

# BUG MUSIC

HOW INSECTS GAVE US  
RHYTHM AND NOISE

DAVID  
ROTHENBERG

# Bug Music



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**ALSO BY DAVID ROTHENBERG**

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*Hand's End*

*Sudden Music*

*Blue Cliff Record*

*Always the Mountains*

*Why Birds Sing*

*Thousand Mile Song*

*Survival of the Beautiful*

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# Bug Music

HOW INSECTS  
GAVE US  
RHYTHM  
AND NOISE



**David Rothenberg**



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NEW YORK

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*Mushi kiku to*  
*Honashi na kiku to*  
*Betsu no mimi*

Some hear bug music  
Some hear people music  
All depends on your ears

—WĀFU, 1866, KYOTO



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## FIVE

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# From *El Grillo* to Das Techno

**W**hen I say that insect sound has influenced human music, people either fix me with a blank stare, or shake their heads and say, “Rothenberg, you’ve really taken this animal music obsession too far this time.” Or they might hum Nikolai Rimsky-Korsakov’s “Flight of the Bumblebee.” I smile back and say you can’t laugh at that piece, it’s one of the most famous compositions of the nineteenth century and a litmus test for virtuosity on so many different instruments. Why? Because it’s based on the sound of a bug. It’s a song of the incompatibility of man and insect, and a struggle for a human instrumentalist to become what she is not.

It’s hard to blend the discrete melodies and harmonies of our classical music with the weaving, buzzing, continuously sliding bee pitches. With all that chromatic warbling, melodic motion around and around, up and down, wavering and undecided, we see just how hard it is for our tempered instruments to sound much like

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an insect. In this famous minute-long showcase of dexterity, it's almost as if Rimsky wants to turn the orchestra into a warbling electronic oscillator, an instrument more comfortable with the sliding pitches and buzzing tone of the insect world. Plenty of musicians give up and never learn to play this piece, because they cannot play fast enough or because they do not really want to turn into a bee. And yet it's a great miniature, a piece that has stood that test of time so everyone knows it. Not just because it's funny, but because it shows that humans can use music to learn something about the natural world.

The first few measures:



Other well-known examples of insects in human music are few and far between, but extremes do make good examples. There's one piece of Renaissance music by Josquin Desprez that appears in many music textbooks, mostly because it's a brief, lucid piece called *El Grillo* (*The Cricket*), and it was composed around 1475, in the era of parallel harmonies long before that Baroque world of smooth counterpoint. The first thing cricket-like about it are the words:

*El griiiiiilllo*  
*El Grillo è buon cantore*  
*Che tiene longo vehehehrrrrso*  
*Dalle beve, grillo, canta!*

zzhh zhh zhh zhhh; zzhh zhh zhh zhhh  
*Dalle dalle beve, grillo grillo canta*  
*El griiiiilllo*  
*El grillo è buon cantore.*  
*Ma non fa come gli altri uccelli;*  
*Come li han cantato un poco,*  
*Van' de fatto in altro loco:*  
*Sempre el grillo sta pur saldo,*  
*Alhor canta sol per amore.*

*Translation:* the cricket is a damn good singer, who can keep going a real long time. Sing well O cricket, sing sing sing, good times, cricket, chirp chirp singing, *zzh zzh zzh zzh*, he is a damn good singer. He don't skip town like those other birds, after they've sung their song, they fly off somewhere else. The cricket just stays put. On the hottest, stickiest days, he sings just for love.

OK, Desprez must know the cricket is no bird, but he does pick up on one interesting bit of observed ecology. Those crickets sing and sing and sing and don't need to move. Their prey can't find them, so we can only hope their lovers can.

And what's so good about the cricket's boring song? Plenty. It's rhythmic, pleasing. He even imitates its repetitiveness and even its noisiness. The tenacity of the cricket is most admirable. He loves music. He needs music. He cannot stop. Desprez wants some of that certainty, and finding crickets for inspiration, he gets it. This is one of his most beloved songs; we have been performing it for hundreds of years.

More than just inspiration, he dares to imitate the sound of insects in the music themselves—the repetition, the space, the same notes:

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In some performances of the piece the singers even make cricket-like *zzhhs* right in the middle of the piece. Even in the fifteenth century, musicians tried to imitate nature and knew nature would always remain a little bit beyond us. Even the simple, plaintive repeats of the cricket remain musically beyond us, because we can't quite be satisfied with such simplicity in our music.

We know such music is exactly enough for the insects who make it, but we humans demand much more. Too much more. We will never be satisfied with the music we have, and have to keep changing it, endlessly repeating ourselves while imagining we are doing something new. Crickets and all other singing species are far more satisfied with their basic, primal, grounded, necessary music than we will ever be. That is enough for them to demand our utmost respect, never mind how much nature needs their services and their art.

Human musicians have well realized this, and applied our rather inadequate classical notation to try to capture the nuances of *Gryllus* sounds for as long as we've had notation. For some reason the Hungarians were very diligent at the application of musical notation to natural sounds, and even adapted notation a bit in "A Zene Hangjegyekben—*Notae stridorus*" ("The Chirp Notation") by Gyula Pungur in 1891. Pungur gives a fine summary of the basic, simple chirps of the most common Eastern European cricket species. Here are a few of them:

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I believe these transcriptions and sounds specifically influenced Béla Bartók in his solo piano piece “The Night’s Music,” movement 4 of the 1926 suite *Out of Doors*. This was one of the composer’s most popular pieces of this period, and the presence of cricket-like repetitive dissonant irregularities is very audible right from the beginning of the piece. Bartók loved bugs, and was a devoted entomologist, with a vast collection of beetles and flies. He likened the collection of insects to the collection of folk melodies, which he felt was not only a hobby, but more a responsibility for the contemporary composer. We have to know what traditions we are coming from, and remember the rich and unusual creativity held by diverse cultures, which the homogeneity of European modernism had a tendency to eradicate.

László Somfai, a musicological expert on Bartók who wrote a fifty-five page essay on just those piano pieces Bartók composed in the year 1926, says we should not quibble with what sounds represent what species when looking at how Bartók made use of nature. He was no exact speciesist like French composer Olivier Messiaen, who took pains to tell us exactly what phrase came

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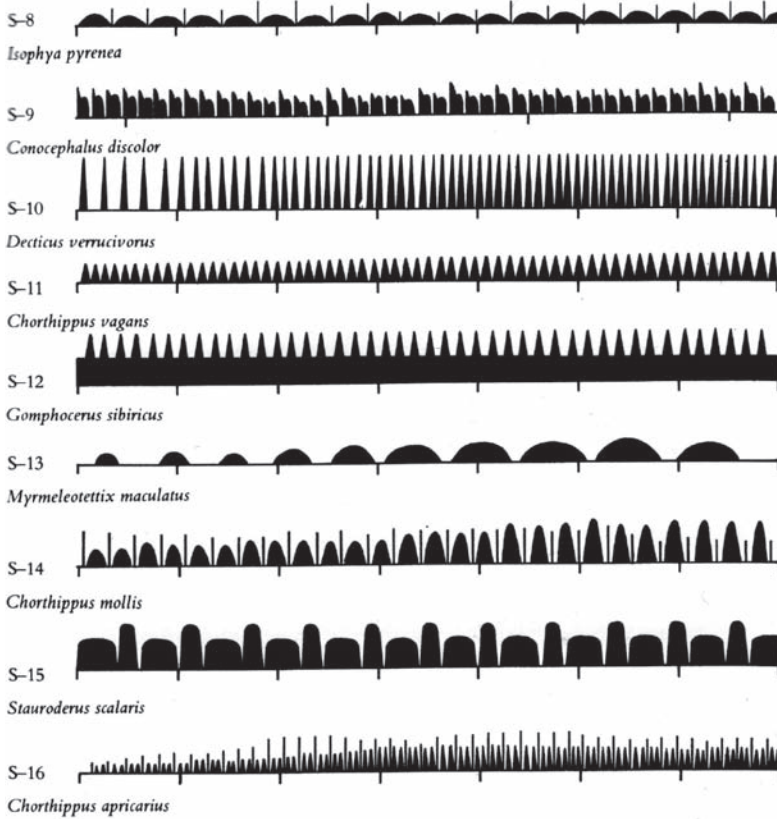
from what bird in his many ornithologically inspired works. No, says Somfai, our man Béla sought to identify “found sound objects” in nature and paint a musical picture of the actual natural world. “This stylization of the sounds of nature in Bartók’s works . . . simplifies them into musical motives that assume their appointed places in a musical structure that is highly consciously designed.” But we do hear the simple, even cricket chirps moving their way into clusters of noisy Hungarian Unka frog, *Bombina bombina*, with dissonant piano tone clusters musically mirroring the rough frequencies of nature’s noises:



