[Music]

>> [Background Music] Welcome to another one of our "Music and the Brain" podcasts from the Library of Congress. I'm Steve Mencher. Today, we're joined by Tod Machover, one of the most original thinkers in the world of music over the past several decades and especially noted for his ability to lead the way in creating musical opportunities for non-musicians to experience the joys of making music. His mentors include the most important composers of the 20th century. His collaborators are musicians like Yo-Yo Ma and Prince, and he operates from a base at MIT, where he's currently professor of Music and Media at the MIT Media Lab and director of the lab's Hyperinstruments and Opera of the Future groups. I could go on, but then we wouldn't have any time to talk. So, welcome, Tod.

>> Thank you, Steve.

>> Now, I was going to do the first interview with you in recent times that didn't even mention Guitar Hero, but, I'm sorry, I couldn't pull it off. So perhaps you can use the game and its invention to tell me a little bit more about Hyperinstruments and the Media Lab. And then we're going to go quickly to where we're going to concentrate, which is music and health, music and the brain, music and Alzheimer's, and the other ideas we've been talking about with a lot of smart people here at the Library for about two years. But let's start briefly with Guitar Hero.

>> Good. So quickly, quickly to get there, I was realizing today that -- I was talking to Anne McLean and it turns out it's been 27 years since I've been in this building. The last time I was here was to premier a piece for cello and electronics that I wrote for Joel Krosnick, who was commissioned by the Library of Congress. The reason I think of that is that I'm a cellist myself, grew up playing classical music, then rock music. My dad's a computer scientist, my mom's a pianist, and I got interested very early in extending what you could do with traditional instruments, especially something like the cello. And I was thinking that this piece I premiered here 27 years ago was a piece for cello and electronics. And I used my imagination to extend the sounds of the cello, do things that the cello acoustically couldn't do, bring these two worlds together. But at that time, the only way to make the electronic part was to go into a studio. I was working at IRCAM, Pierre Boulez's institute in Paris, at that point and put all of this music prerecorded so that I could set it off at certain times to go along with the cello. And that's the best you could do at that point. And I remembered that when I was a teenager, in many ways the reason that I ended up doing strange instruments and ending up with Guitar Hero was it all goes back to Sgt. Pepper's when it came out. And, you know, if you think of how amazing that was musically, you know, this incredibly like Technicolor all of a sudden amazing music: complex, rich. And it was also the first album that the Beatles made that couldn't be played live. It was made with all the wonders of technology in the studio. And not only that, they'd gotten tired of playing live, just as Glenn Gould did at about the same period, fell in love with the studio. And from the time that I was, you know, 12, 13, I loved that music, but also I felt like something was wrong, something was missing from music that was only done for the studio, could never, ever be played live. So I've been obsessed ever since with how you

have to get the best of both worlds, how you can have music which is spontaneous and expressive and an exchange between musicians or musicians and audience, also has this richness and complexity that you can only do with a studio with technology. And that led me to invent Hyperinstruments, which are basically instruments originally to be played by virtuosi like Yo-Yo Ma and Prince, as you mentioned, but where the instrument listens to how it's being played. And it not only knows what's being played, but it knows how it's being played and why. It knows what the expression is, what the feeling is. And it uses that information so that a performer emphasizes certain things, pushes to a downbeat or plays an F-sharp with a certain twinge. The instrument can morph and turn into something else. The cello could become a voice or an electronic sound, or a single melodic line could become a whole orchestra.

