Music and Imagination: The Rhythmic Brain
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The Philoctetes Center

Levy:	**Francis Levy**
Chase:	**Stephanie Chase**
Barnhill:	**Eric Barnhill**
A:	**Speaker from audience**

Levy: I'm Francis Levy, Co-Director of the Philoctetes Center. Dr. Edward Nersessian is the other Co-Director. Hi, and welcome to *Music and Imagination: The Rhythmic Brain*. Now I'm very proud and happy to present Stephanie Chase. Stephanie Chase is the Artistic Director of the Music of the Spheres Society. She's also a violinist and she's played here before, to our pleasure. Stephanie will be our host tonight, and she's going to introduce our distinguished guests. Thanks, Stephanie.

Chase: Thank you, Francis. When you mentioned the title of this exhibition, I was thinking of *Weather and Imagination*. I think the weather tonight is not quite as bad as people imagined it might be, so thank you for coming and I'm sorry it kept some people away.

A couple of years ago, I was doing a little bit of research on the Internet, and I was looking for somebody to consider as our guest lecturer. We have pre-concert lectures before many of our concerts at the Music of the Spheres Society, exploring different aspects of music. I forget what the search terms were that I put in, but I came upon Eric Barnhill's website, and I read about his work. I realized that he was on our mailing list as well, so I thought, well this is fortuitous, and read a bit more. I found that he was extraordinarily interesting, and it's a field that I know so little about. I'm going to turn it over to him almost immediately, but I do want to read you his bio.

Eric Barnhill is the creator of Cognitive Eurhythmics, and currently practices at the Optimal Health and Development Center in Westchester and in private practice in Manhattan. He has used the curriculum with Alzheimer's, Attention Deficit, Tourette's, Autism Spectrum and other motor- and neurodegenerative disorders. He received a Feldenkrais Practitioner Certification from the Feldenkrais Movement Institute, a Dalcroze Certification from the DALCROA School of New York, and a Master's in Piano Performance from the Juilliard School, so he's also a very accomplished pianist. And I see that you did the Goldberg Variations recently—

Barnhill: Yes.

Chase: It's my pleasure to welcome Eric Barnhill.

Barnhill: Thanks very much for having me, and thank you very much for inviting me to be here. I know you like it to be more relaxed and conversational here, so once I've just thrown a bit of background at you, I also would very much like to get into a little demonstration of some of the

techniques I use and some of the stories from my practice. Maybe we can just mix that in with going back and forth.

I studied piano in graduate school. While I was there I got very interested in what are called these "alternative methods," alternative practices that are sometimes taught at performing-arts conservatories. I got into Alexander Technique, and Feldenkrais Method, and Tai Chi, which I've been doing for twelve years, and also Dalcroze Eurhythmics, and some other things. By the time I graduated, I was about equally interested in the piano that I had come there for, and all these alternative body-mind disciplines. I sort of pursued them equally over the next few years.

My first few teaching jobs, and many of the places where my practice took root, were out in the suburbs—like a lot of people who graduate from music school—and I very eagerly took special-needs students. I really like teaching them; they tend to really like music. They're often very brilliant about music when they're not necessarily performing well in other mainstream disciplines, and so it was something that fascinated me a lot. After I did this for awhile, I started to notice that I looked at their problems differently than other people seemed to be looking at them. Where people often saw someone who had very little self-control and very little ability to focus, I often saw a body that couldn't organize itself into a beat. Thanks to Dalcroze, which is a method of teaching music through movement, I often used movement in my lessons. I would also have students who had tremendous difficulties with Attention Deficit and Hyperactivity and so forth. Often they were brilliantly rhythmic and musical when it came to beat, but when it came to meter or some larger, hierarchical structure of music, it all sort of fell apart. They couldn't hold to that structure. Lastly, I would often work with children who had speech, language, or reading difficulties, and I found that if I could get them to move in a way that corresponded with their use of speech, and I could get their speech to reflect their movement, then I could get great change in their ability to use language.

I began to wonder why music had this effect that it did, so I set about trying to explain it, trying to find research that would help me explain it. It's been many, many years doing this now, and I've put a book together that's near the end of its process, and I have this theory. I just wanted to quickly go over the points with you, and then we'll open it up to questions on that. Then I'll talk to you a little bit about my practice. So I'm going to go over to the chalkboard here, and just talk a little bit about the brain.

The main idea is that the rhythms and features of music—through the gateway of movement—impact psychological processes, which in turn can impact the structure or certain aspects of the functioning of the brain. This is my theory. I've compiled this from a lot of different researchers, and what I thought was really interesting was these researchers are often considered somewhat marginal in their disciplines. They're not considered illegitimate in any way, but their viewpoint is considered alternative. Yet when I stacked up all the reading I had been doing, I found this very clean line that seemed to unite them all together, so whereas they might all be on the fringe of how that discipline is looked at, altogether it seemed like a very parsimonious way to think. It seemed like the mind and music and the brain were all doing the same sort of thing. That was the theory that I put together.

I'm going to start from the top and work my way down. At the top, I want you to consider two alternative ways that we think of the brain's content. The most traditional one is Structure, and

the other way that is more and more popular and more and more interesting to a lot of people studying the brain is Process. A good example of a concept that describes brain content in terms of structure or architecture is a hypothetical thing—and again, it doesn't get any more technical than this—known as the "grandmother cell." The idea here is that the brain has the hierarchy of a pyramid, like the way we think of a corporation, for example, and you have lots and lots and lots of worker-drones at the bottom, and more and more executive functioning on the way up. For example, neurons near the eyes perform very basic recognitions. Then a second layer will perform associations on those recognitions. Another layer performs associations of combinations that it recognizes there, and on and on and on until you get to the top of this pyramid, and you've got thing-specific cells, right? So once all these associations add up in a critical way, you have a grandmother cell that says, "Bing! That's my grandma." So that's the idea. You have this pyramid structure. Though it's obviously overly simplistic, this general idea is still accepted by a lot of people, or considered to have some validity.

Now for the other side—Process—I want you to consider something called the 40 Hertz Hypothesis, which is based on the work of a lot of people, but Francis Crick was the guy who put it this way. The idea here is that there are constant rhythms in the electrical activity of the brain going on all the time. It's the speed and the nature of those rhythms that really determines what's going on, more than the content of any cells, let's say, more than any particular architecture. It's the rhythm that's creating the content. In this hypothesis, different groups of neurons in the brain start to oscillate at the frequency of 40 Hz, which is forty times per second, when they are part of our conscious perception. We know, for example, that when we do neuroimaging we have a pretty good idea which parts of the brain are impacting the scene that we have as a conscious person because all those parts are oscillating at 40 Hz.

The interesting thing is, there's a big problem in neuroscience called the Binding Problem. I have things coming in through my ears and through my eyes and through my muscles and my memories. How does that all cohere into one scene, one coherent idea? That's called the Binding Problem, and in the rhythmic model of the Binding Problem, everything doesn't have to be connected to each other all the time, because if I'm oscillating at one frequency here and one frequency here, these two parts know they're in synch, even if they're not directly communicating. All these little patches that are oscillating at 40 Hz are the parts that are currently conscious. So that's just one of the most prominent examples of a theory in which the rhythm in processes is more important than the content of what's going on in your head, than the actual structure, the chemicals and the molecules and so forth. All right, that's all I'm going to touch on in terms of brain.

Now in terms of mind, I've found a number of very interesting thinkers, some of whom I've met. All of them kind of knew each other, but none of them are necessarily too central to their field, the field of psychology. The first one I became interested in was James J. Gibson. Gibson was a specialist in optical perception—vision. When he started studying vision, people wanted to know how the eye perceived a two-dimensional picture, and that was basically it. They figured, "Well, we look at how the eye perceives a square on the wall, or a circle on the wall, and we figure out how that works, and then we'll go to more complex things from there. We'll work our way up." He felt that this was never going to go anywhere, because there was no way to isolate any one part of vision from any other, and that included self-movement, so that he felt movement was as much a part of the visual apparatus as the eye. I'll just give you this one quote of his: "Looking

around and getting around do not fit into the standard idea of what visual perception is, but note that if an animal has eyes at all, it swivels its head around and it goes from place to place. The single, frozen field of view provides only impoverished information about the world. The visual system did not evolve for this."

As one of his followers says, just to bring this back to rhythm very clearly: "In dynamic events—movement—the things that would probably most interest us as a creature, an integrated figural form, usually involves the presence of a stable, rhythmic pattern comprising various related periodicities." What he's saying is we're meant to move or to be moved at, and to see things in motion, to perceive invariances in movement over time. To see patterns over time or rhythms in the array of what we're perceiving. For Gibson, the central thing that we're doing all the time is perceiving movement over our visual sense and detecting patterns in that movement, which in a way, as this follower said, is a very rhythmic activity.