All I want to show you with this excerpt is how putting insects in human music can encourage the use of new dissonances that express the great distance between classical music’s pure tones and the complexity of entomological sounds. Bartók heard the same irregularities in folk music, and that’s why he heard so much in his country’s venerable traditions that the contemporary composer could learn from—unusual harmonic movements, strange rhythms, all organic and understood by the population, not brand-new avant-gardisms that were hard for people to take. No, this dissonance was deep in the tradition, as dissonance in nature is deep in our ancestral biological heritage.

So maybe those musical notation examples of insect music are not the best ways to represent such textural and unpitched sounds.

A mid-twentieth century European insect field guide by Heiko Bellmann also thought about this, and tried to represent insect song patterns by abstract rhythmic glyphs:

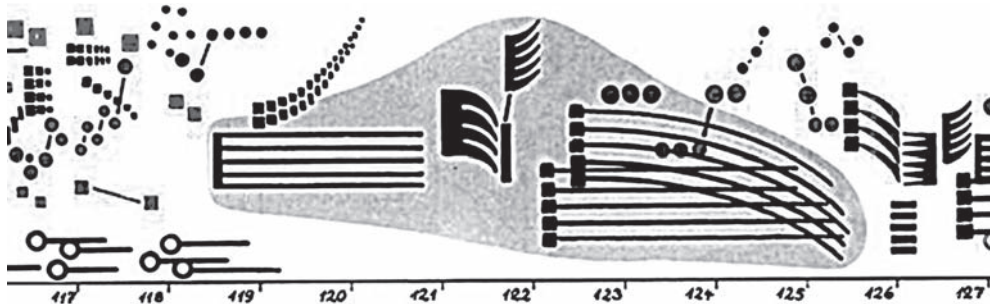


This is supposed to help us identify the insects if we run across them in the meadows, but it also represents a kind of experimental musical notation for unfamiliar noises, similar to what composers of electronic music and other compositions where the sounds included could not be represented on a usual score were doing from the 1950s onward. The appeal is immediately clear—we’ve got a graphic way that reveals the rhythms, shapes, and distinguishing

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qualities of each creature, that doesn't depend on inadequate ideas of note, scale, and pitch. In a way these experimental tools for composers came out of our attempts to understand insect and bird sounds, which right from the beginning elude traditional tools for writing down sound. Blend all these distinct creature sounds together and you have the beginnings of a new notion of combining sounds into a whole, with composition as swarm, a thrum of layers of rhythmic noise.

György Ligeti, another Hungarian, composed celebrated dissonant washes of orchestral strangeness in pieces like "Atmospheres" and "Ramifications." Listening back from today's perspective, they really do sound like layers of shimmering, screaming cicadas. His earlier piece, "Artikulation," was given a graphic score after the fact by Rainer Wehinger:



I wasn't surprised to hear from his son Lukas Ligeti, who told me that his father was haunted for years by a dream of a swarm of biting insects chasing him in a black cloud through the field, and this image drew him onward to seek to reveal this profound vision in sound.

Yet the traditions of Western classical music are by and large far away from the noisy wash demanded by those intent on dealing



with insect music. I've plucked out a few anomalous examples, but to find music steeped in the world of bug sounds, we have to look beyond our own traditions to tribal musics thousands of years old. Pay a visit to the Ituri forest in West Africa and listen to the music that the Bayaka (sometimes they are called Ba-benzele, sometimes Mbuti) pygmies are making there. Here is a people whose traditional life is richly defined by a music that weaves humanity into nature, not carving our songs out of the surrounding fabric and separating ourselves from the surrounding world. In daily pygmy life there is song that gradually emerges out of rainforest sounds, most noted the shrieks and calls of birds, but underneath it the rhythmic pulse and thrum of thousands of insects and frogs, the defining ground of the soundscape but, as usual, something about which little has been said.

So much has been written about central African pygmies, from Colin Turnbull to Jerome Lewis, but I had to hunt hard to find anything specific about the rich ground of insect sounds that colors their music. We are fortunate to have hundreds of hours of fabulous recordings made by the American Louis Sarno, who left New Jersey to live with the pygmies in 1985 and has mostly been there ever since. I was fortunate to meet him in New York last year on one of his rare visits to the country he was born in. He says:

Above all, it's to the sounds of the forest that I tune, not merely my ears, but my entire being. There are many levels of sound. The most basic, the electronic pulse which never ceases, is composed of legions of tireless insects—the crickets, katydids, and their kin. Special mention must be made of the awesome white noise of the cicadas. These sleek insects are notorious noisemakers. . . . More than once I've been in the midst of a delicate recording, some long sought-after sound such as the rising song of the red-chested cuckoo

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sung by several birds at the same time, . . . when a single cicada has suddenly decided to advertise itself to the opposite sex and blasted its burst of white noise directly into my microphones, sending the recording level into overload.

More than once, too, I've abandoned my microphones to pursue the guilty cicada, chasing it from tree trunk to tree trunk, full of rage and grimly determined to destroy the insect with my projectiles of sticks and baseball-sized fruits. Yet in fact, no sound is more evocative of the forest, and when the Bayaka hear the voice of the cicada, which they call *élélé*, they say it makes their hearts glad.

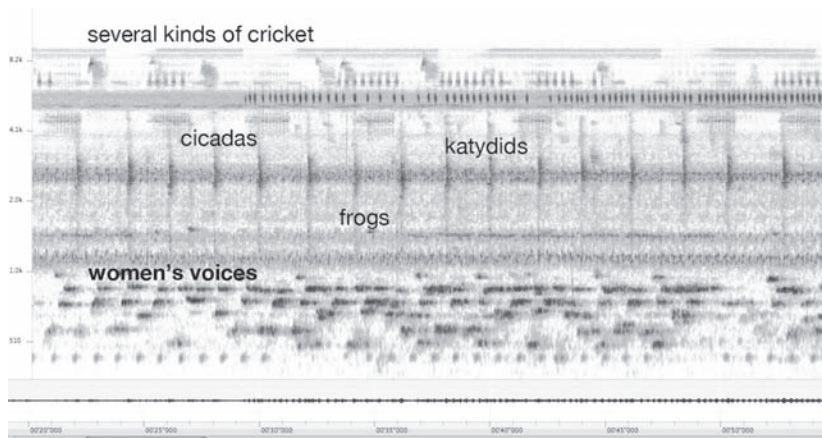
On the track “Women Off to Gather Payu” on the book/CD set *Bayaka*, published by Ellipsis in 1996, we can really hear the way long, overlapping human choruses cut through the rhythmic, beating animal choruses. Gathering food is work, but with music it becomes art.

Mushroom gathering lends itself especially well to lyrical accompaniment, for it is not in the least bit strenuous and often takes place in beautiful and spacious primary forest. . . . Yodels—calls or cries in which there is a transition between chest and throat voice—are the most natural and effective way to use the voice in this environment, because the voice resonates through the trees; both high and low notes hang in the air at the same time.

