[SQUEAKING]

[RUSTLING]

[CLICKING]

MICHAEL CUTHBERT: So we're going to make a good part of today about talking about some of the other people who have thought about music representation or talking about other people's thoughts and whether we agree with them or not, specifically, two giants of the Field, Eleanor Selfridge-Field, her article on music representation, and Nicholas Cook on what's comparative musicology and what's computational musicology and what they might have to do with each other, if anything.

So let's start by talking a little bit about the Eleanor Selfridge-Field article. Before getting into computers and continuing afterwards, she's a specialist in Baroque music, which is Western European musical era from-- a lot of people say 1600 to 1750, roughly 1580 to 1770, but with the previous areas overlapping, and previous and next ones, for a bit.

And so she talks about some things in her article. Anyone remember anything about the article that has this diagram? What's this kind of showing here? Do you recall? I know you do. You're just shy.

AUDIENCE: A note has a lot of parameters.

MICHAEL CUTHBERT: Note has a lot of parameters. Yes. Note has a lot of parameters. What kind of relationship are we talking about "has a" means? What word pops into your head when you think of "has a?" Go into your ontologies that you've forgotten.

What are the two choices? Yeah, go ahead.

AUDIENCE: Is it meronymy?

MICHAEL CUTHBERT: Taxonomy and meronymy. Did you have your hand for which one of those two that would be?

AUDIENCE: Would it be meronymy?

MICHAEL CUTHBERT: Meronymy, yes, yes, yes because a taxonomy is the one that we use for kingdom, phylum, what kind of a thing is something. Yeah, so a note has a lot of different parameters. And it's made up of a lot of different parameters.

I think it's something that maybe just sounds so obvious, but this was a really revolutionary way of thinking about some of these things. And this diagram has become one of the legendary diagrams in the field. Every field has these legendary diagrams. And I know that Dr. Selfridge-Field would have drawn that flat a little bit better if she had known that this was going to become so famous.

But yeah, this is the one that we go, oh, yeah, we're talking about components of a note, and we're going to argue about certain things. And we can see that some of these things are-- what kind of a thing is duration? She talks about, is it a graphical thing? Can you see duration?

That's interesting. That's good. It's good that you're puzzling over it. Well, let's try to figure out the context that I'm talking about when we talk about duration. She talks about three contexts that musical representation happens in. I don't know if you remember them-- three contexts. It's a big part of one of the early parts of her article.

Give the first letter of each of them. Some trigger? Let me see. What are some ways music is represented?

AUDIENCE: Graphical?

MICHAEL CUTHBERT: The graphical. Yep, the graphical. How it looks, right? Great. Let's fill out the other two before getting back to the question I was talking about. Yeah, go ahead.

AUDIENCE: Sound.

MICHAEL CUTHBERT: What's that?

AUDIENCE: The sound.

MICHAEL CUTHBERT: Sound. Good. And then the other one she uses two words at different points of the graph. The sound, graphical.

AUDIENCE: Is there also semantical?

MICHAEL CUTHBERT: Semantic, yep. And semantic or semantical. I like semantical. And what would the L be? It's a synonym in this case for--

AUDIENCE: Logical?

MICHAEL CUTHBERT: Logical, yeah. So the semantic-- yeah, you're right. It should be -al, logical. Great. So what's duration in this? Which context are we talking about in this diagram?

AUDIENCE: Graphical.

MICHAEL CUTHBERT: What's that? I just can't hear.

AUDIENCE: Graphical and logical?

MICHAEL CUTHBERT: Graphical and?

AUDIENCE: Or logical.

MICHAEL CUTHBERT: Graphical or logical, great. So definitely not sound. Are we all in agreement with Jake that this doesn't sound very good unless you have a good internal imagination? This We're not hearing anything. Good.

So what's-- who-- you got to take a stand on this, even if you're wrong. Who wants to say that this duration here is more in the graphical domain? I mean, we're seeing a picture here. Good. And who thinks it's more in the logical domain? Great, great. Super. So we have a little bit of disagreement. More people on the graphical side.

What would be the argument that it's a graphical duration? Somebody who went for the graphical? Yeah, Vanessa?

AUDIENCE: It's a visual representation. There are tons of different visual representations that represent how long a note is supposed to be. So you can look at it, and it'll make sense what it's supposed to be.

MICHAEL CUTHBERT: Great. Super. So we can look at it, and we can see what's going to be-- we're seeing a graphic, and we see the graphic and go there. Who wants to make an argument for the logical on this? There are three people. Yeah?

AUDIENCE: I guess even just seeing this, it's all relative to other parts of the-- you need the context, like the semantical context, of beats per minute or-- yeah. And at the time so you can share it.

MICHAEL CUTHBERT: Right. So we're going quite a bit further in saying, yeah, the duration only makes sense in a larger context. Thanks. Super. Let me come up with two ways that you might describe something. We'll stop there.

Describe what I did, what I have on the board, in the most purely graphical description possible. So I want to take-- yeah, John?

AUDIENCE: There's three notes of equal.

MICHAEL CUTHBERT: There's three notes of equal duration. Great. Dur. Dur. Yeah, not der. Anyone want to see if we can go even more graphically? Yes. Go ahead, Jason.

AUDIENCE: Two vertical lines with three filled in circles with sticks attached.