Two more people I want to just briefly run by you. Mary Jones, a theorist of attention, who got going in the 1970s and is still at it. She is the founder of something called The Rhythmic Theory of Attending. When she got involved in attention, people wanted to see how you would attend to what's called a static visual array—again, something static and visual, right? But she says: "When people hear friends engage in a conversation or listen to a familiar tune, when they watch a basketball game, or when they observe a mother-infant exchange, they are engaged by temporally-patterned changes. Such events comprise actions and movements that display distinct beginnings, recognizable rhythms, characteristic tempos, and lawful endings. An attentional theory that captures how we truly attend must consider how people respond when the object of attention changes in time." She has an absolute parallel to Gibson, in the sense that her field is static, and she sees rhythmic pattern and process as being more central than things that are static.

Lastly, I want to go a little bit into communication. There are a lot of people I could credit, but Madeleine Haynes and James G. Martin were two of the earlier people who worked on this problem, and this is a question of why we need music when we speak at all. The voice goes up and down. People use rhythmic beats when they talk. There's a whole field known as prosody, right, and why is that so important to us? Well, I'll just throw the money-quote at you: "Prosody and its constituent features generate an intonation contour which serves to bound speech production into meaningful units. This enables the processing of information within as large a unit as possible without losing meaning or taxing the short-term memory."

Just to elaborate on this, what people have found since this research is that when we are listening for meaning, we need the prosody, and without it we can barely get through a Standard English sentence. There are lots of different ways that we know this, but one of them is that when we have computers spit out words without any kind of rhythm or intonation, our comprehension drops by seventy percent. When people talk, they generate a framework—they're projecting a framework that the sentence is going to follow—and when they do that you can hang expectations on that. That allows you to navigate the sentences that most people are saying to you, and if they didn't have that prosodic contour, you wouldn't be able to follow them at all. So really, without music, communication through Standard English sentences is basically not possible.

Most interestingly, a lot of reading difficulties are connected with something that's called phonological recoding. That means that people are inside regenerating the prosodic contour—the spoken version—of what they're reading, even if it's very quick. There's a great experiment that proved this in 1982 called the tongue-twister experiment, in which sentences that had some kind of very difficult phonetic quality, but otherwise were grammatically no more difficult than others, were much more difficult to comprehend. People had to take much more time, and that was considered part of the evidence—that we rely heavily on phonological sound-based memory in order to read.

I bring up these three people because I'm going to show you some demonstrations in which I work on these three general areas: perception and prediction, attention and reading, and communication. My theory is that all of these different rhythms—in a way I was somewhat able to outline here—connect together, that just as rhythmic process is becoming central to our study of the brain, it may be that these theorists, who are not necessarily at the center of the field, are right in line with what's coming. So I developed my theory based on this research. My belief is that the key missing component here is movement, and when we take the idealized patterns and rhythms of music into our movement, our voice and our speech in an integrated way, it becomes a teacher and it can teach us better, more efficient, more functional ways to go about our rhythmic processes of mind. Ultimately, developmentally, this can have an impact on the neurological processes of the brain.

There is something with the terrible name of "slaving," which is the last thing I want to mention to you. This is my best guess as to the mechanism by which all this works. It was invented by Hermann Haken, who was the inventor of the laser. I don't know if you know how a laser works, but normally the phases of light are diffuse. They spread out all over the place. They're all on their own. Given certain conditions, all these waves spontaneously form into one beam of light—a wave of practically infinite length—and that's what a laser is. That's why a laser is so powerful. Haken formulated this general idea that large vibrations can take over small ones and unite them together, so that a large picture can dominate the small picture. Gyorgy Buzsaki, who's a neuroscientist at Rutgers, also believes that this happens in the brain. He studies a lot of rhythmic oscillators, and the larger oscillators, the broader patterns, typically order together and orient the smaller patterns. They are the bigger orderers in the brain and they wrap the picture together.

So my belief is music can have this function for us, and through movement it can penetrate into these processes and give them order where there was none, and help people with special difficulties overcome them. What I thought maybe I could do is take questions or comments on that, and then out of that work into some demos and some stories.

A: Sometimes I'm aware of reading to myself as if I were reading out loud, but suppose you're not doing that. How does the prosody come about in that case?

Barnhill: It's really by experiment that they've had to get at that, so reading this versus reading that, they hypothesized that some things are going to be more impacting. If we had to phonologically re-code inside our minds to read this, then this would be harder than this, or this type of sentence would occur less frequently than this. If they feel there's no other really good reason why that would be so, they regard that as evidence that we re-code, that we regenerate the

sounds in order to comprehend the sentence. It's all deduction, and the details kind of go on and on and there's different schools of thought.

Chase: I have a question actually, regarding what you said about the 40 Hertz Hypothesis. How was it arrived at 40 Hz? What was the process of determining that frequency? Because that's basically an E-Flat, if you multiply it out, right?

Barnhill: Yeah, I think I worked that out one time. Maybe it was something like that, very low. I thought I'd make a CD that was all E-Flat, sell them—

Chase: The universe is supposed to have a B-Flat—

Barnhill: Yeah.

Chase: I'm thinking maybe we're a perfect fourth to the universe. We're all E-Flats inside. So I was curious—what was the process?

Barnhill: They measure all these different oscillations using neuroimaging and related techniques. The main organ to know about is the thalamus, which is considered the gateway of the brain. Basically all the lower brain functions pass through it to get to the higher brain functions, and vice-versa. It's happening all the time. Plus, the thalamus has these spindles that go all the way out into all the areas, so it's kind of in what a feng-shui person would say is the "power position of the brain." It emits this constant 40 Hz pulse that neurophysiologists feel unifies all the different activities of all the different modules into one coherent signal. That's the pulse that they've measured.

Chase: That is so interesting. Of course when you take the Hz frequencies and double them, you get the octave, so I figured out it was an E-Flat, roughly, because I doubled it up to 80, and then 160, and then 320 and 640 and then, you know, A 440 is what we tune violins to.

Barnhill: Do you think that in the Baroque period people found this?

Chase: I was just wondering about that, yeah. That's fascinating. Would this mean that people might have more of an affinity to E-Flat major, for instance, than other keys? Cause you think about Mozart writing a lot of things, and—

Barnhill: Yeah. Of course, he had a different E-Flat than we do, maybe.

Chase: I'd have to get a calculator to really tell you where it is.

Barnhill: I try to avoid jumping to any conclusions that are a little too facile.

Chase: All right.

Barnhill: But, no, I agree with you. The universe and we think in E-Flat, and could that possibly impact something I'm doing. I definitely think about that. I go through movement, so I'm not that concerned. There's been a lot of work on this—music and the brain—and that's generally how people think of understanding music. Your brain takes it in and your brain responds to it,

and this is such a modern idea, because it used to be your response to music was always action. I think that it should still be, really. Let's say a concert hall is a very special case, and the reason you're enjoying the concert hall is because you have a repertoire of action that you've sort of embedded in yourself, so that then you have an affective response to what you're hearing. But I think the fundamental way to appreciate music is through action, whether making it, moving to it, both, a mixture, some kind of freely-changing thing that you're doing.

Chase: I think we had some questions still here before we go on too much.

A: Have you studied or heard of any specific kinds of movements, whether that be through music or dance or something, that helps a person get to that 40 Hz level?

Barnhill: A little bit about my background that I didn't go over that much—I teach a method of music education that teaches musical concepts through movement, and so that ends up with rhythmic movement in time to music and getting better and better and better at that and having that be more and more fluid, so it's not simply this kind of thing, but something that is really a musical movement. The way that that would impact anything underlying is really speculation at this point, and I would love to have the resources to see if there's any way to measure some kind of palpable difference. When I take people with Parkinson's through something like this and their Parkinson's is reduced and their Tourette's is reduced, we know that those problems are tied deeply to thalamus and this issue of uniform, 40 Hz vibrations going out, breaking down. They both have to do with an inability to inhibit movement patterns in certain ways because the unifying signal is not reaching them, and we also know that when you play music, that often helps people like that already. My belief why is because it then can kind of substitute for what's missing in the thalamocortical network. What I would like to do with cognitive eurhythmics is create a practice so that people don't need to rely on external stimulus like music to have those effects we see when you play music with Parkinson's, but rather they have enough music inside.

A: It struck me as remarkable that the English language—a sentence produced by me, you, an announcer, an actor—is full of rhythmic change, and a rhythmic change can be very variable, but still it produces something we call meaning. This need to produce rhythms is intrinsic to the use of language and to the reception of that language by somebody else who's listening. Not all languages have that much rhythm. For example, in Spanish very often it goes along on a monotonous note and then drops or goes way up at the end. But in English, certainly, there's an enormous amount of variability in the course of any given sentence, so these rhythms are constantly affecting us, like we're listening to music as well as words.