Listen to it from thousands of miles and decades away and we hear an image of how our species might live and sing more closely to the world around us. Not only lilting female voices trance the pygmies into the swirl of their local forest sounds. We can also add the human kind of regular beat to the insects' more swirling,

hypnotic one. In the nighttime *boyobi* ceremony, fast drumming is added to the insect and human chorus, and as we mark the time, the forest music clearly has its place, the waves of overlapping crickets and cicadas, a high wash of frequencies whose musical purpose comes through. Bugs are above it all.

Here's a sonogram of part of the puya gathering ceremony, showing how the overlapping multispecies' rhythms appear:



The point I want to make with this picture is that it looks clearly *organized*, with different sounds specifically appearing at clear frequency ranges over time. The natural rainforest soundscape is no random melee of cacophonous sounds, but some kind of natural, total composition that nature has evolved itself. Human hocketing song is at the bottom, and higher up the fuzzy frequencies of bugs, frogs, occasional birds with a clear rhythmic crack. It's a very organized continuous soundscape, a clear image of acoustic niches filling the screen, a sonic Mbuti design that science puts into a picture. You could almost draw it as you listen. Every creature has its place amid the sonic frequencies, and seems to stay out of each other's way. It's the clearest image of Bernie Krause's niche

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hypothesis that I've ever seen, because each kind of creature uses a specific sound frequency to fill the forest with its sound, in an easily audible and visible way.

Krause, one of the best-known nature sound recordists, has traveled the globe collecting the most beautiful and rarest natural sounds, which he has chronicled in books and recordings with titles like *Into a Wild Sanctuary* and *The Great Animal Orchestra*. Over the years he has developed a semi-scientific hypothesis that creatures in nature divide up the acoustic spectra as a result of natural selection and make their sounds in an acoustic niche, akin to an ecological niche, so their noises will be heard and they don't get in each other's way. I say "semi-scientific" because Krause has not felt it necessary to test his hypothesis before writing about it and presenting it, something scientists tend not to do. But as a musician and campaigner for a quieter, more sonically natural world, he is perfectly free to do so.

In recent years he has begun to work together with scientists to rigorously collect data on the niche hypothesis, and in the past year he has published some work together with Italian bird sound ecologists Almo Farina and Rachele Malavasi, which does support the conclusion that once birds have returned from their winter migrations, at first their songs seem to be a complete jumble, as they constantly get in each other's sonic ways, but after a few weeks, they settle in and use their relative acoustic niches much more successfully. So this intriguing hypothesis is starting to get some empirical support.

It is remarkable how little work of this kind has been done until now—we don't really know why birds sing at dawn, for example. Or why bugs sing at night. But clearly the pygmies have known for a long time what science would like to prove . . . that each species must find its own sonic place to fit into the soundscape, and the

landscape, in a meaningful way, and this remarkable plot of sonic frequency against time bears it out, looking just like a musical score.

So much like a musical score that there is even some debate as to how accurate the image and recording are! This recording, one of the most successful commercial releases of pygmy music heard in its natural context, was made from raw tapes of Louis Sarno together with the studio alchemy of Bernie Krause. Now on *some* of the tracks on this 1997 Ellipsis Arts release, Krause specifically added some high frequency insect noises to mask the noise of the analog cassette tape Sarno used. But Krause told me, “not on this track, this is pure Bayaka singing in their pure forest.”

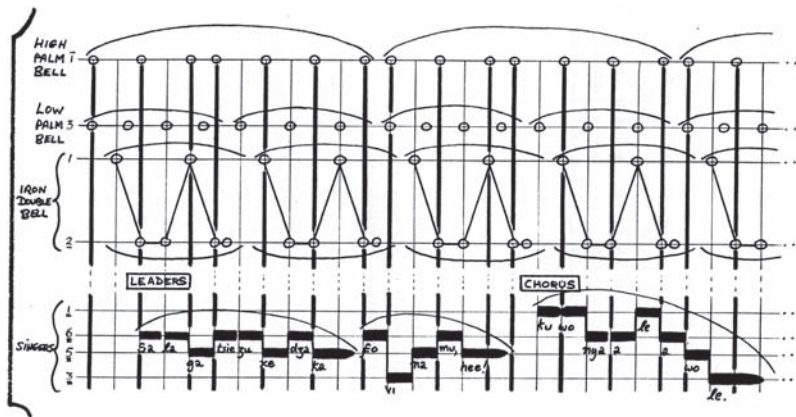
Sarno, however, cautions me against using this recording as my visual example. “I’ve lived in that forest for years, and I hear some morning bugs here, while the recording is supposed to be happening in the late afternoon.” How much does purity matter here? Not at all if we are making an artistic statement, and if Krause composed the final version using the sonogram as a guide, all kudos to him for making use of a new kind of musical score. But if we are making a statement about finding beautiful organization in the natural way some humans have integrated themselves into their rainforest home, *then* we might want to know for sure whether manipulation has been going on. I’ve got some of Sarno’s raw field recordings, and they reveal nearly this same level of pure beauty. I don’t need to judge the situation, but I do feel compelled to report the controversy.

Just listen to the *boyobi* ceremony recording—the bugs have their acoustic niche in the mix. After the humans stop, you may wonder, are the insects more synchronized than before? There is plenty of reason to assume they might be. Insects are known to respond to regularity in rhythm. They know well how to synchronize to a beat. We began by showing how you don’t need much

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mathematics for that. Yet the sense of overlapping rhythm is more clear when you listen to it combined with the human music of the Ituri forest pygmies. Their music makes one of the best examples of a collective sound that fits into the natural world in which it has been produced.

The sonogram is remarkably similar to a schematic analysis Hewitt Pantaleoni made of a musical performance by a choir and percussion ensemble in Ghana:



Perhaps you see some similarity between this schematic diagram and the sonogram. Or perhaps not. What I see is repeating simple patterns, overlapping, each at distinct places in the sonic sphere, independent, but fitting together in a way that makes the whole greater than some of its parts, the key property of any polyrhythmic, emergent musical order. The bell patterns always occupy higher frequencies than the singing voices, but the lower, singing voices offer the greatest variety of pitch and sound, just like the pygmies singing along with the way-up-there cycling beats of the bugs, birds, and frogs.

Just how old are the songs of the Bayaka pygmies? When Colin Turnbull asked his hosts to sing the oldest music they knew in 1961, they surprised him by singing “Clementine.” Yet ancient Egyptian accounts describe musicians in the lower Nile adapting pygmy tunes even before the pyramids were up. This music has clearly been heard as something special for thousands of years. And music always gets around.

Even bug music. Start to hone in on the complexities of timbre that these critters resound, their incessant rhythms, and their trance-inducing overlapping patterns and we start to hear a musical tendency that traverses the globe. No surprise that in Bali, where traditional society is built upon layers of social and calendrical cycles to mark the repetition of time and the complexities of kinship, there is music based on superimposed alternating rhythms of echo and natural delay, from the clang of fast gamelan orchestras to the array of hundreds of chanting human voices in the famous *kecak* monkey chant, where each voice makes a cricket-like *cha* sound, all hocketing back and forth in an exciting fast beat, regular and irregular at once—*CHA! cha cha CHA cha cha cha CHA cha cha cha cha cha cha cha cha CHA cha cha cha CHA cha cha cha cha cha . . .*—while above, a drawn-out droning voice chants tales from the *Ramayana*, one after another for many hours of ritual intensity.

Loop a piece of that background human thrum and you have something that would blend right in with the warm rainforest night surrounding the ceremony. Indeed, American sound artist and composer Richard Lerman has recorded the sounds of Indonesian insects immediately after a gamelan performance. He found them synchronized with remarkable order, much more so than before the concert. That is the kind of news I want to hear—that insects might be able to listen to us, to grab a sense of order from

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us, and have a use for the human beat in sync with their own. Would there be anything remarkable about that? In Indonesia there is a kind of jaw harp called the *genggong* that is often played in ensembles that sound like a group of calling frogs or bugs.

