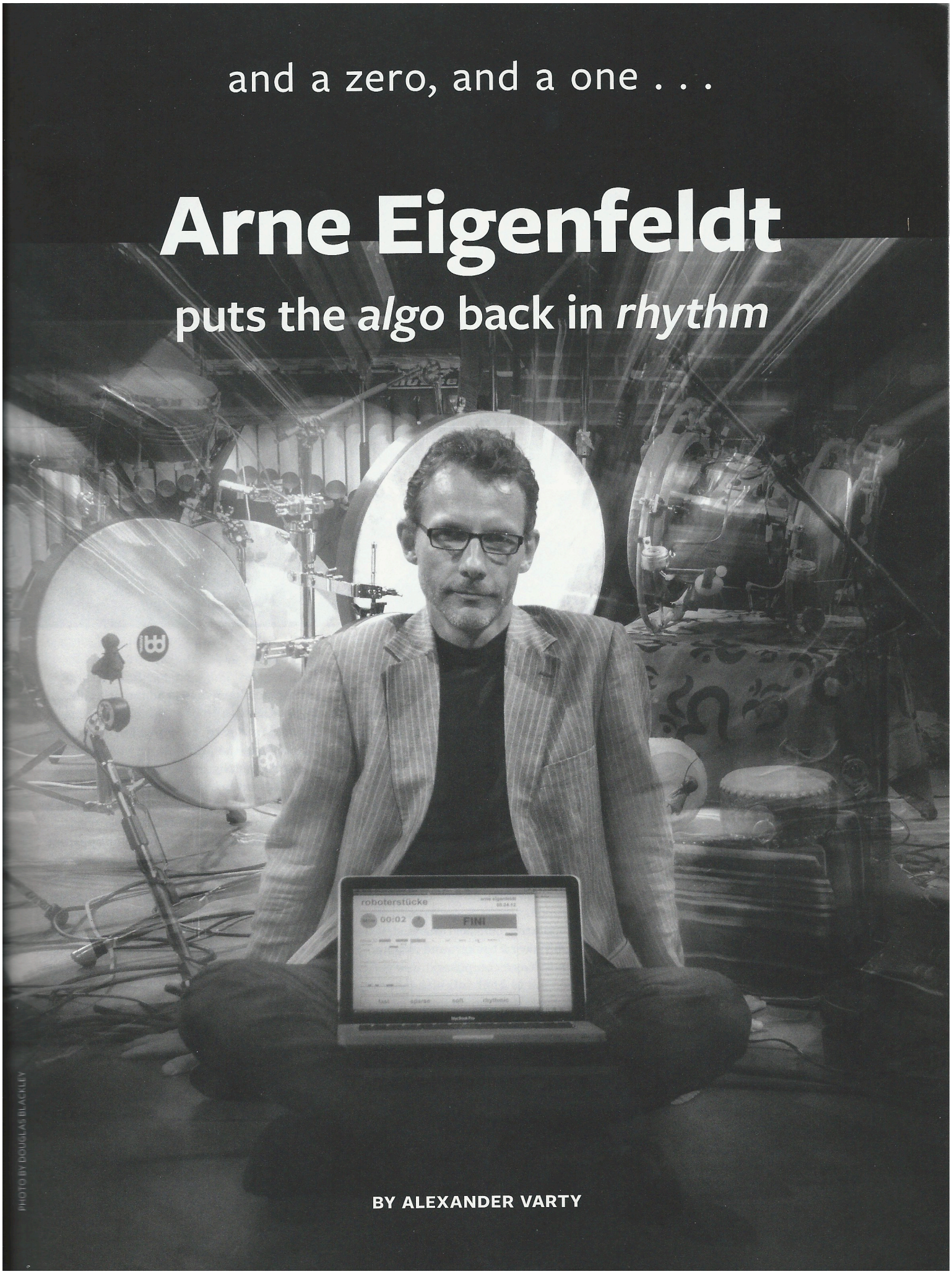

PHOTO BY DOUGLAS BLACKLEY

BY ALEXANDER VARTY

THERE'S SOMETHING MYTHIC about the story of automated music, beginning with the very Biblical notion that the first robotic performers—the clockwork automatons of thirteenth-century Persian inventor al-Jazari, who floated them in a boat for the amusement of royal drinking parties—were created in man's own image. Things got stranger from there. The pegs and cams of the music box and the barrel organ gave way to the player piano, which, under Conlon Nancarrow's direction, surpassed flesh and blood in playing fast and complex scores. This, in turn, led to multitrack recording studios, computerized sequencing, and the apparently endless possibilities open to anyone who owns a laptop.

Now it seems that the machines—whether purely software-based or steel-and-servo-motor robots—are learning to think. And who knows where *that* will lead? Well, perhaps Vancouver composer and Simon Fraser University associate professor Arne Eigenfeldt—who doesn't claim to be able to predict the future but is working hard to create it.

Ironically, Eigenfeldt didn't become a musician in order to specialize in computers, programming, or robots. At first, it was music's social aspect that appealed to him, especially the complex interactions of the ensemble setting. He began his professional career as a bassist, playing casual gigs and jazz. Coding came later. "When I was fifteen, in grade ten, I decided, 'I'm going to be a musician. I don't need math or science,'" Eigenfeldt says, during an interview in a Vancouver coffee shop.

It quickly became apparent he was not so much a performer as a composer, which in turn led to his longstanding interest in generative music—compositions that generate their own variations, based on an initial theorem or design—and his more recent work in robotics and computerized musical analysis.

"I don't have a background in piano," he explains. "So as a composer it was very difficult for me to hear full ideas, because I couldn't hack them out on the piano, and the piano is a wonderful instrument for having these multiple ideas going on at the same time. So I was very much drawn to using the computer to create processes and be able to hear them, and then alter the processes