MICHAEL CUTHBERT: Two vertical lines with three filled in circles with sticks attached. I like everything about that except the word that came before attached. Why don't I like "sticks?" I like stems even less.

AUDIENCE: Lines?

MICHAEL CUTHBERT: Lines? Yeah, what don't I like about stems if we're going for sticks? Yeah, Adam?

AUDIENCE: They already give a contextualization for an abstract symbol.

MICHAEL CUTHBERT: Yes, we're already abstracting something. Jason, that was fantastic. And Adam, great, too. Yeah. So we can go-- we're already making assumptions that, well, a line could represent a stick.

So it was John's-- I think that three notes of equal durations is a great description. But which one-- but three filled in circles. And by the way, we're already-- we're already doing some sort of-- we're already interpreting a little bit that a bunch of continuous lines that are ovaline and stick out. We think, oh, that kind of represents a circle.

But yeah, but we'll go with that. Three filled-in circles between two lines with more lines. Something like that. Which one of these does Selfridge-Field consider to be on the graphical domain and which one to be on the logical?

Too obvious? Shout it out. Graphical or logical?

AUDIENCE: Graphical. Logical.

MICHAEL CUTHBERT: Describe the thing that is pointing to you in the most graphical form you can. Does anyone want to take a shot at this? Matthew, do you want to take a shot, what it's pointing to, the most graphical?

AUDIENCE: It's a flag hanging off the end of the stem.

MICHAEL CUTHBERT: It's a flag hanging off of a stem. Who wants to go even further? Back, this corner? Take a shot.

AUDIENCE: A strip that decreases in width in a curled--

MICHAEL CUTHBERT: A strip that decreases in width in a curled manner. Yeah. So I think we can go further even than a flag. But we have curled strip thing. Your interpretation says, oh, that's a flag. And then there's a next level up says flags represent duration.

So we can go in all these worlds. And why I love this article, even though it's now over 20 years old, is that nobody puts out so clearly to me to think about what all these things actually mean.

So we have three domains. Let's talk about the sound-- the context, she says, is the term she uses. I call them domains in my head. We'll use her term, context. Sound, graphical, or she mostly uses the word logical. But semantic or semantical is also a term that's used. And that one is coming up a lot more.

Together, these last two parts-- and we're pretty good at distinguishing between sound and either of these other ones. Right? Yeah. Together these last two, we'll sometimes put them together as symbolic. These are things that deal with symbols on a page or conceptually on a page, or conceptually written or conceptually written. Great.

Now, she says in her article which one of these holds the most interest. Talking. No one remember this? It's OK. It's a longish article, But yeah?

AUDIENCE: Is it graphical?

MICHAEL CUTHBERT: Graphical. Unfortunately not. But thanks. Thanks for taking a bold stand. Stuff's good. We've eliminated graphical. Which one? Want to take a guess?

AUDIENCE: I'm going to say sound.

MICHAEL CUTHBERT: You would say sound, and you would be with most human beings. Because most people buy many more CDs than they buy abstract musical scores encoded in computers. But she's really on the logical. So it's good.

So sound, yeah. Sound is what most of us work with in music. But for her purposes, for the purposes of representation, she especially-- she was really interested in logical things. Thanks. Right. Everybody who didn't speak was thinking of logical and things. No, thank you, bold people, for taking a stab at this. Great.

So one of the things that she talks about later on-- do you remember that she talks about musical scores? And anyone remember any sorts of musical scores she brings in? Some funny ones and some pretty normal ones.

We had a lot more fun on our problem set this weekend than reading time. I can tell went in, but not in the depth that usual.

AUDIENCE: Second trio from the Mozart clarinet quintet?

MICHAEL CUTHBERT: Second trio from the Mozart clarinet quintet was the first one. She also-- thank you. Thank you, Jake. You're allowed to have computers open, so you can also look at these if you want. Yeah, she also talks-- oops, sorry. Thank you.

Somebody-- I'm going to get an assigned task for each person to fix various stupid Cuthbertisms. So I'm going to want one person to be the "we can't see anything" task and one person for the "the thing is rolled up." OK, yeah.

So this particular one-- she also does some other things, including Gregorian chant, a lot of things representing a music historical perspective. And each one chosen-- many of the later ones chosen because they have a particular interest and difficulty in representing.

Part of your problem set two is to make a contribution to that set of repertory, that when you say and you will hear software people coming up with things who haven't been taking the full liberal arts education in music, oh, I have a system that can represent all music.

I want to be like, great. Here's *DDR.* Show me how your system represents it. Here's South Indian music. How does it? So these are all challenges. And there'll never be a system that can represent all of them. But hence why most of us will avoid the "all music" things.

This particular score has had about as much impact from the article as this diagram had. It's become the "Hello, World--" a little bit more complex than "Hello, World--" of music representation encoding. Anyone know from computers explain what a "Hello, World" is? Yeah?

AUDIENCE: Kind of the basic file that everyone writes at the beginning as a sample.

MICHAEL CUTHBERT: Yep. And what do you do with "Hello, World? You?

AUDIENCE: You print it out.

MICHAEL CUTHBERT: Print it out somewhere. Great. And some languages, you put that backslash n. Otherwise, nothing prints. Yep, great. So it's how do you do something very simple in a programming language?