I hunt for the clues that enable insect music to become human music, or people music to slip quietly into bug music. Our ears are fluid, and can hear what we will to hear. Plenty of people I've described this project to have found the whine of cicadas to be as annoying as Louis Sarno found them, messing up his delicate recordings, but at the same time part of us always loves these sounds because they are emblematic of something extreme and powerful in nature. I want to learn why it is that sometimes we value noise, love it for its pure power of sound, and at other times we shun it and scream as it disturbs us. This is not always a matter of personal choice, sometimes it is woven into the very fabric of our culture.

During her fieldwork years among the Temiar people of the Malaysian rainforest, anthropologist Marina Roseman was surprised that her informants had little interest in the beautiful, complex birdsong melodies she heard all around her in their environment. Instead, they preferred pulsing, beating, repetitive, noisy birds that were emulated in their own drumming on long bamboo tubes. "Barbet and cicada calls—pulsing like the heart, hidden in the dense jungle foliage, persistent yet unobtainable . . . set the cosmos in motion and affect the transformation of Temiar trance, a momentary intermingling of self and other." One of their spirit songs is even called "The Way of Old Woman Cicada," and the words go something like this:

*Dancing in a slow step  
the green tinge of sunset and  
the late hour cicada sound*



laaw laaw *marks the time*  
*of dizziness, whirling, and change.*

When the Temiar walk into the forest during fruit season, they caution each other to listen to cicada sounds only with a “strong heart,” lest they be drawn off into the forest and distracted doom. The proper beat of their own music is precisely calculated to “intensify longings of the heart,” and, as you listen to their songs, it is no surprise that the bugs in the background sometimes seem to be beating in time. Human life is synchronized with the thrum of the rainforest world, where the right rhythm matters more than the contours of any song.

Their cosmology is exact and rigorous, matched to the powerful sounds of their rainforest home. This music is wrapped up in ceremonies of healing and meaning for these forest people, and they are one important example of a culture that values as music sounds many of us first would consider noise. That cicada sound is ultimately alluring, so be careful around something that can so quickly lead you into a trance.

Trance, says Gilbert Rouget in *Music and Trance*, means movement, noise, company, crisis, sensory overstimulation, which he distinguishes famously from ecstasy: immobility, silence, solitude, and sensory deprivation. Of course not all of us will agree. Through the thrum and enveloping of timbre, tone, and beat, music has long led us on into ecstasy. Rouget is one of few authors who tries to grapple with the mystery of how strange sounds envelop our consciousness, leading us to places dangerous and deep alike. The lives of traditional people who live mostly in rich, noisy forests are usually full of ritual dance, and trance that extends human lives into the soul of the forest. Still, some insects are comforting; others are entrancing, perhaps dangerous. Cricket vs. cicada. They are always there, singing behind everything else in the forest. Are they then

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the background to human life, grounding our music, or have they a clear part in our music? When we hear them synchronize with our shaman beats, we want to smile, because we believe we belong.

Composers who make music directly out of insect sounds today have two aesthetic choices: They can either work on the sound as an entity separate from human music, something pure and natural, to be taken on its own terms. Or they can join the entomological with the human, either constructed in the studio, or live in the world. I am immediately more impressed when people dare to make music live with animals, because it is so risky and leads to less expected music. On the other hand, as our musical tools today enable us to turn any sound into something far from its origin, totally unrecognizable, such prejudices might make little sense in the sonic world we now inhabit. Many electronic music composer/performers have been especially impressed with the strangeness of insect sounds and the unusual directions they send us. Each may begin with similar timbres, but they understand the meanings and roles of their sounds in radically different ways.

Why make music directly out of the sounds of insects? The sound artist and former professor of ecology Francisco López says, don't do it to make some ecological point about the overlapping layers of nature, or to document a vanishing acoustic world. The reason for a composer to choose any sound is because he wants to make music out of that sound. Too much music made out of natural sounds, López claims, is marred by the ideology of longing for a romanticized natural world where humans are excluded. Too many bug-saturated recordings of the rainforest waste our time identifying every species, claiming to teach us, like a zoologist, of what creatures sing here and which ones sing there. Too many lovers of nature sound music implore us to consider all sound as

music, announcing that the world as we naturally confront it is a vast musical composition, ours for the hearing.

For López all these clichés are wrong. A composer does not accept the spontaneous and accidental in the world of sound; no, the opposite should be the case. He is an expert in listening and assembling, and must make precise decisions as to the destiny of each sound he uses. Whether writing instructions on paper for people to make music from, or combining and recombining actual sounds onstage or in the studio, he is the boss, and he must encourage us to take sound more seriously, not for what it is supposed to signify, but for what it is. If the composition doesn't interest us because of the wonder of its sonic construction, then no explanation or story should be resorted to to buttress the work up.

López releases CDs with no information on the disc or the package; they are often printed all in black. He asks his audiences to wear blindfolds so they think of nothing but the sound as the music rolls on. On his 1997 release *La Selva* he tells you nothing about the Costa Rican rainforest where he has recorded all the sounds out of which he composed the continuously streaming multilayered piece. Bugs? Frogs? Birds? Which is which? Such a question matters not—what's at stake here is a musical composition, not a nature lesson. The rich, complex sonorities of thick forest noise are not what uninitiated listeners will immediately call musical, but López's work is designed to convince you that these sounds have become musical through his structured transformation of them. This is not an improvisation, it is no sudden encounter between a musician and a new environment. It is a carefully constructed sonic journey. Look at nothing while you hear it, devote all your attention to immediate sounds, think of nothing separate from the information and feelings that you hear.

What he does not want you to do is to hear this beautiful trance-inducing music and think, "Oh, how beautiful these bugs and birds

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do sing! Amazing how nature can offer such beauty.” The beauty must be purely in the sound, with no ecological nature-saving story needed to justify it. López is a purist, and he will only ask for musical reasons to explain any joy we find in music.

Thus he wants to appear much more rigorous than John Cage, the famous pioneer of open listening and experimental music who urged us to take all sounds seriously because they came from places we did not expect. Cage was playful, philosophical, Zenlike, paradoxical, sometimes preferring wry stories to specific instruction when it came to composition—some of his pieces involve the performer sitting onstage, breaking sticks, or following obscure rituals. The works are full of elements far removed from the refinement of sound.

For López such an approach is chronically unserious. A composer must not shirk his role in choosing sounds that are beautiful, total, and important. The composer who uses sounds as timbrally complex as those coming from insects will have to explain why such sounds are musically interesting in the first place. Rather than following John Cage, as so many lovers of natural sounds like myself are wont to do, he instead calls himself a disciple of Pierre Schaeffer, the French composer and theorist who some say invented the whole discourse of sound art through the practice of *musique concrète*, which basically means making music out of the sounds of the everyday world, not the *abstrait* sounds of traditional musical instruments.

This does not mean simply accepting the sounds of real life as musical, which is what López says Cage is doing. Instead it meant building a vast theoretical edifice to try to explain how these ordinary sounds can be categorized, understood, and musically appraised, all without reference to the hundreds of years of Western musical tradition based on rhythm, melody, and harmony. Schaeffer was after that difficult to describe quality called

timbre, the sense of color and density that distinguishes one musical instrument's sound quality from another, or one cicada's *whoom* or one cricket's *chhh* from another species's. His vast *Treatise on Musical Objects*, for decades available only in French, has been summarized and edited in his student Michel Chion's *Guide to Sound Objects*, finally in English in 2009. And in these dense pages appear a few lines that might help us explain why and how we musically enjoy the dense inharmonic sounds of insects.

The book is a long and technical collection of new categories out of which to comprehend sound, far from the usual musical categories of note, rhythm, tone color, volume, and articulation, and here are the two out of hundreds that might most help us make sense of the unique qualities held by insect sound. Number 78, the *wef*: a sound of prolonged duration, created by superimposing "sheaves," fusions of slowly evolving sounds . . . "macro-objects," slowly evolving structures. This is a category that values layers of sweeping, changing sounds, such as a tree full of hundreds of swelling cicadas.