and have that interactive relationship. So I think I was just drawn to it. But I've never used a sequencer. When I started working with computers in the 1980s, sequencers really weren't established then. There weren't any tools that were obvious to own, so you had to sort of build your own. And the first things I built were these process-based things; maybe I'd give it a sequence of notes, but every time it would play them differently, whether it was in a different rhythm or a different volume. That seemed to be much more natural than the tape-recorder or the sequencer, where it's just playing the music back."

Eigenfeldt admits that there's an apparent paradox here: while his compositional interests have led him into in the unapologetically unnatural world of artificial intelligence, he's concerned that his music be perceived as having a kind of organic integrity. "With generative music you're creating systems that generate music, but the problem at the end of it is: How is the music audiated? How do people actually listen to what is created?" He offers *In Equilibrio*, which he wrote in 2009, initially as an example of a generatively composed piano score. "The first time I played it using synthetic sounds, and the audience couldn't get over the fact that it didn't sound exactly like a piano," he says. "They just heard all of

ON THE CD: *Roboterstück, Winter Was* and *Indifference Engine vs. Brian Nesselroad*

PHOTOS BY DOUG BLACKLEY

LEFT AND ABOVE: Detail from the KarmetiK Notomoton, an eighteen-armed percussion robot. Here, it's waiting to jam at a performance by Arne Eigenfeldt at the Goldcorp Centre for the Arts, SFU Woodwards, in May 2012.

these problems. And I thought, Well, I'll accept that. And then I moved to more completely synthetic sounds, but the audience started listening to the timbre and all these other aspects, so [their perception] wasn't note-based. So I started using a Yamaha Disklavier, which is a robotic piano. And I thought, This is the final solution, because I can now create music that's meant for a piano and that's played by a piano. But in performance the audience had a completely different reaction to it: one person said they didn't really enjoy the piece because there was 'no effort.' I thought that was a fascinating response."