This piece, or at least the clarinet part, the top part of the five, has become that piece, at least one of it. So I think we should at least hear it once so we can get it in our head.

Oh, and just so I can hear, kind of go "whoop" when-- you might do it involuntarily-- when something happens that's not in this score, from this recording.

[MUSIC PLAYING]

No, Adam got it. Anybody else? Jeff, what was--

AUDIENCE: It kind of glazed over the triplet at the beginning.

MICHAEL CUTHBERT: It glazed over the triplet, yeah. Great. Which is kind of a problematic performance for this particular one because one of the reasons why this was almost certainly chosen was, can your system represent triplets? The performers playing on a clarinet that we hypothesize Mozart originally wrote this for that could go two notes lower than this, and so played those low notes instead of starting high and going down. Good.

So this is the "Hello, World" piece that you'll be getting. Any other thoughts about Eleanor Suffrage-Field's work? We'll come back to her more as the semester comes on.

Well, just a reminder, there's one exam in this class. And it's the midterm, but it's about 2/3 of the way through the semester. And it's the only one that's not based at all on programming but based on readings and the big thoughts. I put it that way so that you have these readings and big thoughts going through your head as you start working on your final projects.

I think this is-- I think you can pretty much count that some thoughts of this and some of these questions might be on there. So give it another read when you get a chance.

And let's move on to Nicholas Cook's comparative versus computational musicology article. And here, I've given you the questions I'm going to be asking, written down on the outline today. And so take a second to jot down some of the notes. So you probably already have them because I gave you these also on the Canvas site you've been thinking about.

Take a second while I play a little example from the first piece that he discusses.

[MUSIC PLAYING]

Anyone know *2001, Space Odyssey* is one of the pieces?

OK, so we'll get back to this and what he uses this piece for in a little bit. But first thing is kind of the fundamental question, a couple of the fundamental questions about-- what does he mean, there's no such thing as a good or bad representation of music per se? Vanessa?

AUDIENCE: Just to the point is that all that's particularly good or bad about it is depending on what you're attempting to use it for. So there are different situations where certain characteristics might be more beneficial than others. And in that scenario, you can make a good or a bad choice. But it doesn't mean that it's all-around a good or a bad choice.

MICHAEL CUTHBERT: Great. So, fantastic. I think that really captures a lot of what Cook is saying. It all depends on what you're trying to get out of it, what are you trying to do. So some of your own representations are going to be really bad representations, even if you get an A-plus for certain things.

Oh, did I have the whole recording going? But they could be great representations for some other things. Somebody want to give an example, either from the reading or from your own thoughts, but maybe preferably from the reading if you have it, of what one representation that would be bad in a specific case and the same representation, how it could be really good for something else? Yeah, go ahead, Shruti.

AUDIENCE: I guess I just wanted to tell, but at the beginning, they had a lot of charts that represented pieces. And they mentioned that this would be really good for comparing the formats of different pieces to each other or finding similarities between repertoire. But for example, a performer wouldn't be able to use this representation.

MICHAEL CUTHBERT: Fantastic. So Cook begins his article by showing certain charts that might help compare similarities across pieces but not be very good for a performer. So this is from the same piece, from "Lux Aeterna," one of the parts showing at any given moment what the full range of the piece is.

What can you say about what happens to the range of the piece around measure 60 to 65? Does anyone want to take a-- yeah, go ahead.

AUDIENCE: The average pitch just increases overall.

MICHAEL CUTHBERT: The average pitch?

AUDIENCE: Frequency?

MICHAEL CUTHBERT: Frequency. The average frequency increases quite a bit there. Anything else you could say about it that's going more specific even that the average pitch? Because that's also a very good representation, average pitch. Yeah, Adam?

AUDIENCE: There's a descending sequence that goes throughout the canon and alto chord.

MICHAEL CUTHBERT: There's-- yeah, there's a descending line sequence, something like that, that's continuing on. And then it continues, but what else happens? Yeah, Jason?

AUDIENCE: A bunch of voices up here in the top?

MICHAEL CUTHBERT: Great. Yeah, a bunch of voices come in at the top. And the topmost ones maybe also have a descending sequence. That's great. Now, you can get all of this from a musical score, but we'll go back here.

Where's the first point that there's two different notes? This measure? Here, here, here. You could do it. You can do it. But that is what this is not a very good representation of.

On the other hand, it's a very good representation for seeing, oh, my gosh, I'm going to have to count really hard if I want to get in exactly at that right moment. But second representation showing the number of different notes. Pitch count graph-- how many different notes are being sung-- is a very good representation.

If you just wanted to-- now you're doing your next horror film or something. And you're a big Stanley Kubrick fan, so you're going to rip off what he did in *2001.* But you just need a five-second clip for your scariest part. Where are you going to choose? Give me a measure number. Adam, give me something.

AUDIENCE: 52, 53.

MICHAEL CUTHBERT: 52, 53. Yeah, right? We have a whole bunch of different pitches, all sounding at the same time. That could be really tense. I think this is talking about pitches without octave, pitch classes. You all know that term now. So yeah, a lot of things happening. Very easy to do in this graph but very hard to do in others.