[Music]

So I got very interested when I got to MIT in building this kind of instrument. And because of my background, being interested both in classical music and rock, as we started developing this technology and people like Yo-Yo were doing amazing things with it, I also started thinking that this same technology could be used to measure what anybody does when they react to music. And I got very interested in opening the doors of participating in music to anybody. And it turned out that the software we were writing that could listen to Yo-Yo's playing and expand it and the way we were measuring his gestures. So he was making gestures with a bow, but it turns out the techniques we were using could measure anybody's gesture, waving their hands, and so you could conduct music. And I made a project called the Brain Opera in the mid '90s for Lincoln Center in New York that was a kind of orchestra for anybody to play. And it turned out that some of my students who worked on that Brain Opera project really got hooked by this idea of making sophisticated, interesting musical experiences that could be touched by anybody. And they graduated, went down the block -- they're still a few blocks away from the Media Lab in Cambridge -- and they started this company. For about 10 years, they made music games that were popular critically but didn't sell very well. And as soon as they decided to make a plastic guitar -- make this kind of guitar soloist model and to make a game where you could very easily tell if you were, you know, progressing in the game or not -- it was amazing 'cause it was a skyrocket, overnight success without any marketing. So to me that said not only were they very clever, but the time had come where you really -- first of all, people did want more from music than just listening to an iPod or listening passively to a piece. People were willing to jump in and make music themselves if you could make the right model. That was one model, and it kind of opened a field.

>> I want to find a way to move from there, which is the thing that people will have heard about you. I mean, I've known about you for decades. I know how important you are to music, to the intersection of music --

>> Thank you.

>> -- and technology. I understand that. And yet I know that people who don't follow music may not have heard your name, may not know about you except for this fabulously interesting giant pop culture thing called Guitar Hero. But I want to find a way now to move from that to some of the other work you're doing because that's my interest here, is the intersection of the music and the health. And so let me tell you about our last visitor here, who was just amazing, a woman named Alicia Clair. She's from Kansas, and she's been working for several decades now in the intersection of how music is used for Alzheimer's, mainly in late-stage Alzheimer's patients. And she told us in great detail about the idea that sometimes when communication has stopped between people, as a person sort of disappears from their Alzheimer's disease, there's one thing that can bring them back. And that thing, I'm sure you know, is music. And so in reading that you are starting also to do some work with Alzheimer's and music and memory, I wanted to go directly to that and to find out exactly how your work with Alzheimer's is proceeding.

>> In many ways, something like Guitar Hero is extremely promising because it does allow everybody to participate. But at the same time it's very limiting. And it's almost frustrating because of how much it does but also how much it doesn't do. So we, over the last five or six years, got very interested in trying to do everything that Guitar Hero doesn't do, which is making interactive music environments that are much more personal, much more expressive, and also environments where you can make your own music. Because my own sense is that exploring creativity through music and simply having a powerful creative experience is central to motivation, well-being, and directly to health in many ways. So we started out by making a tool called Hyperscore, which originally was for children. And it's a graphic software program that makes it possible for anybody to compose original music without knowing any of the rules of music or having any musical training. You make little motifs and melodies with little symbols that look kind of like eggplants. You move them around, and each of those gets a color. And then you draw with those colors and the shape of your drawing does a kind of variation on your melody, harmony, or rhythm. And then all the rules of music are built into this environment. So you can draw these things, you can leave them exactly where you place them, but you can also turn on harmony, for instance, and say, "Now I want to harmonize this and I'm going to use another line to show how the harmony changes: Does it modulate? Does it move to different chords? Does it increase tension?" So we had a lot of experience in 2004-2005 with Hyperscore and children. We went around the world having children compose first pieces for symphony orchestras like the Berlin Philharmonic, the Boston Symphony. And this was a computer software, but you could push a button and this graphic notation turned into real notation for players, so real musicians can and still do play this. We had such amazing results with children that we -- it just occurred to me that inviting anybody to create their own music and to have it played by professionals and have it mentored and share it with lots of people could open doors to many people who could benefit by making music. So I started thinking about people with various illnesses and, you know, people who maybe were in long-term care in hospitals who weren't really invited to do anything creatively. And this was five or six years ago. I'd also heard quite a bit about -- especially about the relationship of memory and music and Alzheimer's. Same thing is true with