Then a few pages later we have another intriguing sound object, Number 83, *accumulation*: the disorderly piling up of micro-sounds fused together by their similarity into a grand macro-object. Examples are a stream of pebbles ground together by a receding wave, a dawn chorus of twittering birds, or an orchestral string section plucking hundreds of shimmering pizzicatos. Many tiny blips blurred into one, as opposed to overlapping, textural swells.

These two processes are aesthetic principles that can be applied to the granular synthesis invented by Curtis Roads, as described in chapter three. And they may serve to explain what is interesting about a large class of insect sounds, though these might not be the primary sounds they were designed to explain. The two principles do help to explain what is going on in certain kinds of electronic musical effects that can help turn any sound into a mass of

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showering insect noises, something like GRM Tools “Pitch Accumulator,” a sound effect plug-in for making digital music on a computer, which was, not coincidentally, developed by Pierre Schaeffer’s Groupe de Recherches Musicales in Paris.

Francisco López introduces his work *Hyper-Rainforest* to a blindfolded audience in Troy, New York: “What you are about to hear,” he says, “is the culmination, somehow, of thirty years of recording in the rainforest. . . . I believe sound is a way to discover something spiritual about yourself, and I hope you discover something about yourself today. What I hope to show you is that recording machines, and machines in general, are not neutral. They do things we cannot do, as we do things they cannot do. It is time we worked with machines to produce something more than reality.”

*Ah* . . . more than reality. Never just the sounds of the world, which we know to be sounds of the world, but music, an art made of sound. So John Cage tells us there is no such thing as silence? Fuggedaboutit. There sure is such a thing as silence. Music makes it possible, when the sound stops. It takes music to make the absence of sound serve a real function. Or does it? Remember those frogs and katydids that use silence as a communicative act. In a wash, a lek, of thousands of singing males desperate for the attentions of wanting females, sometimes the *ceasing* of the signal is what it takes for the signal to have its desired effect.

López is a most careful composer with accumulating walls and wefts—he works with layers of nature’s noises while reminding us to forget where the noises come from. He is a true master of this form, taking the listener on unique journeys where not all of us are prepared to go. Close your eyes, wrap on the blindfold, take the risk. You will listen to what the composer wants you to hear.

López contributed beautiful tracks to my *Book of Music and Nature* CD and the more recent *Whale Music Remixed*. In both

cases he presented long, intense pieces that I was forced to cut down to a manageable length, and each time this proved extremely difficult, because López is most precise as a composer, and he shapes complex layers of sound according to reason and plan so that he does succeed in convincing us to hear music in natural noises through the power of these sounds alone. He contrasts very long, slow fades with sudden drops or surges in volume, pulling you in to a whole new vocabulary of sound. I do think it is important to know its tones come from nature, but if the composer literally blindfolds you to mask your most obvious senses, then we must trust him that he truly wants you to hear sound not as found music, but as composed music. Decisions have been made. The listener must abide by them.

López would probably not be so interested in my question, “What can human music learn from insect sounds?” He might prefer the larger question: What does music learn from sounds? If the sounds you work with come from insects, fine. But only use them if they are interesting sounds. It matters not what they are, only what you can accomplish with them.

Contrast this with the more programmatic description of a piece that, upon first listening, might sound similar to López’s *La Selva*. Robert Curgenvén composed *Silent Landscapes No. 2* with a particular geographic journey in mind:

Nightfall by a riverside camp near Wollumbin (Mt Warning), walking in dry grass, the sharp call of a single insect emerges. Above the nearby road, power lines catch the breeze—an echo finding resonance over 3000 kilometres west at Karlu Karlu (Devil’s Marbles) in Central Australia, where the wind strikes a parallel rhythm some years before. Further north, other winds blow in grevilleas lining the Buchanan Highway, en route to the Tanami Desert. Along a river, 20 metres

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deep in a flood that isolates a town, crickets pulse agitatedly on the Tropics' edge. Two thousand kilometres east, aeolian currents bring the Musical Fence in Central Queensland to a slow crescendo. Finally, 2000 kilometres south east again, returning through the grass to camp, the cycle is, for now, complete.

Curgenven, an Australian field recordist with thousands of soundscape recordings in his collection, assembles several distinct sonic environments together precisely because of their overlapping mash-up similarities. He wants you to know his piece is a specific sonic journey from eastern Australia way over to the middle, down somewhere else, then back to the first site, unified not just by the composer's travels, but also by virtue of amenable, related sounds swelling gently from one place to another, like familiar landmarks glimpsed or songlines voiced into being.

In contrast to López, this composer wants to tell a story that links a sound structure to a specific map of places experienced, in the actual world. He wants the listener to know that. The music must here represent precise, real places the recordist has been. It sounds like nature, it follows a journey. The structure is clear, the purpose for each location evident: Hearing one sound immediately reminds the composer of somewhere else suddenly far away, but possessing a relevant sound . . . suddenly we are there, like a view out a train window cascading into *déjà vu*. So you still think listening is forgetting the name of the thing one hears? Not if you want to remember the story when the piece is done.

Insects always sound like insects, right? Not in the world of today, when any sound just cries out for transformation into something absolutely remote. When I first heard British composer Mira Calix's astonishing work *Numu*, I imagined that it, too, was a sound experience created in the studio out of choruses of insects.



I was amazed how she was able to turn the noisy, scratchy timbres of the bugs into pure, luminous tones. Hmm . . . I wondered, what kind of filters was she using, what kind of resonators? The piece proceeds with hypnotic, repeating tones, not exactly minimalist, but an evolving, ever-changing drone. I am drawn in by the beautiful sonorities, it is hard not to fall sway to such entomological charms. I'm trying to listen blind, I want to enjoy sound as sound, but then I learn how the piece was actually made.

*Nunu* was commissioned by the London Sinfonietta, and performed live onstage by the orchestra together with live insects sampled in real time by Calix and mixed into the fray. She manages to transform cyclical, looping chirps of crickets and whines of cicadas into hauntingly beautiful tones, using familiar but still astonishing effects. Cicadas, cockroaches, crickets, and beetles were all in one terrarium, but contact microphones were arranged so each bug could be sampled and manipulated separately. The situation sounds quite spontaneous, but the recorded result is remarkably structured and harmonic in a more traditional, rhythmically hypnotic manner than the López and Curgenvén pieces.

By now you might think we are on a trajectory into the appreciation of a very obscure branch of music . . . insect-assembled electronica. So far Calix's is the most sonically accessible because of its repeating, lilting drone of minor chords. It is instantly emotional. How does the piece differ when we learn the insects are resonating live on stage?

First off, it makes me immediately want to try this myself. Especially when we hear, just after ten minutes into the thirteen-minute piece, the unmistakable *phaaaroooaah* of a seventeen-year cicada. Where did she get one of those in London? Wait a minute . . . do other cicadas make such a tone? Seems like Marina Roseman's recording from Malaysia also has such a sound . . . I must look into this. How is the *Magicicada* exactly in tune with the

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minor wash . . . did she prepare for this or is the recorded edition of the piece a studio creation? López would tell me that all these questions are distracting from the musical experience, but as a musician and writer awash in bug music and nothing but bug music during the time of the composition of this text, I am constantly asking questions. I am constantly hearing things—hums, buzzes, whirrs, whines, scratches, scrapes, washes, tones—all reverberating in my ears during this year of insect thinking.

Calix uses one clever approach that makes electronic music palatable to many more people: the repeating, harmonious, drone-like minimal phrase. This is why Philip Glass, Terry Riley, Gavin Bryars, and Steve Reich have gotten popular—they took the incessant repetition from world music and pop music and brought it to the more elite concert stage. With the world of music made by machines the tendency to endlessly repeat comes naturally—machines do not get tired of doing the same thing over and over again. Is this something people have always actually wanted from music but have been afraid to ask human musicians to provide? I think so. People after a while can come to prefer drum machines to real drummers, because they keep more rigorous time than any imperfect living mammal. They produce something close to the Platonic perfection of a beat, not always perfectly regular, but with irregularities that can be exactly programmed. Complete control of the beat, turning human variation into insect purity, fuzz, clack, and *chhhh*.