So goes through some of the different things. Now-- oh. This-- sorry, I just forgot on this. This one-- can you perform from this one, from this graph? See a lot of nos. I see some ups. I see some-- yeah. It's not the best thing for being able to perform that piece. Probably not the best thing, but you can almost perform from it from the range graph thing.

So there's some things that are in between better. The pitch count graph-- can you perform from this? No. Though you could-- I mean, thinking about in the future, you could take a piece of this pitch count graph and use a computer to write a different piece that had the same pitch count profile. And it might be an interesting type of thing. But yeah, you couldn't perform the same piece for some ontological definition of the same piece. Good. We can skip the entrance graph.

The second piece talks about-- oh, this is the Bartok string quartet, number 4. Oops. We'll get a tiny-- if it's working-- few seconds of that, if it doesn't give me a YouTube ad. Nope. OK.

Bartok, similar era. A little bit earlier composer, also Hungarian. So this is showing-- what is this showing? Anyone remember? Somebody who I haven't heard from yet? Jonathan, do you remember this?

AUDIENCE: Sound waves?

MICHAEL CUTHBERT: Sound waves. What particular parts of it? Anybody have that?

AUDIENCE: I'm not sure.

MICHAEL CUTHBERT: You're not sure. OK, good. Good. "Not sure" saves the whole class. OK, Super!

AUDIENCE: Harmonics?

MICHAEL CUTHBERT: Harmonics? No, not exactly. Yeah?

AUDIENCE: Amplitude.

MICHAEL CUTHBERT: Amplitude-- how loud each part is. What does it mean when the viola is really, really, really, really quiet? It's not playing, yep. So you can quickly see which parts are playing where and then somehow make a composite that is more like the-- what do you call it, the amplitude wave type-- the sound wave of the piece as a whole. So yeah.

This is one of the ones in that article, one of the moments, that I'm always like, eh, doesn't get so much out of it. But because this is the type of thing computational people do, wrote my own program to generate the same thing.

This is a piece by Joseph Haydn around, I guess, 1790, called "The Surprise Symphony." Anyone know where the surprise happens from looking at this? Yeah. So sometimes these things can be very great. I didn't even realize, though, that the dynamics were kind of thinning out leading up to it. I always knew that there was one gigantic chord right about here.

I'll go on, and you can see the various other places that these things happen. So these can be good representations for some things.

So what's this Humdrum that he's talking about? Anybody remember this part? Yeah?

AUDIENCE: It's a framework which [INAUDIBLE] serves as a way to manipulate data into new units.

MICHAEL CUTHBERT: Great. So it's a-- I think I heard it's a framework that's used to manipulate musical data in the Unix terminal. Great. It's written by-- it was originally written by music cognition and perception and theory specialist, David Huron, who we're going to read a lot about what he used Humdrum to demonstrate new about music.

But right now, we're looking at, oh, what he did. Humdrum is in many ways the predecessor to music21. And a lecture that David Huron, the inventor, gave when I was-- I think I was a first-year grad student-- changed my life. I'm like, oh, my gosh. I want to do this. But your system, the system, was already 10, 15 years old by then-- 20 years old maybe. And we have these things called objects now.

So it's non-object oriented. It's shell scripting things, which is pretty cool. Did anyone ever pipe a script from one thing to the next? Yeah, you input, send it to a program. Input text, usually, or bytes. And it sends something out. And you can send it to the next program.

So you could have one program that just goes through and strips all the ties from notes. And then you have another program that labels the pitch classes of everything. Very, very cool. Very new things.

And so Humdrum had its own format, which was called-- actually, I'm going to jump through-- some of these questions don't seem as relevant for class discussion-- called kern, which was basically a musical score turned sideways. So first part going vertically here, second part vertically here, third part, and so on.

And so this was a way that meant that looking horizontally, you could see anything that was happening at the same time. And very useful back before graphical editors, where you can tab among them.

Contrasting in the article was this particular format, EsAC code. And this was one of the ones-- how do we read this? Some people-- good. Great, but I want to get some more reluctant participants, then we'll come back. Anyone want to take a guess what anything means? Yeah, John?

AUDIENCE: Looks like some of figured bass.

MICHAEL CUTHBERT: Some sort of figured bass. Yeah, it does totally look like that. Not exactly what it actually is, but great, great first guess. What numbers do you see that make you think it's figured bass?

AUDIENCE: Scale degrees.

MICHAEL CUTHBERT: Scale degrees, yeah. So something maybe to do with scale degrees. Do we see 8s and 9s or zeros? No, no. So that could be a good thing. So great. Great guess. Moved us toward the right direction.

These are scale degrees. What's all this other stuff might be? Yeah, Hannah?

AUDIENCE: Just the sharps, and the dashes represent the accidentals?

MICHAEL CUTHBERT: So sharps is probably a good one. So this piece would have a lot of accidentals if the underscore did. And it might.

AUDIENCE: I meant the shorter dash.

MICHAEL CUTHBERT: Oh, the shorter dash? Well, can you tell me where one is?

AUDIENCE: I guess in the first line, the one before the seventh.

MICHAEL CUTHBERT: Yeah, it should be like, can somebody point out one that I can reach? Yeah, this one or this one. Good, good. Yeah, so minus signs. I think we've already seen that as a way of representing maybe flats and sharps.

When we say there is no such thing as a good representation or a bad representation per se, I will say it is a bad representation if this means flat and that means sharp. But if we reverse them-- so I'll assume that. Good.