Parkinson's Disease. Many people who can't move because of Parkinson's, if you find the right kind of repetitive music, it's as if parts of the brain get synchronized that don't get synchronized any other way. It also seems to simplify circuits in the brain which get overloaded and all of a sudden you can move over a threshold, a doorway for instance. Same thing with strokes. Many people who have strokes and lose the ability to speak still -- most people still form words in their heads. And any one of a number of pathways get destroyed or blocked and you can imagine the words, but you simply can't say them. Many of those same people can sing a song with the words perfectly, but they can't translate that back to speaking. So actually one of my colleagues at Beth Israel Hospital Harvard Medical School in Boston named Gottfried Schlaug, he's at Harvard, but his technique is called MIT, Melodic Intonation Therapy. He found out that repeating words rhythmically and alternating each syllable with an interval and using a hand tap reinforces the ability to relearn through sound. But we started out using Hyperscore as a technique for people with many health problems to compose, especially at a hospital called Tewksbury State Hospital outside of Boston. For five or six years now we've been working with groups in the mental health division and also the physical disability division and have had unbelievable results with people whose psychological conditions, their symptoms are reduced enough that they, instead of staying for years and years in the hospital, are able to go back to normal life, people whose physical conditions are at least brought under control when they're working with Hyperscore. And so we have a long-term kind of colleague named Dan Ellsey who has cerebral palsy since birth. He's been a kind of collaborator/partner to think about how both composing with Hyperscore and then performing pieces that you've composed using special interfaces that we design can be really the only way for many people to show who they are and what they care about through music. Now, in Alzheimer's, we are in contact with and are very interested in therapies that use exactly the phenomenon that you mentioned: the retention of connection to music into late-stage Alzheimer's. But we've been interested in exactly the opposite because we're interested in music as an assessment tool, especially through these composition activities. So one of the great things about music is that people simply love it, so people are willing to engage in a musical activity over and over and over again without being forced to. So if you can find the right kind of activity, quite simply it's a very good way of getting data over a long time with somebody. Music also uses so many different parts of the brain, coordinates different parts of the brain. You can isolate different parts of the brain depending on whether you're dealing with rhythm or melody or texture or form, and so you can observe different mental capacities. What we've been concentrating on with Alzheimer's is whether music is a powerful early detection tool. It's exactly the opposite of late-stage Alzheimer's because as we know with Alzheimer's, by the time people show symptoms, it's too late for any of the treatments that can slow down Alzheimer's. Of course there's no cure for Alzheimer's, but we want to detect it as early as possible so we can slow it. So we developed a set of tools. They're two categories: One of them is like a music memory game, and it's an application on an iPad or an iPhone. And you see a bunch of circles on the device and you hear music in different styles. And it's almost like -- oh what's that game where you turn over cards and --

>> Oh, concentration.

>> It's almost like a musical version of concentration. And we've done many tests about what kinds of music, what juxtapositions, how different the music should be. One of the interesting things we found out early on in our studies is that amazingly, musicians and non-musicians on this particular kind of test do rather similarly, which is very useful. But it turns out that what are called associative pairs for memory, memorizing not just a fact, not just a sound, but a sound across media -- so a sound and its position in space -- doing that together accesses a certain part of memory which is one of the very first parts of memory that deteriorates in Alzheimer's Disease. And so it turns out that this particular test -- well, this test is clinical trials now at McLean Hospital in Boston and it's been funded by the Alzheimer's Association. And it turns out that it looks like it's more effective than just about anything else in finding out that this memory capacity is deteriorating. It doesn't even take all that long, but over a course of a couple of weeks we find out that there really is a problem and then can probe more deeply. What we're doing right this second is taking this Hyperscore composing language -- so it's nice to have this app on the iPod and your iPhone, but it's really, really nice to be composing your own music to use this Hyperscore software. So we're building right into Hyperscore the ability to do these memory tests with your own music that you're making. So you make music, you'll make one of these melodies and without you asking, all of a sudden a little test will pop up and say, "Ah, nice melody. Let's remember that. So is this similar? Is that not similar?" And so your own music becomes the subject for this --

>> Diagnostic tool.