In electronic music today emotional clarity comes through with the klanging harmonies of musicians like Scanner, who succeeds so well by always adding a slight minor wash behind his far-out experimentations and samples of secret conversations and mumblings. In his duet with percussionist Pete Lockett, a piece called “Plush Insect,” there are shaker-like bug beats, crickets morphed into telephones, a warm ringing coming out of the tabla into a

long tone, and under it all a steady groove. If the beat is steady, do we now have a music more people will like?

This is an old debate for anyone who has been experimenting with making unusual sounds into music. If you just add a steady rhythm, will people consider it popular music? So much of the world's human music is based on a consistent groove, overlapping interesting sounds, and very little change in harmony. That is what inspired world music pioneer Ben Mandelson aka Hijaz Mustapha to once say "four fifths of the world cannot be wrong." And yet in the world of elite or supposedly classical music, certainly in the West, when you add an endlessly repeating beat to the mix, you downgrade your work to pop status. Clearly people like regular beats, but do we like them somehow too much to take seriously? The story is complicated in our time because of the rhythmic possibilities of the machine, first drum machines, then computers, which never tire of repeating the same thing over and over again. In fact, that might be a simple description of what such machines are best at doing. After the technology comes the deluge—of a new aesthetic, where people start to prefer hyperregular drum machines to untrustworthy real drummers. We come to love the precisely mechanical, endlessly repeating rhythms of the electronic world.

So what does this have to do with insects? *They are our original teachers of rhythm.* Their sound world offers of scads of regular beats, sometimes exactly in sync, sometimes slightly off—irregular, overlapping, forming complex polyrhythms, sometimes by accident, at other times by evolved design. Those of us who believe in using natural sound in music have faith that there is something richly rewarding about using such sounds, something more organic and real, deeper than sounds we might artificially conjure with electronic source material at the start. We sample the sonic world of nature to soften the precision of the artificial sound world, to bring the irregular rightness of nature into the human dream of absolute

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control. The whole enterprise is fraught with paradox—we know natural sound has its million-years' purpose and is beyond the questing uncertainty of human test and experiment, and it is perfect as is, so why mess with it? Humans mess with everything; we love music, the regular beat takes us in, and we endlessly want to enrich it while constantly keeping it the same.

Birds and whales, even rushing water, all my previous topics, are much more invitingly musical than insects, with their buzz, whine, and general distance from the human way of being an animal. But in their very distance, bugs invite attention and wonder, and as our music welcomes ever more noise into its palette, these original purveyors of the regular beat fly into our consciousness with ever more thrum and scrape.

Graeme Revell founded the industrial noise band SPK in Australia in the 1980s, inspired by the strange rhythms he heard in the nonsense voices of mental patients in the hospital where he was working as an orderly. This band is famous for some pretty harsh, noisy releases, and right from the beginning Revell notes how inspired he also was by the parallels between insect sounds and the whirr of industrial machinery that so marks our modern age. He later became one of the most successful film composers in Hollywood, writing music for films that sound like a background in noise aesthetics might really help one get the sound right: *Sin City*, *Red Planet*, *Bride of Chucky*, *The Crow*, *Collateral Damage*, and *Shark Night 3D*, just to name a few. But for us he is important because he released a cult recording called *The Insect Musicians* in 1986, which made use of the then-cutting edge Fairlight CMI sampler, the first electronic instrument able to sample real world sound with high fidelity.

Not only are the pieces on the album composed entirely out of a wide variety of insect noises, but Revell's liner notes are probably the best example of any musician writing about the aesthetic

conundrum of sampling itself. Now that he has finally gotten his hands on an instrument capable of fluidly turning any sound into raw, acoustic material that can be transformed into any other sound, this master of noise realizes that this is a very dangerous capability indeed:

An unforeseen difficulty presented itself during the composition of *The Insect Musicians* as a result of this degree of control. Once we can divide a sound into minute segments and then redraw (using a light pen) each of those segments, the resulting modified waveform may bear absolutely *no* relation to the source at all. To the audience with no prior comprehension of digital analysis, the process must then seem either invisible or a sheer fakery. The musician could indeed tinker indefinitely to create the perfect replica of whatever instrument, if that was his aim, but all that would prove was that Fourier was correct when he hypothesised that any sound could be re-created by the right combination of sine waves.

Revell very rigorously analyzes what he is trying to accomplish with the taking of insect sound as musical material: each creature's sound sampled to precision and then played on a keyboard as timbral material, worked out into scales and melodies back when the sampler was a sudden new possibility, not an assumed tool of electronic musical production.

It was a whole new world back then, and already Revell knew there was a problem with all this flexibility. The only solution would be to keep the technology fluid and inspiring, something akin to poetry:

A poetic technology must satisfy somewhat greater conditions than simple technical capacity. Like any poetry it must

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open up a space of multiple meanings. . . . For what is shown is that an unlimited array of instruments and music can be created from the sounds of nature, including those of human activity. . . . In the microscopic analysis of the sounds and their organization (Rhythm) we find suggested new structures of musical syntax and semantics. Though it is notable that from the first listening one will notice a few greater affinity [*sic*] between certain ethnic (“primitive”) musics and natural sonorities. *The Insect Musicians* is therefore both very new and, at the same time, very old. It is nature and hyper-nature in a sort of indivisible whole.

*The Insect Musicians* is a tour de force of 1980s sampling wizardry. The technology was new then, and the music, still strange and revolutionary, sounds dated in a way technology-driven music sometimes does. Each sampled note has the same volume, inflection, or velocity. The curiosity of the insect-based tones does start to get at the listener, in a way older, or more recent, pieces do not. My favorite from the disc is the one with the most steady beat, “Invaders of the Heart,” created from the sound of distressed honeybees, wood-boring beetles, European cicadas, and the death’s-head hawk moth, not all the most musical of species, but when sampled, they all become timbres to use in a grand MIDI arrangement of tones and beats. From synthetic-sounding gunshots and a few marimba-like tests, soon a regular machine beat arrives and the bees’ choir above it.

An electronic witches’ dance! An early video game soundtrack for the arrival of the villains from outer space! It does not really sound *alive*, but contrived in the way old electronic music often does. There is something demented and extreme about it, a nod toward madness, those babbling Australian mental patients. Or is it a foreshadowing of the scary movie soundtracks Revell will

later have so much success writing? He's definitely got a knack for grand, evocative orchestration of weird synthetic bug-based sounds.

The more I listen to it, the more I like it. The tools of sampling were limited back then compared to what any notebook computer can achieve today, but electronic music has such a deep yearning for retromania, trying to capture the past when the future seemed so much wilder than it turned out to be.

One specific quality makes sampled music sound dated: the sameness of timbre of each sampled note, whatever pitch is played with it, and the lack of realism because each note played on the keyboard has the same volume. The technology was available for Revell to move beyond this, it came with the first velocity-sensitive electronic keyboard, the Yamaha DX7 in the mid 1980s, but Revell's use of insect timbres does have this stunted quality, possibly by design, possibly by expediency. It all sounds more controlled and mechanical than it needs to be. And yet . . . he probably just likes that aspect of it, influenced as he is by the pounding of machines. By controlling the insects he lets us hear the insects. Since sampling was so new at the time, maybe he didn't want to confuse the listener by making his new bug instruments sound too much like new, unidentifiable instruments. He wanted to be sure we heard exactly what he was up to.