What are some of the other symbols we see? Adam?

AUDIENCE: Symbols in the melody are--

MICHAEL CUTHBERT: What's some other things we see up here?

AUDIENCE: Top is the composer.

MICHAEL CUTHBERT: Top is the composer, maybe. Boehme. It's not actually, but good guess. Good guess. That's great. Yeah, Vincent? Sorry, sorry. Yeah, Vincent, and then-- I don't think he's going to find everything. Yep?

AUDIENCE: The underscores represent duration. And then the 16 in the key sounds like the lowest.

MICHAEL CUTHBERT: OK, OK. Good, good. We'll start with one thing. The underscores might represent duration. So what does that mean? Think about that for a second. We'll come back.

AUDIENCE: That is totally what I was going to say.

MICHAEL CUTHBERT: OK, well, then fill it out a little bit.

AUDIENCE: Well, I was going to guess that one underscore would be some standard, maybe a quarter note or something like that. And then two is more.

MICHAEL CUTHBERT: Yep, and then two is more. It's a fixed-width font, but it's still hard to see. What are the lengths that we see the most? One, two. Do we see three a lot? Not too many.

AUDIENCE: End of the line?

MICHAEL CUTHBERT: End of the line.

AUDIENCE: Every other line.

MICHAEL CUTHBERT: Yeah, so there's some places where you see two. Good. So that might have something to do with things. Any places where there's two that are numbers that are without a separating underscore? John, where do you see one?

AUDIENCE: In the bottom left.

MICHAEL CUTHBERT: Bottom left. Good. Thanks for finding one. I can point to. Yep. And what's right preceding it?

AUDIENCE: A period.

MICHAEL CUTHBERT: Period. What period might represent?

AUDIENCE: Rest.

MICHAEL CUTHBERT: Might represent a rest. What else might it represent? Yeah?

AUDIENCE: A dot.

MICHAEL CUTHBERT: A dot. So it could be one of those things. Quite often after-- let's see. So one of the ways we can figure out is if we get a particular length, and then does everything else work? What do you think the space means? Go ahead.

AUDIENCE: Measure separation.

MICHAEL CUTHBERT: Measure separation. So some measures seem to be a lot shorter than others. But yeah, it could be a measure of separation. It could also be, as a lot of these formats are, just to make it easier for us to read. That there's a certain readability that's built into some. Good, good.

And Vincent, you were starting to say something about the 16 up there having something to do with the?

AUDIENCE: So how the underscore represents duration, also how one or two. But those would all be multiples of whatever is specified there would be the 16. So the first one would be two 16th notes or an eighth note.

MICHAEL CUTHBERT: So this would be two 16th notes?

AUDIENCE: So we got that 5 where there's one listed. 51. And then, say, the 6/4.

MICHAEL CUTHBERT: Great. So let's see. What do you think a 4/5 means, everybody? 4/4, right? Good. Do you want to say something on that?

AUDIENCE: Yeah, yeah. Basically along these lines-- and yeah, I think the thing that you're probably trying to get to now is that it doesn't quite seem to add up if it's 4/4 and each one with a 1 is a 16th. So there are a lot of measures with three. And I believe it's two underscores. I'm sorry to make you point super high. Maybe there's an example, lower. But the top line, the first one, it seems like the full measure. Yeah.

MICHAEL CUTHBERT: So that's two underscores.

AUDIENCE: Yeah. Which would imply that they're all quarter notes if it's in 4/4, which means that-- and then the one right below it has the exact same but in the last-- with the duration of the quarter note splits it up. So those seem like eighth notes rather than 16th notes.

MICHAEL CUTHBERT: Great. Super. Awesome. Wait, let's do a tiny bit of the metadata. You can take a guess. What language is the metadata? Anybody know? Let's see. I just want to-- yeah, Jason?

AUDIENCE: I think this is the EsAC code from the reading?

MICHAEL CUTHBERT: Yep, this EsAC code. And what's the EsAC-- or Essen, is the two ways of putting it. Yep. And anyone know where Essen is? Yeah?

AUDIENCE: Germany.

MICHAEL CUTHBERT: Germany. Do we see some German things? Good. So this is a very famous piece. And I want to say, as you're choosing things to represent and choosing things in it, and Nicholas cook is amazing, I think Nicholas Cook chose the absolute worst piece he possibly could have chosen to be the demonstration.

And I've thought of switching out-- C U T might be-- it does not stand for Cuthbert. It's assigned about the title. Germany, Germany-- anyone else-- over all. It's the Nazi national anthem. So I wish that he had chosen--

But fortunately, if we crop off the top, it is also the pre-Nazi national anthem with different words and the current national anthem and a piece composed by Joseph Haydn, so the "Surprise Symphony" composer

And I wanted to put it up. It's rather small. Might need to zoom in or get up, or you can look at the article. See if you can now read the notation from hearing this, assuming YouTube is going to work this time. And this is the modern words.

[MUSIC PLAYING]

Second line. 3, 1, 5. 1, 2, 3, 2, 4, 2, 2. My, was that a flat! Might be an octave sign.

You can hear. The sharps are definitely sharps, those who can hear secondary dominants. Anyhow, we don't need to hear the rest. Yeah, yeah, yeah. You win the World Cup more than us. We know.