Barnhill: The research on rhythm and music in speech is snagged by a few things. Actually, there is an old distinction as stress-time versus syllable-time languages. Languages like English and German, where the accent tends to stay in the same place and we smoosh the syllables to fit the accent—those are called stress-time languages. Languages like Italian and Spanish and more Mediterranean languages, where the syllables tend to have the same length—but there's sort of an arc that emerges above that—those are called syllable-time languages. Now that distinction is not absolute, so the skeptics have kind of won, and nobody's really researching that right now, but what's so amazing to me is all the music and additive rhythm, which is when you derive your meter by adding together eighth-notes in combination of twos and threes, so you know—

That's not so much a Germanic rhythm, right? That's more of a Mediterranean rhythm. Those tend to come from areas with what used to be called syllable-timed languages, and music that has strong, even beats tended to come from languages that were considered stress-timed, so I regret that that distinction is not considered absolute enough that anybody's looking into it anymore, because I think that there's tremendous significance between culture, language and music.

A: I just wanted to comment that people are taught to speak by hearing people speak, and particularly by being spoken to usually by a mother or some kind of mother figure. Whatever kind of language you learn, your mother's voice is music, so I think that the metaphor of what you learn as being musical, and having some meters that shape your world and have meaning—that's true no matter what language you speak. That's just my personal—

Barnhill: Yeah, well I do too, and because they can't find this exact beat in the speech signal, they've kind of given up on researching that much about rhythm and spoken words, but Paul Zukovsky did this famous study at Bell Labs, in which you really can't find the beat in the acoustic signal of most classical music performances either. There's just always flexibility; there's not an exactly mathematical beat in music performance either. This has caused a lot of speech researchers to give up a little prematurely, in my opinion. It's work that I think I've gotten results with, and I would love to see more research done in that direction.

A: I just have a question regarding Eurhythmy. Do you find that it is increasingly helpful as a collaborative effort? There's a lot of egos that will all gather in one room to perform Eurhythmy—do you see those egos bumping into one another, or if often they start to combine to create one rhythm?

Barnhill: First of all I want to make the always-confusing distinction between Eurhythmy and Eurhythmics. Eurhythmy is something created by Rudolph Steiner for the Waldorf School system, and it does involve moving rhythms of speech and music. Dalcroze Eurhythmics, which came out at roughly the same time in Switzerland as opposed to Germany, shares a name but not that much else. Dalcroze Eurhythmics was a method of education for conservatory students, because Dalcroze had many conservatory students whose movements were kind of wooden, but he felt that the rhythms by which they walked and moved around the room were just what he was looking for, so he tried to devise this system in which people could tap their natural sense of rhythm in order to use that in their music. That's a process that's very similar to what I'm using here, so that they have the music sort of already inside them, and they're trying to draw it out into a technique of performance, and in so doing, give life to the performance.

In terms of the egos in the room, Dalcroze believed that his method could be a unifier of peoples, and in Switzerland—probably in Geneva, actually—he put on mass spectacles where many, many people would move in coordination. He believed this could create harmoniousness among the people. It's true in Dalcroze. It's also true in Feldenkrais lessons that as the lesson goes on, people tend to be more and more of a similar mind, and tend to function more and more together. The standard format for a Dalcroze class, just like with a lot of my classes, is a teacher at the piano and everybody else moving, and there's a way that that music at the piano and everybody immersing in it connects everybody.

Levy: You talked about certain kinds of therapeutic intervention with respect to inhibiting certain symptoms of Parkinson's and Tourette's, but as someone who isn't really immersed in this field, I'm not getting a clear picture on a deeper level of the kinds of cognitive work that you do. Could you give us an illustration, say, of working with a student that has a disorder of the mind in terms of the taking in of information along the lines you referred to, say with respect to reading. Could you give a more specific illustration of how you work these kinds of techniques?

Barnhill: I'm not going to go for language right away. The language one will be the trickiest to do with our situation, but one of the things I tell parents and often show them is that prediction is often called the brain's first function, and that really is the ability to synchronize it and train with the elements in the world around you. Parents who have children with certain kinds of special needs are often stunned to see the weaknesses children have in certain kinds of basic prediction. Nobody ever seems to test for this. Often when you tune up their ability to predict and synchronize and coordinate on a very elementary level with the world around them, you get results. I'm going to play you a beat. Could you please count ten of them, whenever you're ready to start?

Chase: One, two, three, four, five, six, seven, eight, nine, ten.

Barnhill: Easy for Stephanie; not easy for children with special needs a lot of the time. They might get three and then they will just peel off. Or another one that would be trickier is to count off ten of these:

Chase: One, two…three, four…five, six…seven, eight…nine, ten.

Barnhill: Now there's one where, for example, that space would throw off a lot of kids, because they might be able to attend sufficiently in a very small moment to get on that track of counting with the stimulus, but then you can do a lot of things to reveal that they're really just working on their own after that. Anything you change about the drum, the tempo, or the rhythmic pattern, or if I set the drum on fire or whatever—they can count to ten in the way that they've set, but they're not with you anymore. You see? Parents are often stunned to see that they cannot actually stay with ten—

Chase: So they were trained in a certain manner and they have a rather inflexible approach to it, you're saying, that they have problems—

Barnhill: Kids fool you, you know. Their window is at any moment so narrow in terms of an arc of attention over time that they take something in and they go with it until they're given feedback—bad, good—and then they adjust it. So now, while you do that counting, I'd like you to clap and step with the beats.

Chase: One, two, three, four, five, six, seven, eight, nine, ten.

Barnhill: Again, easy for Stephanie; not easy—

Chase: Oh I don't know. I'm getting worried here!

Barnhill: This is a real giveaway, because children with certain kinds of special needs and learning disorders have one walk that they tend to stick to, and one way of talking that they tend to stick to, and synchronizing them up is something they have never tried to do and they absolutely can't do it, and they don't know they're not doing it.

Chase: Okay, bring it.

Barnhill: One, two, three, four, five, six, seven, eight, nine, ten. [He walks around the room as he counts, taking steps randomly, not on the beat]

Barnhill: How many steps did you take? Ten. For sure ten. No way of knowing that wasn't ten. There's no synchronicity there.

Let's say that they have a thought, and then they have the language of the thought, and then they have the movement. Just getting them synchronized—that's one of the most very basic things that I do in terms of developing cognitive capacity. Now actually, we could take this example right into some of the stuff I do with language, although we're a little stuck for mobility. But if you could repeat after me: Hickory Dickory Dock.

Chase: Hickory Dickory Dock.

Barnhill: The mouse ran up the clock.

Chase: The mouse ran up the clock.

Barnhill: The clock struck one and down he run.

Chase: The clock struck one and down he run.

Barnhill: Hickory Dickory Dock.

Chase: Hickory Dickory Dock.

Barnhill: Okay, now I want you to clap that instead of saying it after I say it.

Chase: Okay.

Barnhill: Hickory Dickory Dock. The mouse ran up the clock.

Barnhill: I can have kids who can clap that perfectly and not say it with any kind of rhythm, and not know that there's a difference.

Chase: I'm better at clapping than some people.

Barnhill: Let's clap it and then say it together. One, two, ready, and—

Barnhill and Chase: Hickory Dickory Dock/ The mouse ran up the clock.

Barnhill: Okay, and just doing that, just tying their speech with their movement—

[Chase continues clapping and finishes the rhyme]

Barnhill: Nice job.

Chase: I worked with my trainer today, so compared to what she had me do, this is easy.

Barnhill: With something like that, you could have kids who are very brilliant with their body but have a reading disability. Suddenly you can show them that this doesn't connect. They can see that, and it's very concrete to them and they can often fix it, and then often their speech is very different when they're done.

Chase: If I could actually interject something, because I want your input on something that is difficult for me—I'm working on the Suite from Stravinsky's *Histoire du Soldat*. It's in several movements. I'm doing the version which is violin, clarinet and piano for a concert that we're doing next month. I've never played this music before and I really haven't heard it very much, and I find with Stravinsky's music that the coordination aspects are so difficult that I'm having to train myself in a way that I normally don't have to train myself. First of all, there's the visual perception of the music because I have a lot of chords, so it's three notes instead of one note at a time. It might be moving by quickly, but I'm trying to do it under-tempo, and I'm playing chords basically in first position, so it's not like I'm even having to negotiate around the instrument very much, but just the three notes at one time, the having to rearrange my fingers, and then the rhythmic aspects of it. It's not terribly, terribly difficult in and of itself, but you start putting all these things together and it's just—. So I'm working very slowly through this, and a lot of the rhythmic things are very tricky for the musician, because he'll give you a 5/8 bar, meaning that you're thinking in terms of eighth notes instead of quarter notes. There will be five eighth notes, and then he'll give you something else, and it might even be five followed by three, and so he has a pattern **w**hich in and of itself may not be that difficult, but if you're having to coordinate all these other things going on, your brain is so preoccupied. I'm thinking to myself, well, he's saying five plus three. What if I make it four plus four? Then it's a lot easier. I'm actually re-barring some of this music just so I can internalize it a little bit more easily. I was thinking about all these things you were talking about—the visual perception, the reading aspect of it, but then also things to link into and the coordinating aspects. It's a real challenge, and thank God it's only a couple of minutes long.