>> -- for this diagnostic tool. So we believe very strongly that music as a diagnostic tool is very, very powerful. And we have this application in Alzheimer's and we're going to pursue it vigorously. And it seems like it's already very successful and we're starting to publish. I have a fantastic student, one of my favorite people in Music and the Brain named Adam Boulanger, a name worth remembering. He just finished his Ph.D. at the Media Lab and he's doing a postdoc this year. What we're doing for the postdoc is doing all the tests to accumulate the data to show how well this works and obviously how we can make it better, but also we want to scale those. We want to get these tests out to people and we want to have enough data to show that it's a test worth using as widely as possible because we think it can really help people.

>> Now, you've talked to us about something I guess that I would call for lack of better words "looking at these issues from the outside in." So how are you interfacing with brain scientists who are doing the fMRI work, who are looking at this from the inside out electrically and chemically and what's happening in the brain during these things, or are you?

>> Well, we are. Luckily in Cambridge there's an unbelievable community of, you know, musicians and music therapists and brain scientists and brain imaging people. And the community is getting closer and closer together. So people approaching these ideas from every possible angle are

in close contact. My own sense is that fMRI work is extremely useful for long-term research for understanding simply how the brain operates in various music situations. So for instance my two daughters were part of Gottfried Schlaug's the first longitudinal study of how children's brains do or don't change if they study music instruments or not. So he did -- as I'm sure you know -- did a five-year study to see whether somebody starting an instrument over five years had any significant change of brain development from a control group of people who had music once a week in school and then people who had no music. This is very, very interesting. We think that maybe more real-time EEG measurement for instance. We're doing a lot of work with somebody named Pawan Sinha at the Brain and Cognitive Science department at MIT, who is one of the great brain plasticity experts. Actually, his field is brain adaptation after sight is restored, but he's extremely interested in the visual arts and in music as well. And he's doing experiments with simply how to pull better and better information out of EEGs. EEGs are much faster, they're much more immediate. And if you want to look at how somebody's actually responding to a piece of music and what happens while they're performing or while they're composing, my sense is that we'll learn more, faster, with EEGs.

>> Now, a librarian here at the Library of Congress some years ago, a fellow named Sam Berlofsky [phonetic] laid out the idea -- it was back in the '90s I think -- that we were headed toward a future where any music that existed in recorded form would be available to us in a sort of universal jukebox, accessible to anybody at any time. And I've been amazed at how the future seems to be catching up to his prediction ever since. I wonder if this has any interest to you or any relevance to your work.

>> Something that interests me more than having a billion pieces on your iPod is the idea of having a piece of music which itself is maybe in unfinished form when you get it. So a piece of music which might be partially created by whoever, you know -- by yourself, by a famous artist, whoever -- and it's delivered to you in a form that is meant to be either constantly played out in different ways just on its own, or perhaps constantly played out because it picks up other sounds from your environment or it picks up something you're actually doing. I think that's one of the more interesting futures, music which comes to you as a kind of seed that is meant to be realized in different ways. It's like a recipe and you can mix different things into the recipe. There's a small company in England called RjDj, which, you know, it's kind of like Guitar Hero. It's pretty cool, it's not all that great, but it's going to change the world I think. They make a set of environments, mostly for mobile phones, and this is exactly what they do: They commission young artists to make pieces of music that are designed to play all day and constantly morph. But they're also designed -- until two days ago what their stuff did is you'd download it to your iPhone and then it's very cool because instead of actually composing with it or playing with it, it was designed just for you to walk around with your iPhone. And so if you walked around and you were running, it influenced the music in a different way if you turned it here and there. And it was great because it was all designed so that it wasn't meant to be conscious, you know, you weren't using an interface to change the music. What they released two days ago is