So two more questions. One I didn't put on here before we move on to another topic. What does comparative musicology mean? And how does it have anything to do with computational musicology? And that's the main title of the piece, the article. Let's take the first one. What is comparative musicology?

You can probably figure it out from the words. So yep?

AUDIENCE: I believe it was just the concept of comparing music to each other, regardless of where they're necessarily from.

MICHAEL CUTHBERT: Yeah. So it's comparing pieces of music to each other but not necessarily close things. Not, oh, let's look at the first movement and compare it to the second movement. But let's look at-- oh, let's look at a nationalist song from Germany, and let's look at a nationalist song from Kenya and see if they have any connection.

Let's look at-- oh, shoot. I forgot to put it into the slides. The person-- I'm blanking on her name. I'm not checking my email. I have the picture to put into the slide, and I didn't get-- her name is Trehub. Sorry. Yeah, Trehub. Big *New York Times* obituary. And I have a notification that won't get--

Sandra Trehub, the pioneer-- one of the pioneers in the psychology of comparative musicology died very recently. And she was the one who famously did experiments to show that people could identify-- here are two songs from the same culture. Which one is the lullaby, and which one is not? all throughout the world.

And this experiment's been replicated with other musics quite a lot recently over in the lab at Harvard. But she was a big one. So this notion of looking across cultures.

Anybody take in this class-- I think a couple people have-- Intro to Global Music or World Music? Yeah, great. So did the word "comparative" musicology come up much in your class?

AUDIENCE: Not really.

MICHAEL CUTHBERT: Not really. Good.

AUDIENCE: In the paper, it says that that was what it used to be.

MICHAEL CUTHBERT: That's what used to be ethnomusicology, the study of music and cultures. And it-- yeah, did you want to add? You also didn't see it in your classes? Yeah.

So comparative approaches of looking at things from here and there and saying what's similar to them got a-- gave way to modern ethnomusicology, which is the study of music in its culture. And so the notion that you go to a culture. You get to know the culture very well. And then learn from how the culture itself is describing its music in order to say something valuable.

And that the more you get to know one culture and the less you spend time comparing this culture in Paraguay to that culture in Lapland, the more that you just focus on one place, the more depth of knowledge you'll get. And in part because the early negative history of comparative musicology deserves its very bad rap. And we have to still be really careful for it.

Because we're always going to be comparing-- what are the countries I keep-- Paraguay and Lapland and Kenya and Okinawa and Japan and all these things together. And then we're also going to compare it with Beethoven's Ninth Symphony in order to demonstrate what, if you're a German around 1914 or a German around 1933, what is the conclusion you will always come after comparing all these things? Is someone going to take a guess? Thinking a hypothetical mind. What's that?

AUDIENCE: Yours is the best.

MICHAEL CUTHBERT: But whose is the best?

AUDIENCE: Whoever you identify with.

MICHAEL CUTHBERT: Yeah, and the people doing this were mostly white Europeans. So the comparativist project, while it gathered a lot of data, we would now say it was embodied in the narrative of white supremacy. Oh, now, this class can't be shown in Florida.

[LAUGHTER]

And that really, really happened. And the issue is-- and so ethnomusicology, this focus, trying to say, let's stop making this comparative type of project so that we can actually understand why individual pieces of music are great and interesting and valuable and meaningful and touching to people all over the world. And a lot of people, even in Germany, don't like Beethoven's Ninth Symphony. So working as particular things.

And then the irony that comes out is that the comparativists were still looking at a small number of pieces to compare, Quite often you look at comparative musicology, also called systematic at that time, systematic musicological works. We're talking about one piece from here, one piece from here because that's all that people had.

And so this goes out of style right when this thing comes along. And suddenly-- I mean, not this particular lightweight thing, but the gigantic, honking ones that you can still see in the computer museums and stuff-- that we're able to compare large numbers of information and at least encode their biases. If not, at least you could see what had been encoded into it. So this is where the comparativist project comes together with the computational project.

But as you can see, the danger is that by using a computer, we can still be replicating the kinds of mistakes that were made quite a bit ago. So we're going to have to be hyper vigilant. The more--

[MUSIC PLAYING]

Ooh, bad! Hyper vigilant against that.

[STUDENTS LAUGH]

We're getting hyper vigilant. And it probably means that sometimes that we shouldn't be focusing on musical things for major projects that we don't know anything about. So I'm very glad that the encoding of South Indian music that we have somebody in the group who is an expert. can I call you an expert on it? A very, very strong understanding of this and that we want to get to know our repertories before we work too much on them.

And I think it kind comes back to this anyhow, even for repertories that might be more conventionally studied. So we're going to look at some pieces in a bit. And we're going to start by jumping into a particular Bach chorale.

And I want everybody at some point to do all the things they're trying to get into the style of that piece by hand. Because we want to be able to at least be a little expert ourselves on a particular repertory before we turn it over to the computer. Helps to avoid the GI/GO or GIGO problem. Anyone know what that is? GI/GO?

AUDIENCE: Garbage in, garbage out.

MICHAEL CUTHBERT: Garbage in, garbage out. So we want to make sure that we're not putting garbage in. Great. I think I'm going to skip number three for now. We'll do it, the site Score to Sound because that one's a little bit me talking more.