Barnhill: You bring up what is one of the most affirming things that I've found about this work, which is that I see no distinction between what somebody is going for when they're just trying to catch a ball, and on the very other end of it what a high performer is going for with some insanely sophisticated multilayered piece like Stravinsky's *Histoire*. I really think that it's all about an ability to internalize—

Chase: Also, ultimately, we're working with muscle memory too, and I think that for a musician is a very important aspect—that we're dealing with all these other things, but once you have started practicing, you're dealing with familiarity. Something I was thinking about in terms of language and rhythm, and a little bit about what you've been talking about, is the sense of narrative. For instance, if I'm performing a piece and I know it well and I've prepared it well and I feel comfortable with it, it's a sense of getting into a narrative. You're sort of stepping onto a conveyance that's moving along. You recognize the landmarks along the way, but that has also

to do with familiarity. When things are not familiar—in terms of having heard it or not heard it, in terms of the rhythmic structures, in terms of the note combinations and the chords that I'm having to do—it's a real challenge.

Barnhill: Yeah, I really think it's a very fundamental thing that has to do with performance and people. I definitely see a deeper instructive aspect to music. It's a tool for anybody to continue to pursue knowledge and development of themselves, and it's all on a spectrum in my sense.

A: When you think about the fact that there are children—often children, but sometimes adults—for whom the simplest negotiation of language or thought or speech is as complicated for them as this tremendously esoteric activity is for you, that's part of the reason why I think this approach is so wonderful. Of course something that you have is a substrate of competence and confidence. You approach this by saying, "Maybe I'll divide this five-and-three into four-and-four." But a child who has no confidence, no sense of satisfaction, no sense of being able to count on themselves to be an agent of change for themselves can't do that, and I think that's where the kinds of interventions that you make must make a tremendous difference, because you can show people who've never been able to create this for themselves that there are techniques for which they can begin to develop that sense of competence and confidence that all future actions that are going to be more complicated have to build on in order for them to be able to function any better, which I think is so interesting and exciting.

Barnhill: Well, there's something deceptive about fluency of any kind. You know, it's funny: I've tried to learn certain musical skills later in life just to get that feeling of what people go through learning things the first time, and fluency fools you into thinking you're just doing it and anybody could do it. We make assumptions on that level about so many different things, and with children, when they don't do it, we just assume they're being willful. They may be getting emotional, and then it's even harder to tell, but a lot of times a "won't" is really a "can't," and until you can take things apart and look at mechanisms, you don't know. You really almost never know, because the emotional readout you get could be telling you what's under the surface, or it might not be because the child doesn't have a grip on it either. I often find that people will say, "my kid won't slow down, he won't listen to me, he bangs stuff." Often if you just can take into their body an option, by getting them to move to the music in a way that's new, the music teaches them a new pattern of action and they'll use it. They weren't being willful. They just didn't have an option that we thought everybody could just do.

A: In your readings, did you find any kind of structural difference, because I notice several different learning styles: visual, audio, kinesthetic. Did you find that there were structural brain differences among people of each learning preference? Second question is, did you find in your readings that musicians tend to be more kinesthetic learners? And a little interesting tidbit: I don't know who did the study, but a couple of years ago someone did a study about big groups, for example, audiences in concert halls and in theaters, and he found out that in European crowds, the applause was synchronized into one pattern, versus in America, it wasn't so much.

Barnhill: Yes, there tended to be unison clapping if they really liked something. Haken, the inventor of the laser, talks about unison clapping. I think it was either that or it was somebody writing about Haken, I don't remember, but there's more volume in the auditorium with less

effort when people go into that synchronized clapping, and it's just like a laser beam. It's an example of spontaneous order, emerging properties.

A: That might be like a cultural difference too, which would also talk about a predilection or an ease of learning rhythms quicker in certain cultures than in others.

Barnhill: Brain differences and learning types—I don't know how far along that is. That reminds me very much of Multiple Intelligence, which is Howard Gardner, right? So I don't know how far along that is, but I'm sure there's work being done on that that can be found. Probably Howard Gardner is a good locus point. The other thing you asked about was whether musicians were more kinesthetic learning types. The field of music psychology is very interested in stuff like that. This sits a little bit outside of a lot of what I see there. Music psychologists are very interested in every trait of musicians—whether they're more visual or more auditory; or people with perfect pitch, are they better at throwing a baseball; and people with musical training, ten years versus two, so that's where I would look for that kind of thing. *Music Perception Journal*.

A: And mathematics, right?

Barnhill: Yeah, and mathematics. They love to study what musicians are like upstairs. I would look there.

A: When you were talking about languages just before, you reminded me—I lived in Hong Kong for seven years. I tried to assimilate and learn the language. I got a tutor and she was teaching me Cantonese, even though Mandarin's easier to learn. It only had four tones, but everybody spoke Cantonese in Hong Kong at the time. That was nine tones, and the teacher started teaching me the numbers first, right? I kept getting number nine wrong, cause she kept saying I said "dog." I said, "But it's *gao*." She said I kept saying it with a high tone and I kept saying "dog." She kept getting annoyed at me, cause there were all the different tones and I kept getting it wrong. So I had to stop. A year of tutoring and I was getting nowhere because, well I'm not musical. I don't know if that had anything to do with it, but it was so hard. Nine tones in the Cantonese Chinese language!

Barnhill: Mandarin is not considered easy either.

A: Then she forgot to tell me that the word "*gao*," because I was trying to get it so right, also was a rude word if you said it with too high a tone.

Barnhill: Classic, yeah.

A: I went and asked my administration manager for nine of some paperwork and I was trying not to say "dog." Instead I said the rude word and they were all shocked. I'd said the rude word so perfect. When I went back to my teacher I said, "Why didn't you tell me this was also a rude word, not just "nine" and "dog?" Because of those different nine tones, I was getting so confused. I just gave up after a year.

Levy: What's the rude word?

A: Dick. I said dick, something to that—I mean, forget about the characters, learning the characters. I was going phonetic.

Barnhill: That's amazing.

A: Ten thousand characters and the students learn three thousand, and they're all visual and tonal. It's a nightmare. I couldn't do it. I got the basic gist of it, you know I could get a cab to take me to the right place. That's as far as I got, so it was interesting when you talked about the languages—

Barnhill: Classical Chinese music is one of the most interesting musics in pitches and bend, and almost no other culture takes nearly as much of an interest. You have to just wonder what it sounds like to them, because it probably sounds very natural. It sounds very unusual to us, certainly to me. You know, classical Chinese music has all those bending pitches—I think it sounds very conversational. In Japanese you don't have those bent pitches, but you have quick movements among vowels, and the flute music that's over there tends to be very pure-toned instruments that they like, but there tends to be a lot of that quick flitter. It's very interesting.

Chase: I have a friend from Hong Kong who—we've talked about this. In fact, the word "ma" has many different meanings, and so I said, "Can you tell me all the different meanings and pronounce it for me?" He went through all the different tones and it was extraordinary, but in the same conversation we were talking about the fact that you can't put Western-style music to Chinese lyrics, because he said, "You know, nobody would understand, because you've lost all the inflection. You've lost the sense of the tones, the pitches, and so it would be absolutely meaningless." They could be saying the words, and putting them in a Western kind of song structure, but nobody would understand what was being sung—the language—because it would just sound wrong.

A: This is along those lines: do you have a technique of working with people who speak in a monotone, without inflection, without prosody, the music of speech?

Barnhill: Absolutely. That is something I don't have here, because the demos I picked for tonight didn't involve pitch instruments. But the first, most basic one is "Papa Bear, Mama Bear, Baby Bear." A lot of times, they don't even have access to trying to speak in the chest, trying to speak regular, and trying to speak very high. Just using those three distinctions can often open a child up a little bit. A lot of children with that kind of situation are very, very afraid to sing.

A: Is it like a brain exercise? Do you have to keep drilling them the way you learn to play music, or is it more that once they become aware of the distinctions it comes very quickly, almost automatically?

Barnhill: I would say it varies. There's often a big birth at the beginning when they become aware of something, because as soon as it's brought into the light of their awareness, kids will often doggedly work to just go at it and fix it themselves. Once you can make the deficiency something concrete—if it's a matter of something that's still not quite in the light of their awareness—I find they go at it again and again for quite a long time, and it tends to be at a

plateau for quite a long time, and then one day it'll kind of come through for them, and they can see it.

A: Pitch has to do with vibration or frequency in a different way than the meter of poetry, for instance, but does it fit into your theory that in some way or other when you're giving them the music of speech, not the rhythm of speech, that that's part of this access to some kind of natural synchronizer—not rhythm, perhaps, but something like that?