Note that there are plenty of musicians who think the very idea of sampling tones and putting them on keyboards for others to play is just a bad idea. I heard an interview with singer/songwriter Ben Folds on the radio the other day where he explained why he doesn't like playing electronic pianos, no matter how masterfully they have been sampled, since these days of sampled electronic instrument can use hundreds, if not thousands of separate samples to emulate the fluid qualities of a real instrument. Tone, said Folds, is a very personal thing. Whoever played all those separate piano

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notes, on whatever fancy instrument, was probably sitting, bored, in a studio. The player wasn't really playing anything. Folds hears boredom in every sample; like many acoustic musicians, he sticks to the real acoustic instrument whenever possible.

When it comes to acoustic instruments, Ben Folds is probably right. Sampling a tone is far away from playing the tone. I can never accept a sampled facsimile of a clarinet, since I know what it means to play a clarinet. I am happy to use samples for percussion, rhythms, bass tones, even strings in the background like a looming pad, but I try to make them sound different from the real thing. And for washes of background sounds I tend to prefer sounds from nature, and here insects work especially well. I would sample their whole chorus, with all its richness and confusion, and let them all sing, and on top of it try to find a human part over and above their intact music. Because Revell is right, if your sample from nature becomes just a single note, what matters is how you play those notes, and too often electronic instruments emphasize their artificiality, and the life is sucked out of those sounds.

So this may be why there are not too many examples where insect sounds are sampled as literally as Revell has done with *The Insect Musicians*. For that reason alone all would-be bug musicians should listen to it, and consider it. It's nearly two decades old. Have we advanced our appreciation for entomological sounds since then? The rare opportunities offered by the Fairlight to those few who could afford its \$20,000 price tag are now accessible to anyone with a laptop or tablet. Sound can be endlessly refined on the most commonplace tools. Have we learned how to listen any better? Critics today decry people's reliance on cheap headphones and low-resolution compressed MP3 sound files, but I'm talking aesthetics. Do we appreciate bug noise as something sublime? There are newer examples of human-made bug music out there. And some make a reference to looking forward, rather than back,



announcing that we are better prepared, more savvy, ready to take on a new world of sound.

The British experimental sound duo The Black Dog put out a recent album called *Music for Real Airports*, a kind of critical answer to Brian Eno's 1978 *Music for Airports* record, which was at the time considered a brilliant alternative to the muzak airports used to endlessly stream. The Black Dog says Eno's record is too limiting, "largely elegiac," still a form of calming anesthetic muzak even if it was trying to offer an alternative. Airports are too exciting, "important and revealing. They are dystopian microcosms of a possible future society. . . . Airports promise travel, exploration and excitement but endlessly break that promise with their stale, tedious pressure. They are intense and overwhelming environments." Out of the murmurings of human voices echoing off the formica floors and aluminum walls, a steady techno beat emerges, certainly a machine that makes you want to dance. But then after a few minutes, washes of sound rise up that sound solidly like insect choruses. Are they? Does it matter? Why do I want them to be insects?

I have assembled my playlist of the best insect-related sound pieces I could find. You'll find it at the end of this book. My top twenty come culled from an initial list of nearly a hundred, all pieces in different genres where the sound of insects or an entomological quality adds to the experience. As I play the stuff for people, some point out to me that the sounds I call insectible might not really be coming from bugs. Some of these Black Dog tones are clearly from airplanes, motors, and beneath it all a steady, open, computer drumbeat.

How do I know bugs are in the mix if I don't ask the musicians or they don't tell me? My answer is that it doesn't completely matter whether or not the sounds I imagine coming from bugs are actual bugs or not. Listening closer to "Future Delay Thinking," my favorite track from The Black Dog's *Airport* project, it does

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seem likely the sounds are produced by synthesizers, or at least samples from machines. But they have that complex tone, wash-like intensity, and frequency-filling noisiness that is insect sound at its essence. With electronics, bug music becomes our music.

There is one sense in which sampling an insect sound and massaging it into human music might not be the best way to enter the entomological aesthetic. Electronic synthesizers might offer an advantage over the sampler when it comes to emulating insectable noises. A sampler captures a piece of a real world sound, then just transposes it as we play different instances of it from different notes. A synthesizer, an earlier technology, works differently. An electronic oscillator creates a simple tone, perhaps a sine, square, or sawtooth pure wave, and then it is modulated by different carrier frequencies. Sounds like engineering, I know. But this is exactly how actual insects create sounds. Or at least how scientists model their tiny insect brains creating sounds.

Read insect sound science papers and they sound a lot like electronic music science papers; all this talk of oscillators, with carrier frequencies, and control frequencies, the simple wave forms and filters that are the building blocks of electronic music. Where a sampler offers you a piece of a real world sound, ready to be cut, pasted, and massaged up and down a virtual keyboard, a synthesizer, whether an actual hardware one or a software emulation of it, is imitating the way a bug itself makes music. Each key you press triggers different parameters, so the way it plays up and down the keyboard can be most unpredictable, and unintentionally mirroring the real world of insects making sound. So an electronic piece can sound entomological even if real insect sounds are not there.

In the beginning most musicians wanted their electronic instruments to imitate real, acoustic sounds, but over time the special hard-hitting strange sounds of electronica took hold of us, and we

started to look for sounds that were as different as possible from acoustic instruments, but musical in a new, previously uncategorizable way. These may be the very kinds of sounds Schaeffer tried to explain with his dreams of *weft* and *accumulation*, but maybe we should have named them *cricket*, *katydid*, *beetle*, or *cicada*. Or simply *insect chorus* or *rainforest* or *August Nights* to truly grasp the enormity of the kinds of sounds we might go for. Let's create a Bug Night to end all Bug Nights, a grand steamy late summer midnight humid experience!

People did not invent synthesizers to imitate insects, but it turns out they are very good at doing this. So once you have bug music in your ears you will soon be able to hear it everywhere. What used to be a tangled morass of wires coming out of silver-box machines now can appear virtually on your computer. Let me give an example of just two of these sound-making programs that excel at emulating insect sounds. Take the freeware synth Automat, developed by Stefan Kirch. Software synthesizers emulate old analog equipment by mirroring the electrical processes that used to happen with voltages, hums, and solid analog oscillators by emulating them in the digital world. Automat is popular because, first of all, it is free, and secondly, it is immensely and immediately strange, producing right from the get-go sounds that one does not expect. It has two easy functions for generating new sounds: a randomize button, which suddenly readjusts all parameters to surprise you with something unexpected. And, more unusually, it has an EVOLVE button that gradually changes the sound program into something else, producing subtle, not total variation.

Programming electronic sounds is an addictive habit—once you start messing with the sounds you'll want to mess some more. Many electronic musicians agree they spend more time tweaking their sound presets than making music with them. This is in marked difference from practicing acoustic instruments, where you have

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to play them for years to develop your own unique sound. Electronic music instantly gives you hundreds of options; the trick is to develop appreciation for these tones and to know how to move from one to the next, and to know how to choose. The choices exponentially increase with each new generation of technology, but our powers of perception and discrimination do not rise so rapidly to the occasion. We always need to listen more, to listen better, and more carefully. That's why I'm asking you to think of these synthesizer programs in a new way . . . as tools to investigate the insect aesthetic, the bug sound value . . . that rich blend of noise, texture, and rhythm that we hear as uniquely alive and wonderful, evoking long, warm summer nights or lonely, autumn moist-leaf afternoons just before frost as the final crickets strive to survive.

My Automat patch "Bug Nite" is based on a simple waveform of white noise, modulated by various sine waves and delays. I made it by many repeats of the randomize function, hundreds really, stopping when I suddenly realized I'd got a sound that retained some of that pulsing, noisy, yet organized quality of a midnight garden full of *chh-chh*-ing katydids and bush crickets. I didn't have so much use for this virtual device, but now that I've been listening for entomology in so much music, the value of Automat has become clearer. Playing this synth I begin to learn what I want in an electronic sound: something from a machine, but sounding alive. But it has to grab me. I want to hear rhythm, a groove, but an inexact groove. I want rich texture, depth, but not something exactly predictable.