And let's jump to a little bit of programming because we haven't done that in class in a while. So go ahead and take a second or two and grab a Jupyter Notebook while I try to get my screen set up to have two things at once. How about that? Great.

We're going to do some unlocking. Note that this means that from here on out, unless you're told otherwise, you may use these materials in any problem set going forward. So you've already unlocked the pitch module, lowercase p, meaning it's a module. And we'll also unlock the note and the duration modules right now.

And we don't even-- we're not even really going to need the pitch or the duration module. So let's start with everything on the note. I'm going to need to get this later. Let's start with one of my favorite notes. I don't know why C-sharp 5 became one of my favorite notes. I think it just demonstrates something, and it's right in the middle of the screen. Good.

And always remember that you can get a list of what any object can do. And by the way, you all got its upper. And the class rule is I go too fast, you say slow down. Everybody practice that. Say it out.

AUDIENCE: Slow down.

MICHAEL CUTHBERT: Slow down. Good. You don't want me to slow down right now, but at some point you will. And just shout it out. Great. So you can always get this. Python unhelpfully gives it in alphabetical order, which means the things you don't want to know about, the private things, come first.

But you can see some of the things are happening here. And very nicely you'll see that duration is one of the attributes or properties or something of a note. And pitch is also a property of a note. So that's pretty good. Yep.

So we can get that pitch from the note object. And it looks pretty similar to the other note things. So can we get the octave of a note? Yes, we can. Can we get the name of the note? Yes, we can. What are some other things we did with pitch? Can we get the accidental from a pitch? Yep. Can we get the accidental of note? No, we cannot.

So one of the things you'll find in the music21-- and again, music21 is just one framework. You can use Humdrum. You can build your own. But one of the things is it started with that there's some things about a pitch that seemed like you're going to use so often that we might as well put it on the note, make it a shortcut. And then a lot of things just too complicated. So if you want something deeper, go grab it from the accidental-- grab it from the pitch object.

Notes also have a duration, note dot pitch. And pitches do not have a duration. So this is going into the logical representation mode that some things have durations and some things don't.

Let's see what we can do with this. Let's look at the duration since we haven't looked at the duration module yet, or the duration class. So we have a duration, and we can see some of the things. Duration dot almond.

Unfortunately, I did not go with that great idea. Anyone remember what I said I went with? Boring term? Type. So everything starts off as a quarter note, but we can make it half.

And remember, early on in the semester, we talked about representations of duration. Before it was a duration of 1. Now it's some of a duration of 2. Two whats? Could be a lot of things. It could be two seconds with a tempo of 60. Could be two beats, two ticks.

Music21 has chosen to represent everything in numbers of quarter notes. So duration is 1. Duration of 2 is a half note. Let's have dots, 0. So let's add some dots. And now we've added six dots to the notes. And we get something like this.

My favorite random MIT thing that you all can figure out based on that thing-- what is the limit of a half note as the dots approaches infinity?

AUDIENCE: Whole note.

MICHAEL CUTHBERT: Whole note. Good, good. You all can play with the Easter egg and set the dots to infinity later and see what happens. OK, so we have some of these things. Let's put the dots back down to, I don't know, something manageable. And quarter length.

Each of these things affects each other's, and they're almost all settable, so that can be helpful in your programming, like 3.5. And now we get that it's a double dotted note.

And probably a mistake on my original part, but everything most of these objects are mutable. So if we go back to the original and duration, it's still now has the quarter length. So you can change the duration on the side.

Similarly with pitch dot step, it's already a C. We'll make it a D. And now we've changed the step of the pitch to D but not changed its accidental. And now this is still on here. Give everyone a second or two to catch up. I'll make it a little smaller so that any parts that people have missed.

You don't have to write down everything that I write down. Only write things down as they're helpful for you to finger memory remember it.

That's all I'm going to talk about with unlocking notes and durations at this point. I don't think I've put a prominent enough link, but you can Google it. Music21 has a user's guide, and so you've. Kind of gone through chapters 1 through 2 in this class so far.

But let's unlock some other things. Unlocking scores. So we're going to give you your first larger representation things. And to do this, we're going to from music21 import a sign called stream and a sign called corpus. Oops, no trailing.

I was putting that there because you can also import sign called converter. I'm not going to talk about it. But converter is a way of loading things from your hard drive. Corpus uses a batteries included set of about 8,000 pieces that come with music21. So there's about 8,000 pieces in there, and we'll grab one of them. And when I'm not thinking very much-- I apologize-- I go to Bach.

So we'll load from the corpus. We're going to parse, meaning make sense of the representation. Bach BWV 66.6. BVW means the Bach-Werke-Verzeichnis, the Bach's work index. And by Bach in this case, I mean Johann Sebastian Bach, Daddy Bach. There's some other Bachs in there.

And this is work number 66, sixth movement. It's the one that we're going to use quite a bit because it's the smallest, shortest chorale he wrote.

And what I'm going to ask you to do over the next couple of classes as part of the avoiding garbage in, garbage out, I want you to learn to sing your part from this chorale. Can you do that? Can you go to the piano and match pitch on one of the parts?

If you're really not feeling very confident in your singing, you can do the soprano part at whatever octave is most comfortable. But it would be nice to be able to sing this as a group. And we'll come back to this one next class.