Eigenfeldt remains both perplexed by and curious about how his music is perceived. His inner scientist, one suspects, finds the processes behind it compelling on their own, but as an artist he hopes that his music holds meaning for lay listeners, too. He's currently exploring a number of ways to make it more user-accessible, including introducing elements of "effort" and unpredictability into the works that he's created for Los Angeles–based musician and designer Ajay Kapur's robotic percussionists. "About five years ago I was at a festival, and I ran into Ajay, who was demonstrating a robot that he'd built, this percussion robot that played real drums," he says. "It wasn't one of these robots that you see on TV—it was this pieced-together thing, and it was incapable of playing perfectly because of all the mechanics involved ... Because an acoustic instrument was generating the sound, and because the robot was not striking the drum exactly the same every single time, it sounded very, very human. Just all of the idiosyncrasies of the mechanics involved made it sound much more human. So I started working with the robotics in that aspect."

Simultaneously, Eigenfeldt is designing digital *agents*, the term he prefers to *programs*, that are capable of co-composing his generative music in real time, whether operating on their own or reacting to input from a human performer. As demonstrated in *Indifference Engine vs. Brian Nesselroad*, the first in a series of planned encounters with improvising musicians, they do a surprisingly effective job of simulating the sound and decision-making process of carbon-based life forms.

"It's not very difficult to create systems with agents that can create relatively interesting music," he notes. "The problem is: How can they behave at a higher level? Musicians will make decisions on their own, intelligent musical decisions, and that's very difficult to program into the system. So what I've been working with, on the advice of some very smart computer scientists, is the notion of multi-agents. So you create an agent that is a really intelligent entity, that can make decisions on its own, and it relates to the other agents in the system. So it's interactive, it's social, it communicates with the other agents, and it's very sensitive to its environment.

"For example, with the *Indifference Engine*, it's saying 'I'm going to play these types of sounds, and I'm going to play them fairly quickly in this sort of register.' And the other agents, they have their own ideas, so they begin negotiating back and forth to create a collective method of moving forward. So that's become the social idea of the agents working together, and that's a very powerful device in my music. It's very similar to how I think musicians interact as well. They listen to each other, and they don't know necessarily where they're going, but they move towards this collective goal that emerges. And that's really what my virtual agents do, as well."

Similar ideas animate the Generative Electronica Research Project (GERP), a collaboration with Eigenfeldt's SFU colleague Phillippe Pasquier and composer Chris Anderson. This time, the intent is to create a metacreative system that can compose music in an identifiable and popular idiom: electronic dance music (EDM). So far, GERP's researchers have disassembled and transcribed twenty-five examples of breakbeat music and a further twenty-five house tunes, using that information to build new, genre-specific pieces.

It is very much, Eigenfeldt admits, a work in progress. "I'm incredibly excited about what it produces, but when you play it for people they immediately hear the things that are missing," he says. "There's so much more to EDM than simply the note choices: it's also the signal processing and how the timbres change. All of that is so integral to the success of the piece—and we don't have algorithms for that, but we're working on them. At the moment GERP generates all the notes, all the beats: the sequencer score. I still have to select the actual timbres that are played, and there's no signal processing, no dynamic filtering or reverb or anything like that—which, again, is integral to that type of music."

The commercial implications of an automated system that can compose in a popular genre are obvious. And they go far beyond crafting tunes for the dance floor: one eventual application, Eigenfeldt believes, will be in the realm of digital gaming, where increasingly intricate recombinant "storylines" are calling for an equally complex and flexible sonic response.

That, though, is still in the future—a future he's more ready for than most.

ALEXANDER VARTY *is the music critic and associate editor of Vancouver alternative weekly the* Georgia Straight.

LINK: <http://metacreation.net/gerpNew>

FYI: *Arne Eigenfeldt has been commissioned to create a new work for Vancouver's Turning Point Ensemble. It premieres May 2014. The work is for eight musicians reading live generated music on iPads, a robotic percussionist, robotic mallet performer, and robotic piano.*