Samples of real bugs can have a predictable quality as one plays them up and down the keyboard. Synthesized sounds are eminently more artificial, but when modulated and moved around, they can behave in strange ways. When any computer program surprises us, we say there are glitches and bugs. When music has

this quality, we say it is organic, alive, tapping into the forces of life itself, that place we dream our machines may someday go.

Surprise, affability, rhythm, the unpredictable, glimpses of the great world bug—those are some of the qualities Automat offers. It may be best to use when you have no idea what sound you want, or when very controlled, comprehensible sounds seem clearly boring. Of course, most composers have very exact opinions about what kind of sounds they like, even when it comes to the search for the perfect insect tone. My favorite tool is a program by Urs Heckmann, a synth plug-in by the name of Zebra, a very comprehensive sound design tool that is especially clear and well conceived, combining many kinds of electronic music modules. But my approach has always been to learn as little as possible about how such things are put together in the virtual, emulated digital world, but to just start playing them to see if I am pleasantly surprised.

Where Automat says surprise, though, Zebra says control. Everything can be subtly and exactly adjusted to massage the sound, and since I like the idea of working live and in performance, rather than planning everything out, like the actual choruses of insects on a warm singing night, this is the feature where I spend most of my playing time. Zebra has a Performance window with four XY pads, which have been mapped, by the best sound programmers, to those parameters most likely to affect the sound in the most interesting ways. As I play, I can precisely tweak the entomological aspects of the tone, to directly understand what it is that makes a chorus of insects an actually musical sound.

It is not only the sense of rhythm blended with surprise that does it. We choose a synth out of all possible synths first and foremost because it sounds wonderful, often claiming something like warmth, suggesting a retromaniacal warp back to the days of analog synthesizers which, though large and unwieldy, made their

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sounds with real voltages and real wires of electricity, not digital, parsed and partial imitations of the continuous out of the digital all broken up into 1s and 0s. Everything about the precise digital world sometimes seems far too exact, and we often look back to a world of inadvertent mystery and rough, round sounds.

I felt I needed to travel all the way to Germany to see Heckmann at work in his u-he studios to find out exactly how he could have created a piece of software with such elegance and possibility. When I went to visit Heckmann in his secret laboratory somewhere in Berlin, he told me that a whole new generation of listeners and music-makers have emerged who prefer the edgy grit and grating enharmonic 1-upon-0 noise of the digital world. They no longer care for this supposed warmth. The era of glitch and scratch is a direct challenge to this.

What I found did surprise me: an immaculate office with one museum-like room full of classic old music equipment, including a few items shipped directly from famous Hollywood film composer Hans Zimmer who used Zebra extensively in his scores for the films *Inception* and *Angels and Demons*, which required the specific sound of the bell at the Vatican that is only struck when the Pope passes on as no accurate sample of the sound exists. The exact tone was easily re-created with the precision tools of Zebra.

I want to take the emotional beauty of the many kinds of tones and timbres made by insects and find tools to make music out of them. Zebra works well for this because you have precise control as you play of many musical parameters. There are so many parameters to be tweaked, one has no idea where to begin, no sense of what to do with such fabulous potential for sound. The biggest hurdle for all computer music is the controller problem, how to interface man and machine so you can really play your laptop as an instrument, not sitting content to get lost in its possibilities. But

do I want to play the insect chorus, or learn from the insect chorus to humanize it, or electrify it?

Certainly our classical composers who wrote music by writing instructions to produce music, rather than directly shaping the sound, knew that you could at the time only learn from insect sound by finding qualities inside it that suggested new directions for stretching human musical units and structures. With direct composition out of natural sounds the tendency is to simply take a beautiful insect chorus, listen to it, maybe make a loop out of it that intensifies the local rhythm of one section to get that ultimate repetitiveness that it turns out people actually *like* in music, maybe transpose it, tune it a bit so it sounds more like pure notes and less like original noise. Many beautiful musical phrases can come from such a method, but with Zebra there is an immediate way to play with the rhythmic qualities that hold an insect chorus together. I've made an "Insect Chorus" patch that has not a single sample of a bug, just a series of independent oscillators, like models of bugs, and each one can be spontaneously changed in rhythm and buzz by messing with the XY pads. A well-programmed Zebra sound has the four pads already assigned so the musician can immediately start playing the sound without thinking about it too much.

What I like about these insect-like sounds is that adjusting those pads changes the frequency of the independent insect beats and filters their high frequencies in an intuitive way, so the music evolves as the sound is changed. It is as if I conduct the artificial bug sound chorus as my fingers do the walking. I feel my way through the overlapping scratch beats and modulated oscillators, feeling that this is what it must be like to conduct insect choruses, knowing full well the irony that in real insect choruses no one is in charge. Whatever music appears only emerges because of the

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independent creatures each doing their own thing, the only beat they know and the one they're meant to do.

Every synthesizer program is like a graphic philosophy of sound, presenting a structure and an interface to the same problem: the creation of endless possibilities of sound and a playable interface to turn these strange offerings into music. Programming these XY pads is not so easy, since one has to make sure that tweaking them as you play is going to make musical sense, and not sheer randomness or too much glitch. But so many of Zebra's preset sounds can be insectified if you push the XY parameters to their limits. And I have always favored a playalong, test out, rather than a plain approach to making music with the natural world. You must understand me when I say that the same approach can work when playing electronic virtual machines. First get insect sounds on your brain, decide you like them and want to make music with them. Pretty soon you will hear them everywhere and want to find your way into their inharmonic, chorusing, and rhythmic beauty.

So what do I like about these sounds anyway? Is this just a test, to decide how much music you can get out of bugs? In a way, yes. I've spent a few years delving into a kind of sound that previously I, too, would brush off as being little more than a beguiling noise. But listen more closely, and you will start to love it. Tweak those pads and you start to have an instant control of what really is a mathematical model of how insects make sound and combine their rhythms upon each other. The electronic world of insects made with Zebra may not always sound just like the real insects, but they are put together in an analogical way. As science models complex ecological struggles and happenings in nature, the software synthesizer models a world of many oscillating insects. Delve into the sound, and muckrake with the sound. Twist and turn it into different forms and decide which ones you like and which ones you dislike.



Wait a minute, isn't that what my hero John Cage urged us never to do? That's right, this great twentieth-century composer and philosopher of music had this advice for all would-be artists in the new world: "You must free yourselves from your likes and dislikes." That's how he was led to recommend the use of chance in how to move from one musical state to the next. I watched him at work, and he definitely brought a precise, aesthetic sense to his compositions. He may have used randomness to generate them, but he was quite particular about what ideas of music he chose to accept, when putting his name to a work. You can always tell that a Cage is a Cage. In the 1930s he presciently said that one day composers would be making music directly out of electronic sounds—I'm not sure it was a world full of thumping techno that he had in mind, but I like to think he would approve of the question I put to the inanimate synthesizer, "How and why can you sound so much like a meadow full of insects?"

I aim for complex thrumming textural sounds, and slow changes, changes I have some control upon. Is each oscillator a single bug, or does each sound stand for a whole species of bug? This is not a theoretical or actually very intellectual music that I am making here, it is a live experiment in finding a warm, alluring kind of sound. I invite you to listen—if this music grabs only me, I am not succeeding here; hopefully you will care about this music not only because my enthusiasm for the whole story is infecting you, but there is something surprising, inviting, and attractive about this bug aesthetic in music. The machine is not making it on its own, it is *not* just modeling the way insects think. A musician must interact with the structure that enables him to play his way through the way insects think.

I prefer my electronic music to be live, most certainly to be played, not programmed, so that a human has demonstrated something musical can be performed with a sense of insectability behind

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each musical act. The Zebra synth enables a performer to explore his inner (or is it more accurately his outer?) insect. The thrums should consistently evolve, not always the same way.

It works! I'm listening. I want to hear and create more. It places me in an artificial midnight summer meadow. All of a sudden I'm there. Now I want to shut down the machines, get out in the real world, and bring some real musicians to perform live with the thrums of bugs that have become newly musical to my human ears by playing too long with machines.

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