So you now have-- sorry, I should have slowed down. I was talking about something else. Bach-- we're going to style this piece as a variable. And one of the things you're going to find very helpful is dot show.

Can you raise your hand if you have gotten everything installed so that you can see scores when you call show on things? Anybody still having some difficulty? Vic and Shawn, OK. Great, super. We'll make sure that we can get that up and see if we can get that straightened out.

There were some helpful hints put onto one of the discussion points about dealing with MuseScore 4. But Vaughn'll get that. Yeah?

AUDIENCE: Will we get this link to this notebook by any chance?

MICHAEL CUTHBERT: Yeah. I can make sure to do that. Just if there's something that I create in the middle of class and it's not a one-button thing and you don't see it by 9:00 AM the next day, just drop me a line. But I'll try to do that. And sometimes I'll give you the cleaned up one. I should have a script on my other monitor, but I'm not getting it now.

Great. So let's look at that Bach thing. It is something-- in the project in music21, stream is a-- what is it? Shout it out.

AUDIENCE: Module.

MICHAEL CUTHBERT: Module. And Score is a?

AUDIENCE: Class.

MICHAEL CUTHBERT: Class, class. Good. So this is an object of class Score in the stream module in the music21 package, project, whatever you call it. And this is the particular memory location that you can hack on my computer to deal with the stream.

We can change-- we'll just make this-- change its ID to bach_short, something like that. And then we'll see something nicer than just a memory location. That's sometimes helpful.

OK, so recall at the beginning of the semester, how many things are in Bach? This was a trick question on the first day. You all stuck around while a lot of trick questions.

There are six things in the Bach. What are two basic answers that you thought might be a good answer to how many things there are in the Bach? Ballpark figures?

AUDIENCE: 100?

MICHAEL CUTHBERT: 100. Yep. Why? Maybe about 100 whats?

AUDIENCE: Notes.

MICHAEL CUTHBERT: Notes. Good. What's another number that you might have thought could be there?

AUDIENCE: 4.

MICHAEL CUTHBERT: 4. Why?

AUDIENCE: Number of parts.

MICHAEL CUTHBERT: Four of the parts. Good. So let's see what those things are. Well, one of the things-- streams-- scores are a type of stream-- everything there's a type of stream-- can be treated like lists. So you can index them. Get what zeroth object is. Get the first object. Ah, there's our part. Second. And so on.

So what's that last object? Everyone remember Python? Give me negative 1 indexing. Ah, we have something that says, all of these soprano, alto, tenor, bass, all have these, what do you call, this pretty little thing around them.

So that's how we get six things. We have metadata, which is data about data. That is usually having the title of it and things like that. We'll get to metadata later.

But I know you want to get-- so let's see. What's an index I can use to get something that might have notes in it? Zero? Probably not. Negative 1. Which one do we want to look at? Give me a number to put in here.

AUDIENCE: 2.

MICHAEL CUTHBERT: 2. So the 2 is in this case the alto part. And you would think if you don't get that metadata as 0 that this would be-- this might be that one indexed or something. One is soprano, too. But no, it's 0 index but the 0 is metadata.

There might be multiple things at the beginning, not just one metadata. There could be more. Could be metadata lists. So you might not always get this. So you could do something like this for B-- for thing-- I always use thing in Bach since I don't know what it is.

If isinstance thing music21 dot stream dot part print thing. Oops. What did I do? I didn't-- ah. Sorry. Stream dot part because I imported that. I imported stream into it.

So that can be one way to get this. I'm going to tell you all of the most general ways of doing things now so that it forms a mental habit. But we want to-- but just to know, you will learn some shortcuts so that you won't need to have to code all this later. Great.

So now we have all the parts. Let's do this. We got the Bach 2. Let's see. For thing in Bach 2, let's just call that alto. Let's call that alto. Alto equals Bach 2 for thing in alto. I always like good naming.

See, I'm calling it thing. Things are the best naming when you don't know what something is yet. I suppose you could call it L for element or something. Print thing. Anyone recall from the very fast thing first day what is it going to be?

So it's a bunch of measures, but also an instrument. I think that that's been fixed in the latest version, and it looks like everything else. But yeah, so we have an instrument there. So we can do this again. I'm going to copy. I just copied here. And I'm going to go here and paste.

And we'll again do that isinstance checking. If isinstance-- that means is a member of this class-- thing stream dot measure, print thing OK, now we've gotten just the measures.

And we can get-- oh, I don't know-- measure 2 equals alto 3. I think we got that. Is that-- did I guess right? And we can keep writing the same type of thing.

For thing in M2. We don't need that because we're already in a measure. And finally, we get to notes. Finally, we get to notes.

So that's where I'm going to end this part now. I've given you a very tedious way to get two notes from a score-- that you go through, all the parts of-- you go through everything that's in the score, find the things that are parts, and then you could do a next iteration on here, another for loop, another if. Go through each of the parts and figure out everything that's a measure.

And what? Oh, sorry. Everything that's a measure. And go through each of the measures and do this. A for loop within a for loop within a for loop. But we're going to learn some better ways to do this later.

But I want to leave you at least two days with trying to do everything the hard way before we start to get to the easier ways. So you can do this. So that's that. Your only assignment is continue working on your problem sets and to learn to sing your little part of BWV 66.6.