Barnhill: I think we must be speaking in relationship to the natural oscillators of the brain, right? Whatever those are, whatever the real rules are by how we're speaking and thinking in language, I think that a certain type of healthy rhythm underlies that, and it's very connected with the body. In speech you come at it from both ends—one, in training the body to be musical, you give them something they can map speech onto, and I think that also definitely pitch works with xylophones and things like that. Also, there's actually something called a boomwhacker. Does anybody know what a boomwhacker is? It's a big plastic tube that is perfect. You whack it to make the sound, and it makes a very light sound for a very heavy movement. You can hit two together to make a chord, and then if you hit somebody with it and they hit you, it doesn't hurt. The whole thing is just perfect. Kids who are not ready to use pitch in their voice, I have them just try to make distinctions among the boomwhacker pitches. I do a lot of work with animals—animals in the story. "Which one would be the right one for Daddy Bear? Which one would be the right one for Mommy Bear?" You know, I'm sorry about the stereotype, but it works. And so forth, just getting them to have any kind of reaction to pitch, and gradually work toward taking it into their voice, and the first day that they somehow stumble onto what you're doing is often a big breakthrough.

A: Is that a recent finding that the language of a culture is reflected in music? Because I thought that music, or that nonverbal, came before the verbal. Or that music had more of an effect on speech, because speech is more of an intellectual faculty, whereas music's more—when you're a baby, you just start making sounds and noises—

Barnhill: Yeah, and rhythms. I didn't mean to imply one preceded the other. It's definitely a chicken-and-egg, one of these fascinating iterative things. But the research is mostly from the seventies because people sort of lost interest. There's a new book, *Language, Music and the Brain*, and from what I know of this work it's not so interested in beats—that type of thing, rhythm in speech.

A: How often is it difficult to teach someone who doesn't understand the differences, say in pitch, between high and low, and why do you think those sort of physical characteristics were ascribed to music? Why is something described as "high", and why is something "low"? What goes through our brain? Why do we use the adjective "sharp" to describe music?

Barnhill: Well, you know, the Greeks had it the other way around. For the Greeks the high notes were the low notes, and the low notes were the high.

A: Really?

Barnhill: Yes.

A: What do you mean?

Barnhill: Well, like the low notes on the piano—they called those notes on their instruments "high" and these other ones they called "low." But who knows how they were thinking about it? I mean George Lakoff and all this metaphorical thinking—they may have been turning it around in some way that you had to be there to make sense of it. And then, sharp and flat—I don't know what relationship that has to the medieval hexachords and all that. It may or may not be a purely experiential choice to come up with those words, but I believe those came around the time of the medieval hexachord system, which predated contemporary tonality. But if you're asking about people who have trouble mapping something, well yes, in music education, when you're first teaching piano—I don't know about other instruments—you have to teach kids that this is the way to the high and that's the way to the low. You pretty much stuff that down their throat. They don't have an intuitive feeling about that, I find. Generally, these are small and these are big, if you were looking at it in terms of movement. The notes that feel small and the notes that feel big. But high and low, it's just like red lights and green lights—you kind of teach them that that's the way it is. It's interesting that that's true.

A: So they don't find it intuitive?

Barnhill: No, generally not, until you tell kids that. Unless they picked it up, which is often true. They don't tend to know that. They tend to know big and small.

A: What are the notes that feel big?

Barnhill: The low notes.

A: I can even picture assaultive sounds in a high frequency with people tensing up and sort of moving upward to cover their ears, and ducking for cover when a low-frequency type of sound occurs.

Barnhill: Interesting hypothesis.

A: I think it might be innate.

Barnhill: In my experience of music education it's not sufficiently innate that you can rely on it, or drive any experiential path to it, but you tell them that's how it is.

A: You mentioned how people with Parkinson's were able to move more easily when they were responding to music—

Barnhill: Absolutely.

A: But they also respond to visual patterns, and I was wondering how you explain that. Is it the music, or is it a pattern, some sort of structure, whether it's visual or aural, that they're really responding to?

Barnhill: That's an interesting question.

A: It seems that we need patterns to negotiate the world around us. That's my understanding of it, anyway. The other thing is that in Alzheimer's one of the first things to go is the person's ability to drive a car, but they retain the ability to play the piano well into their illness, which is also a very complex activity. Driving a car you're coordinating all different movements, but it's not predictable—there's no pattern involved—or at least it's less obvious, more complicated. But I was just wondering how you explain the visual aspects of this?

Barnhill: It reminds me of Oliver Sacks's *Awakenings*, where he's working with the Parkinsonians. There are some that can't go around the corners anymore, but if you paint or draw curved lines, they can go, and if you do straight lines, they have to stop right there. My belief is this all goes back to movement. There's a whole approach to perception that I didn't get into called the Motor Theory of Perception, and there's a few contemporary people who champion it today, including Alain Berthoz in France, that believe that in all acts of perception, the way we localize any object in space is to project how we would move—how and how much we would move—in order to get there. That's a theory that's actually been around for over a hundred years.

A: Who said that?

Barnhill: One of the best quotes is from Poincaré, who said "To localize any object in space is to create within myself the muscle movements that would take me there."

A: Isn't that an update on the new society of mirror neurons?

Barnhill: I think that's very tied up in it. I couldn't say what the exact relationship is, but it's very tied up in it too that whenever I see something, I re-enact inside to make any judgment about it.

A: But there are mirror neurons operating that are sympathetic to whatever it is that you are watching or imagining.

Barnhill: Yeah, I think mirror neurons are more of a subspecies. The brain is sometimes called the "biological simulator," and its main job is prediction, simulation, and making guesses about the future. I think we very naturally take in events and start working with them inside, in the mechanisms of the brain. We're finding that the brain evolved from movement. A perception evolved to aid movement. First we had movement, and perception immediately started to grow more sophisticated in sea creatures. It grew to assist beings in movement. So movement is really at the basis of a lot more of cognition than it's been given credit for, and I think with things like visual patterns allowing Parkinsonians to move—again, when people see those curved lines, it allows them to create some kind of movement within themselves.

A: Picking up what you were saying, I'm aware that people with Alzheimer's sometimes can't even articulate a thought, but yet can remember a song and remember the lyrics to a song, and can sing the lyrics to a song, and yet not be able to articulate a sentence. I guess it goes back to the idea of prosody—the fact that when we talk we're singing to some degree—but those people who have neurological damage cannot put one word in front of another, yet they can sing a song from their youth and know every lyric and know every word perfectly.

A: Do they sing that song with a motion, or do they just—

A: Well, somewhere in their memory, they'll be able to remember that song and the lyrics, but it's bizarre that they can't articulate a sentence.

Barnhill: If they enjoy it a lot, they might. The first use of cognitive eurhythmics was a second-stage Alzheimer's adult day services center in my old neighborhood. There was in particular one woman, and she's in the paper I wrote on Alzheimer's, which is on my website. Just sat like a stone for the first several lessons, and all the music I played was Gershwin, ragtime, old-time rhythmic music. Then the funniest thing happened—I'd have to look at my story to remember—but I believe she was someone that her feet just—you can't see this, so I'm going to tell you. She started to do something very imperceptibly with the music, and I saw it, and I thought, you know what? That's right in time with the music—how funny is that? Then I changed the tempo of the music, and the woman was a complete stone. But from then on, I treated her like she was completely there, and then one day she just kind of woke up and started doing some talking. It was amazing. I have a lot of stories like that.

Chase: This reminds me, sort of anecdotally, but along similar lines—there used to be an entertainer who was a country-western singer. I think his name was Mel Tillis, and he had a terrible stutter. Johnny Carson would have him on and he'd go on other shows, and they'd interview him, and it was comical. He'd acknowledge that he had a terrible stuttering problem. As soon as he got out there and started singing, though, the stutter went away. So if he wanted to say a sentence without a stutter, he would sing it. Then he was fine. He had a sense of rhythm. He had a sense of structure, whatever it was. There was something that was always a part of that.

Barnhill: So if we imagine that you have perceptions coming in, in this oscillatory way, you have action patterns that are stored in a stereotypical way that are then released, modulated to match the outside environment. What I think it going on is somehow music is picking up some of that slack. Now how is music picking up that slack? That's the real question in terms of the healing power of music, at least in terms of these neurological situations with Alzheimer's and Parkinson's and stuttering. There's some way that the coordination is not happening, and music enables it somehow. It allows the right things to release in the right way, and for me, this plays off of Dalcroze's goal of getting the music in the body. My belief is when you get the music in the body, you give people the tools to make up their own slack and overcome these problems, or ameliorate them at least.

A: Have you found any special educational value in teaching children or adults to sing, play, be one rhythm against a very different one: two against three, five against four? Every musician has to do this, to feel this difference. Just to learn. Dalcroze used to do this all the time.

Barnhill: Yeah, that's right.

A: Is that very educational? Can a child be pushed into that?