something called Inception: The App, which it shot to like the number one app on the iPhone overnight. And, again, it's not all that great, but it's pretty interesting because what they call it is soundtrack to your everyday life. And so what this does is it actually takes the soundtrack and bits of music by Hans Zimmer to Inception and then it measures how you're walking. It measures the sounds in your room and it pulls all those in and makes them part of the music. You can talk into it. You can sing into it. It takes any sound that you make and mixes it right into the music and makes it part of the experience, and it does it in a very clever way. It's not Beethoven, but, you know, people like it because it's done extremely well. And so this is an idea of not only music that you shape, but it's music that's also taking in your everyday life and reflects your everyday life. And I think if we talk about brain science and music, I think the far extension of this idea is that 10 years down the road, 15 years down the road, there's no reason why a musical environment like this can't measure not just how you're shaking your iPhone but can measure your facial expressions and biometric signals like your muscle tension and the viscosity of your hands and measure your brain signals in all kinds of ways. Because then there's really a kind of personal music where maybe music somebody else composes, maybe it's something you made, is truly adapting. What does it mean to adapt? It can be mirroring the way you're feeling right now, it can be compensating, it can see the fact that you're dozing off or that you're depressed or that you're agitated, either because of the particular piece or program you choose or because of a button you push. It's pulling you back to some different state. It's a really -- I can imagine -- and not only imagine, but one of my intentions is to help push forward a personal music that truly adapts to who you are at this very moment because of your musical experiences and personal experiences and your emotional and physiological state. And this kind of intimate relationship between a composition and your being at a particular moment I think is one of the major places music's going.

>> Before we leave I just want to ask you, you know, what you're working on right now that you're particularly excited about.

>> Well, I just finished -- you know, one's always most excited about what they just finished. This thing that I just finished is a behemoth. It's something that took me about 10 years, so I'm really glad to be done. But it's actually a piece which dramatizes and attempts to put audiences in a world similar to what we just discussed. So it's an opera called "Death and the Powers." And very briefly it's about a man who doesn't so much want to live forever. He's late 60s, rich, powerful, successful, a little creepy, a little bit like Bill Gates meets Howard Hughes meets Walt Disney. And he's actually tired of the world; he wants to leave, but he wants everything about himself to remain. So he wants his memories and his ability to communicate with his loved ones and his ability to manipulate his businesses to stay. So he figures out a way to download himself into his environment and he splits. And the entire stage comes alive with him. And so first of all, the singer is offstage, so we have to measure exactly the kind of things I'm talking about: We measure his singing and his muscle tension and his gestures and things he's conscious of and things he's not conscious of. And these well up onto stage, and the whole stage visually and musically becomes this person,

not in a literal sense but in a kind of emotional sense: You know he's there. And everybody who's left -- his wife and his daughter and his associates -- have to decide is this really him and they have to decide, you know, musically and visually do we want to relate to him like this and is something missing and actually is this a form, this kind of legacy that is made, this thing that he's left of himself? Is this so powerful and beautiful? Is this a place that they want to go to? Do they want to leave the world and live in this system, live in this other form? And so it's really a question first of all about what it means to represent each of our lives, what we can communicate, what we can leave for other people in a living form. Is music a good way to do that? What do other people think about this? Do they want our legacy left in this form? Each person in the opera reacts differently. The daughter is the one who decides that -- well, I won't tell you what she decides, but she's the one who struggles with the idea of remaining human or going into this other form. And the opera ends with a finale, a kind of tug of war between the two of them, he trying to [Background Music] pull her into the system and she trying to stay. So we premiered this in Monaco in September. And it comes to Boston in March, Chicago in April, and be great to have people come and see it. It's got robots and moving walls and things you don't usually see in opera.

>> Is the recording we're listening to now from the Monaco performance?

>> Yes, it is.

>> All right. Let's listen a little bit.

[Music]

>> [Background Music] I've been talking with Tod Machover, professor of Music and Media at the MIT Media Lab and director of the lab's Hyperinstruments and Opera of the Future groups. Thanks a lot for joining us, Tod.

>> Thank you, Steve.

>> This has been another one in our series of "Music and the Brain" podcasts from the Library of Congress. I'm Steve Mencher.

[Music]