Barnhill: I make a lot of use of that. I'm racing right now to come up with the way I've used it pretty recently. The way I get into that often is to play music in the octave below middle-C, and then walk this and clap this up here [he demonstrates hands on a keyboard] and then combine them in some way. That's a very common one I use for developing this stuff, because I think a higher order has to be going on in order to take two things that are coming in. One of the

pioneers of music psychology is involved in something called Auditory Scene Analysis, or Stream Segregation. In other words, all the noise in the world is coming in at once in one glob, and yet we create out of it this scene of all these things that are happening. How do we do that? There's been a lot of really interesting research on that, but I think it plays into this exact same thing. I've got to be able to think of them as two separate lines, but then some governing mechanism of some kind has to create a unified response because that's all we're really capable of, is unified response.

And fluency—funny, I was just talking about this with a student the other day—fluency to me, in a poly-rhythm let's say, in two-track rhythm—comes from having worked through every combination that will come up in that sort of situation, and as a result being able to feel like you're doing two things at once, but really, it's being processed as a unit. I think some kind of second-order watcher has to emerge, and I think that that is a tremendously powerful learning lesson for kids, because I think that's really what they've got to do. They've got sounds, sights, language, movement, and some kind of operator in there has to be bringing it all together and sorting it into one piece. I think it's the same operation.

Levy: Music strikes me, along the same lines, as a sort of cliché of culture that I'd be interested to analyze in terms of the effect of music—for example, in a movie, there's the candlelight, the music and the lovemaking following. If you take the cliché apart, then there's some kind of probably interesting relationship between music and motor mechanisms. Also from a political point of view, I read an article in the *New York Review of Books* recently in relation to one of Beethoven's Symphonies—the *Joy*—

Barnhill: *Ode to Joy?*

Levy: Yeah, and its relationship to certain types of political states that have been created by the music, how it was used in Germany. I'm just free-associating here. I'll stop my rant.

Barnhill: Well, it's a powerful thing.

Chase: Yeah, for instance, when you have a so-called "heroic music". Politically speaking, in Russia for instance, Peter Prokofiev and Shostakovich. There was supposed to be a nationalist style, but it had certain sort of "heroic" qualities to it that were very powerful, and you weren't going to have, probably, Impressionism coming out of those guys. It had to be rhythmically very, very powerful, almost like marching. You know, marching is a very strong reminder of armies, so I think if you wanted to write powerful music for a totalitarian government which had a strong army, you might have a lot of marching feelings in it.

Barnhill: I agree.

Chase: There's a question back there also.

A: I'm very bad at multitasking. I like to focus on one thing that I'm doing, and I was thinking of this recently because I'm finishing a long writing project that was just for myself, and most days I do it in silence. I don't have any music on. Every once in a while, I have this insane desire to play music while I'm working on my writing, and I always wondered whether that had an influence on me. Of course there are a million possible sentences I could be generating, and I

don't have a controlled experiment to find out, but if I go through this process of playing music and trying to do some writing, I discover that I either haven't heard the music at all, or I haven't been writing. I don't find that I'm doing both. So I wonder, and our discussion makes me think: are there certain vibrations, oscillating lights, buzzing sounds at a certain frequency, that are associated with hampering or enhancing creativity or certain kinds of behavior?

Barnhill: Interestingly, it's not really anything that I've looked into, and I don't know that much about it. For me, the gateway to really having this music impact the brain is movement. There's a lot of good research, and of course a lot of complete charlatanism about the Mozart Effect, etcetera—about music going into your brain, your brain appreciating it and taking it in, and *x* and *y* happening to it. And there are some methods that I think are worth knowing about, like Tomatis's, which used filtered sounds of the mother's voice to reconstruct parts of the brain that he felt were not properly developed in autism.

A: There have been studies done about the frequency of fluorescent lighting, and it has been proven to increase the occurrence of migraine headaches. Also, I don't know if there has been a study done, but colicky babies have been known to stop crying if you turn on a dustbuster and hold it against their chest.

A: Can I make a comment about that? It's pretty well-known that colicky babies respond to getting up at night, taking them out, and driving them in the car. There is actually a little device that you can now put on the bottom of the crib that causes it to vibrate. And the best one, when my brother was colicky—and this was fifty or so years ago—my mom was advised to do the laundry, and then when the washing machine was in the spin cycle, to hold the baby on top off the washing machine, and the baby would always fall asleep. That's the washing-machine theory.

Chase: And that's from years ago. That's amazing.

A: Well, it's sound too, but I think it was mostly the vibration.

A: That's fascinating, but what about a vibration that doesn't put you to sleep? What wakes you up or inspires you?

A: Yeah, but when you have colic, it's not just like you're awake and you're going to sleep. You're organizing the child into a more organized state.

A: When you talked about charlatanism, do you think there's any validity to the idea that Mozart makes cows have more milk? Apparently, they do studies where they do rap music and chickens don't lay eggs. With Rock and roll they don't lay eggs, but play Mozart, and they lay eggs, so maybe it's not just the human brain, but that there are things in Mozart. Apparently there are dairies that like to play it, and they say that the cows deliver more milk.

Barnhill: I think there's something to it. Of course it's only my own speculation, but I wish that the body would be included, and not just music entering the brain. I just don't think that's the model for how we're going to figure out how music impacts the human being. I really think that the first stop for music is the body, always, and I think you need to have acoustic music to really have a certain type of impact. I think that speakers and digitized music will never be the same as

an honest analog vibration traveling, and so live music for a cow would be the only study I'd accept.

A: It would be hard bringing a quartet into the barn, you know.

Barnhill: I'd be interested in what kind of sounds cows make and when. I don't know much about this, but every organ has a resonant frequency, and there may very well be some kind of connection between the kind of music you play and what kind of resonant frequencies you'd be getting in the cows' organs or something like that.

Chase: Just to follow up a little bit on that, if you think about the human heartbeat being generally around 60 beats, and that often we have an affinity toward tempos that are derived from 60, whether it's 120, 60, 180, there's a relationship there, and it's a very natural feeling to find that tempo, and especially when you're dealing with some of the earlier composers, who've written dance music. That specifically is meant to be moved to, and so with my teacher, Arthur Grumiaux, I was playing a Bach movement for him—it was a Minuet—and he stopped me almost immediately. He said, "If I were dancing to this, I'd be up in the chandelier by now." It was too fast. So there is a very strong association with dance tempos and movement patterns, but where do those come from? The ease of dancing in a three-meter for example, versus, a two-step or something. I find it a lot easier—

Barnhill: Or whether the three-meter contains just a natural balance of even and uneven, and new and old. The average length of a breath is three seconds, and that turns out to be the average length of a phrase in classical music, and actually if you do the math—I think if you go four beats, 72, and four 4/4 measures, it's just about three seconds—so there's this complete convergence upon the length of a breath in the average classical phrase, for whatever that's worth. And then often, the average phrase is set up and then it's broken. That creates tension in ways that might be partially Leonard Meyer in structure, and it may partially also be physiological.

Chase: You remind me of something. In our last concert, I made some arrangements of two Scott Joplin rags, which were piano rags, and I did them for clarinet with string quartet. I thought, "This will be fun," and I talked to the clarinetist and gave him the music. He said, "This is wonderful." And then we go to the end of the first rehearsal, and he said to me, "You know, there's no place for me to breathe," and I thought, "Oh yeah," because it was this ragtime, and he was just sort of doing this constant stuff. He managed fine because he's great, so he could find a place to breathe—he didn't have to suddenly stop and super fill his lungs—but I just thought, "Oh yeah, you've got to really keep these things in mind."

And sometimes with piano, where you don't have to stop, or even with violin, we sometimes get separated, and I'm always talking to my own students, then, about phrasing. You have the full breath, and you have the comma, and you could make sort of a colon. It ultimately becomes very much like a form of language where you're parsing the phrasing and deciding what is the high point, how to inflect this.

Barnhill: You made me think that barbershop quartets, which I think were around the same time as Scott Joplin, have all these commas. They're always pausing to take those breaths. It's a whole different set of music.

A: In sports, if you use music, you can actually get a speed out of an athlete that he cannot run naturally. The Olympic record for the 200 is something like five steps per second. Yet if you teach the athlete right, that athlete can go up to seven, eight steps a second. It's incredible when you think of it, or you try to even beat that pattern out with your hand, but you can. First you have to start with a simpler rhythm by a metronome, and the metronome goes higher and higher, and every day you give them ten beats faster.

Barnhill: Just like running a musical. A musical passage.

A: 180, 190, 200 to 300—and suddenly the person is taking 360 steps a minute, and it can't be done without music, but it can be done with music. It's almost like you're layering the process, because the first process is just the metronome. The second, you have to layer a pattern on the metronome. The third is to relate the pattern on the metronome to a song or something like that. And the fourth would be just when you lay down a pattern, say, of 360 beats per minute, and then when the feet are running at that pace you introduce the drums, and the drums will take that athlete into—well, the nearest I can describe it is when the person is in the "groove."

Barnhill: Absolutely. It takes you beyond yourself, right?

A: Yes it does. It takes them completely out of themselves. I've been trying to understand how that could be used in terms of improving athletics generally, because it's weird in a situation where, say, America's trying to beat the Kenyans in running, and they will not do it in distance, but they can do it if they can learn to generate a pattern which is closer to the pattern they need for the actual marathon rather than over. The Africans are doing over 150 miles a week, but that's not the answer. The answer is really being able to concentrate on a two-hour framework and try to see how much you can get the athlete to fun faster and faster for that period of time, because it's all you really need in order to accomplish the marathon, and the other thing with the body and mind is you can't learn to run fast by running slow.

Barnhill: No, they're different processes.

A: This is basically the approach of the Africans and the Kenyans. It's to run long distances and then try to rev it up at the last minute, whereas if you learn speed from the beginning—and you can generate it musically—it's a very complex way of working, but it seems to me that the more complex the whole pattern becomes, the easier it is to generate high speed, because it seems that somewhere along the line the body is tagging the different movements, the different sequences which are necessary to some specific beat. So you find that if you lay it down right, the more complicated it is, the faster the person can run, and this is all mind-body.

Barnhill: Absolutely. I was once talking with a person at Equinox about trying to do something there on the premise that this discipline that allows you to take music inside your body may be of great use to athletes, and it may be that runners would be interested in even just a classical Eurhythmics class, in which they're representing different music and rhythm in their body and

how their body feels different in different tempos and speeds and different musical figures. That might be of interest to athletes.

A: They kind of do that at Equinox, in spinning classes, if the teacher's good. There's always a soundtrack of music, and they'll switch the songs to increase the number of pedals you do per second.

Barnhill: As you probably know, they've banned iPods in distance running. You can't use them during the marathon because they thought it was like a performance-enhancing drug.

A: I suggest that the way to use it is with learning in the preparatory stage, and to internalize it to the point where you would not need it in the actual race itself, because the whole thing can be generalized. So that even when you're starting to run, before you start the race, you really start humming it to yourself: "One, two, one, two…." and then you're running at it, and if you've done it long enough, the body has internalized it. It will run at that rate.

Barnhill: I think very subtle rhythmic distinctions can be felt in the body, and I've certainly felt that as a performer. I relied on it a lot. I knew if I wanted my recapitulation to be slightly more out there than my exposition, I would rely on a feeling, and not any kind of analysis of this kind. I think you can feel these distinctions much more than you can think about them.

A: I just wondered if could give more examples of the things you do with children to create this—like you said, with the drums.

Barnhill: Examples of anything in particular?

A: I can't remember if you exactly said it before, but like when they were mentioning something about reading disabilities that you said you would get to later—

Barnhill: I wanted to mull over reading for a second, but in terms of attention. I once had one child—I'm not sure what his diagnosis was, but it was clear that his short-term attention and memory was just zero—and what was amazing was he could do these incredible imitations. I could know what band he listened to this week. He couldn't play any piano—he would just hit the piano, and he would move his body and sing, and I knew what he'd been listening to, but it never contained anything, so it was like he could just take snapshots of the world. Actually, over a year and a half I taught him how to play "Twinkle, Twinkle Little Star" on the piano, which is really funny, but the type of stuff we would do would be—let's see, how am I going to do this in here? Well, stand up and I'll show you how this works. So if I had him there, I would say, how many times did I bounce this ball? How many times did I bounce it?

A: Three.

Barnhill: Right, and he would say "Three." And then I would bounce it. How many times did I bounce this ball?

A: Four.

Barnhill: He would say four. And then I would go like this [Barnhill bounces the ball six times]. And I would say, "How many times?" and he would say either "three" or "four," depending on what was the right answer the last time. He had no ability to process that. That's what's very interesting about psychological phenomena like the railroad tracks. We automatically divide railroad tracks into groups of two and three. We automatically hear that, even though it's not really there, because as soon as information comes in, it needs to be categorized. It needs to be in a hierarchy, or there's just instant pileup. You couldn't get to your front door. If I bounce it seven times, it's just instant pileup, so how did I sort this out? Well, he could count fours, so I did four-beat measures, so: [Barnhill tosses ball up on first beat and bounces it for three]. One, two, three, four...One, two, three, four. And I would have him try that and count while he did it.

A: Wait, so throw it first? One, two, three, four…One, two, three, four.

Barnhill: That's right, so then I'm creating multi-layers without making him have to think about much of anything, and then I would change the count, and this would happen over time. I don't know how clear it is that this could unfold over time. One, two, three, four…Two, two, three, four…Three, two, three, four…Four, two, three, four…

Barnhill: Now I could get him to focus on a much more sustained task, and what's maybe not entirely clear is I'm relying on him to be able to feel in his body that this has been three, without having to "tokenize" it—that's the real word I want to use, but without having to count that out and interfere with his other counting. He's good enough that he can track three, so I can have him do like eight measures. Then I'd say after eight minutes he gets to run around the room or bang on the piano or something, and that's how I'd get him to sustain tasks. I'd have him do very simple actions that he could manage, and them I'd have him build hierarchies out of those actions using basic musical meters.

Now in terms of how that would apply to language—some of the work I do with language is with dynamics, musical dynamics, because children can maybe take them in when they hear them, but they can't put them in their movement. Depending on how conceptual they are, I may teach them the little Italian words for dynamics, because that creates a special language that we can use. Or I might just use the letters. Actually, I don't have props here for this, but I have sheets of paper with all the different dynamic symbols, and I would give them the drum and I would point to one or another. Or I would have the xylophone and I would play an expression and point to one or another, and that would get them using different dynamic nuances, and then I would take that into a nursery rhyme. For me, Mother Goose is it. Whoever that was is a total genius, particularly her understanding of how you need rhythm to teach language—rhythm and rhyme are really the key things for teaching all the key parts of language.

I'm sorry that I got you up and didn't have much for you to run around and do, but those are things I use for speech. For music I had one student—her verbal scores were like ninety-nine percent, but her visual processing scores were like one percent, basically like she's blind, and I taught her those Italian—you know, "pianissimo, pianissimo…piano, piano…forte, forte…fortissimo! fortissimo!" [He demonstrates sequences of beats in each dynamic on the tambourine]

Then we would do movements, and I would ask her, which one is this? The real trick is to get them to find the middle ones, because then you're dealing with something that in special needs is called Thresholds, which everybody knows is a big problem. For example, one thing—and this is something I look for a lot, especially when I start working with a student—is quiet to medium. They can imitate what I do, and as soon as it goes over moderately loud, they just go as hard as they can. They just go crazy. And with music, you can really do something to help them, because you can start to draw these different distinctions, just in pattern of sound, and you want them just to reflect that in their body, so there's no task you're asking them to do and there's no judgment in a way, and there's none of the baggage of language. [He plays a beat with descending vocal pitch].

Barnhill: And he just went—[He plays the corresponding rhythm on the tambourine]. I would say, "Okay, you showed me this one," and then I would play it very loud, and then just take it down one tick. You know, "Now, show me that." Then he would try to find some way to modulate that, and I can get him into a whole area of reactions he didn't have at another time, and then sometimes if I'm lucky, the schoolteacher will mention that he has more variety of responses. I think music can be the teacher for movement patterns, and that enables these kids to have more options in life.

Chase: Any more questions?

A: It sounds like you don't always know what the child's diagnosis is, but there are certain phenomena that you're going to work with. Is that because you find perhaps some final common pathways of behavior that you'll see and you can work with those, perhaps regardless of what the actual process is by which they happen?

Barnhill: That's exactly right. In the early days, I would even forget to ask, but then I realized it didn't look very professional. I really want to see how they respond to these activities of music and movement, and I educate them in that direction, and I really don't claim to be doing anything else. My theory is really a theory. This is the only way I've found to explain it. My sole interest is in how they move to music, and what's nice about that is it frees me of having to think about them in one way or another. These diagnoses are all relative, and really everybody is very, very different. We do know that. The same thing can work for two very differently diagnosed people, and a different technique is going to work for other people. Somehow that enables me to just be right with them as a human being, just to find a rhythmic flow, a game that's their speed with them, and just to take that a step further every time is exactly what interests me, and not really the diagnosis terms.

Chase: When you're working with children, do you sometimes work with the parents as well and teach them some of the skills that they're going to be doing a lot?

Barnhill: Yeah, I think that's important. I particularly like to get some result in there and try to figure out how we can apply this. There's trickery in some ways—walking into the room, walking out of the room, I might come along and be using whatever new movement I think they've got for that day, get them to find ways to do it on the way out to the car, and let the moms see, and get that all set up so that the moms can try to use it at home for certain things, and that definitely works.

Chase: Do you ever have classes that are really designed for the parents of these children?

Barnhill: I don't. If it's working well, I'd prefer to just be me and the child, and then we always bring the mom in at the end to show what we've done, but I think there's a big learning factor there in asking your child to show what they've figured out how to do. That allows it to deepen. That's a big payoff for the kid, so actually, that is how I normally do it.

Chase: How often do you work with children typically?

Barnhill: Once a week.

Chase: How long is a session?

Barnhill: Forty-five minutes, usually.

Chase: Do you have some children with whom forty-five minutes is way too long, and so you must work with them for a much shorter period of time?

Barnhill: If it's way too long, I tend to let it wind down in the middle, and find something else to pick up with on the end. I had one boy who—this was actually a small, semi-private group that I got set up with—he just ran and ran and ran around the room, pushing and bumping, and had no other options, and the total interaction was about three seconds, but it was good. I had this musical thing going, and it was a stop game, and all the other kids would stop. He would just be like—[He demonstrates movements of the boy not stopping]—and that was it, but the mom saw it, and he never does that. That's my gateway.

Actually, there's one boy who's in my case studies. He was three and a half, and he had these huge leg braces and he couldn't stand still. A lot of the time there was no balance point, no equilibrium for him, and he just kind of wandered with all the activities, very, very small, and one day I found the right tempo and he just—[He marches.]

Chase: Fantastic.

Barnhill: The tempo was that big that I could get him to do that. You find just the right thing and you get the organization.

Chase: Would you say the majority of the kids that you work with are on some sort of medication?

Barnhill: I often don't even really know. I prefer them not to be. I have a friend who teaches children's ballet who has a rule—no medication—because the talent often gets stifled by it. I think also the musicality can be affected, and I prefer them off. But parents need to do what they need to do.

Chase: Speaking of ballet, I remember when I was a kid I was in high school with a lot of ballerinas who were actually still working with Balanchine in those days. I would see them practicing in the hallways. They were doing their combinations. They were always counting out off to themselves. They were never singing a melody, and the first day I remember—

Barnhill: Were you at LaGuardia? You said you were in high school and you knew a lot of ballerinas?

Chase: Professional Children's School.

Barnhill: Oh, PCS, right—okay.

Chase: I'm a professional child, yes. So I was amazed the first time I realized that they were just sort of counting off numbers to themselves, and doing a rhythm with a number and putting together combinations, because I always thought, "Oh, they're moving to music, and they're listening to the music, and I always though it was this sort of association like a musician might have—you're sort of responding to it. No, unfortunately. I think things have maybe changed a bit since then. It's interesting. Balanchine was always considered to be a very musical choreographer, and yet you talk to people who are conductors, who are actually conducting ballet, and it has often nothing to do with how you would normally be conducting the flow of the music, but it has to do with the combinations of steps, and how long can they be in the air before they come down again, and very technical things, and so sometimes it's a very un-musical feeling.

Barnhill: I have a dancer mother of a boy I worked with who said she really wished she had had that because it's so great to have a background in rhythmic movement before you get so into technique. She was just right in the technique, and she never really had a way to let that rhythm out into her dancing in a free way. I think that's true for musicians too. I think with the Dalcroze class when they're young, and the background in just doing things rhythmically, then they have access to it through their instruments someday. You lay the groundwork for later.

Chase: Sometimes it's a releasing of things that have been trained into you that you're sort of exploring or improvising upon, which I think touches on the fact that a lot of classically-trained musicians have a hard time improvising. And yet you improvise on the piano, so what do you find?

Barnhill: I abandon everything for improvisation. I love improvisation. But it was like building a technique from scratch all over again, completely.

Chase: What was the process for you to be able to do that? You're leaving behind a structure—we've been talking about structures all along, and the need for them. Whether you call it a pattern or a structure, and the rhythm, and sort of recognizing it, and also perhaps memorization being a part of it, recognition, familiarity. When you go into improvisation, I suppose you're dealing a little bit with familiarity. You know what chords might work coming out of this combination of notes, but tell me about it, if you don't mind.

Barnhill: It's been a great trip into the unknown. To get certified to teach Dalcroze takes years, and you have to develop a basic improvisational facility at the piano. That's probably the most challenging aspect of the training for most people. I ended up playing for movement, and the truth is, as soon as you start doing it, you realize the better you improvise, the better the children will move for you. It's just night and day. Somebody sits down with a slightly different touch, and the children just go. There's truth in that. It can't be denied because children are so honest.

That led me to think about what I think music really is, and what's the source of it. My improvisation is very Western classical, but I tend to take motives and let them develop, and let forms come out of that and break back down, and I feel like I've understood how music is put together in a totally different way. In an analysis course, you might learn that things are treated this way and this way and this way, but with improvisation it's almost like you're seeing the theme from inside, like from the driver's seat. Then the reason for the contrasting section is not that it was the convention, or that they happened to do it. It was that if you're making that theme, the need for contrast comes upon you.

Chase: You talk about *rubato*, which is stretching a tempo and straying a little bit from this precision of rhythmic meter, but sometimes when I'm playing a piece I'm feeling how the music wants to be played, how the phrase wants to come out, and so I guess this is a similar idea that you have. It's not necessarily that you're taking the structure and putting one structure in with another one—you're just sort of allowing it its own flow and letting it happen. You feel that it should happen this way.

Barnhill: That's very much what it feels like, and so I began to understand a lot of musical devices. At least for me, it was really an epiphany. Instead of laying them out through practice, saying, oh yeah, the need for contrast is now the need for recapitulation is now different things. Getting to know music from the inside.

A: I think this is relevant to the movement, because I studied improvisation for several years with a great Jazz pianist—it wasn't intellectual—and one of the things you were to do every week was to sing Billie Holiday, and then more difficult was Charlie Parker—.

Barnhill: Yeah, I believe so!

A: I remember I was starting to count something out and he said, "Don't count it. Just feel it." That was their basic rule, always. Just listen carefully enough and let your body attune to the music. You could do that.

A: I wanted to know if you used any higher technologies in your work. I know that there's a lot of development for helping children develop their cognitive abilities. I wanted to know if you found any particularly useful, or if you've used any at all.

Barnhill: No, I'm very low-tech, always. I'm big on acoustic sounds. I have a problem with children hearing this canned sound, because we're supposed to understand something when we hear sound about where things are, how big they are, and when you have canned sound, you're really teaching the brain to ignore that, I think. I'm sort of an Amish therapist, almost. I just use very basic acoustic things, with the movement at the center. A friend of mine who runs the Optimal Center in Hartsdale does rhythmic metronomes, and they have gotten results. I mean it really works. That's a body thing. You're really beating time with the metronome, and things change, and you have to do this and that. It shows me that even doing something very one-dimensional—just this kind of beat as a point in time, but doing it with your body—helps kids pay attention better.

Also, with Dalcroze, they've actually done gait studies in Switzerland now, with this very interesting geriatrician Reto Kressig. They measure a gait after a Dalcroze class and before. And after, the geriatric people walk as if they're at least twenty years younger, and they can actually measure that by looking at the way the gait looks when they step on the sensitive thing. They've had some really nice work over there on how rhythmic movement can help tune these things up.

Chase: Any more questions?

A: The information that we got this evening said that you had some personal experiences that led to your getting involved in this work. Since it was written down, I assumed that it would be okay to ask you if would say something about that.

Barnhill: Well, I grew up with Tourette's syndrome. The thing is, Tourette's decreases with age generally, so I don't want to make any extravagant claims. But certainly well into my twenties it was still around, and very visible and—when I wasn't thinking about it—very audible, though I could kind of repress that for interviews or something. I really got into rhythmic movement and Dalcroze, things like that, and the first person I worked on, the first idea I had was this idea of internalizing rhythms. It's huge in Dalcroze. An understanding of music is really internalization of music, and having it inside yourself. I thought, well, Tourette's is really people doing things kind of out of synch. What if an internalization of rhythm allowed them to do things more in synch, or to get themselves in synch? I began to work on myself in this way, and that was what really got me interested in the whole cognitive side of it. It was like, "Well, I know that I feel like things just aren't lighting up."

There's this great old scientist, William Condon. He did sound-film analysis of people, and their whole body synchronizes with them while they speak, but in people with disorders the body breaks into five different rhythms while they speak. I always felt like things were fragmenting somehow, and like a lot of Touretters, when I played piano it went away. Everybody knows that certain rhythmic movements—music and swimming and Tai Chi and things like that—make the Tourette's go away. I thought, Dalcroze educates this relationship that I can carry around with me, and so maybe that will give me some way to get on top of this. I would have some information within myself I could use to kind of counter-balance. That's what I feel I developed, and my Tourette's syndrome did basically go away. I'm very interested at some point in working with the Tourette's community, but it's sort of a crazy theory, and I've never gotten any interest over it. I've been to their national conferences, actually, a couple of times. But that was really the genesis of looking at the cognitive benefits and the learning-disability-type benefits of this work.

Levy: Eric and Stephanie, I want to thank you very much for a marvelous evening, and I think this is a subject for perhaps even some research that Philoctetes would be interested in.