[SQUEAKING]

[RUSTLING]

[CLICKING]

MICHAEL SCOTT ASATO CUTHBERT: Hello. As the last element in our discussion of musical representations, I want to talk about two different fundamental ways that we can represent musical scores, timewise and partwise. And these really matter in anything that has more than one note or more than one independent part going as once. And I want to acknowledge I'm going to be using slides from a presentation called "Notation as Composition" by William Andrew Burnson, creator of the Belle, Bonne, Sage notation package.

One of the ways that we can look at musical notes is as-- musical scores is as a series of containers so that we can think of-- and part-based containers. So we have a score, and within that score, as the first element, we have two parts in this case. And within those parts, we have measures. And we might even go further and think that within those measures we have voices.

But first, when we think about dividing a score into parts, let's say it's the score of a massive three-hour opera, well, you start with whatever is at the top of the piccolo or something like that, and you go with the piccolo part from measure one all the way to the end of the three hours. Then you go to the second part, probably the flute, and you go all the way from one to the end. And so on. And so you have everything in one part from the beginning to the end. And it makes it very easy to do the kinds of analyses that look at what happens in a part.

The other principal way of looking at musical notation representation is you have a score. And within that, you have all the things that happen at a certain moment. So at the beginning, you might say, well, there's all the clefs. And if it's a 10-part score, you might have treble, treble, treble, treble, treble, alto, bass, bass, bass, bass, bass, so on. And then you have all the key signatures, all the time signatures, and then every note, everything that happens at the beginning of the piece.

And then you have everything that happens at the next instant, the next time that something happens here. And in this particular case, when we get to the third instant, which is the E quarter note in the bass, and then the C eighth note, and the E, there is something that is happening in the top part, that G half note, that is not represented in that instant but is thought to be continuing from before.

And in the next instant, there is just an eighth note with nothing else happening. And so this makes it very nice to see what's happening at every attack. And you might be able to programmatically go back and see what's happening at every instant. But it makes it very hard instead to figure out what's happening from one beginning of the score to the end.

By the way, we call these instants instants or offset moments or cuts through hierarchies, generally speaking. But often, we colloquially call these salami slices and the process of creating these things salami slicing. It's just kind of something that's come out. In music21, we call this process quartification. And so you'll see that quartify happens a lot.

So which is better, part-based containers or time-based containers? Each of these formats has their own positive things and drawbacks. As I said, part-based containers make it very easy for us to follow an entire part from beginning to end, an entire line from beginning to end. Time-based containers let us see what chords are happening in a certain moment but very hard to follow melody.

But each of them has certain difficult-to-encode things, for instance, an ossia staff, a staff where something optional is happening. Or you can do this instead of something else. What part is that in? How do you encode that? Do you put a part with hidden measures all the way up to this moment and hidden measures all the way to the end? And how do we indicate that the player could do this?

So this is something that's very hard to encode when we do part-based representations. So instead, let's move to time-based representations because it doesn't have this-- they don't have this problem. But instead, they have other problems. Where do we put these grace notes in encoding like this, especially when we know that not all five of those grace notes come after that last-- let's assume it's treble and bass clef-- after that last B of the septuplet within the triplet? Where do we go? How do we encode grace notes? Do they attach to the note next to them or what?

And both of the representations have major problems when we want to look at things that involve horizontal and vertical at the same time, things like voice leading. Here's a common voice leading error in very strict traditional harmonic writing, where we have-- and we have overlap where the low G crosses the boundary established by the B before and goes up to the C above it.

Which format makes this possible? If you're just looking at each part alone, you see, OK, there's a B going to an E. Then we get to the next part. There's a G going to a C. But you don't see that the G going to the C overlap the B going to an E. On the other hand, if we look at it in time-based, we have a G and a B. And we look at that, then the next chart, we see there's a C and an E, but it's hard to tell, well, did the G go to the C? Did the G go to the E? What happened? How's the voice leading happening?

So these are the problems in musical representations. And we'll quite often find that we have to convert from part-based representation to time-based representation and back. Or in the case of a voice leading moment, we have to keep both the part and the time-based representations in our head, in the musical memory, in the representation at the same time in order to find these things. I find these problems really cool and hope you guys do too. And solving them is another one of the great joys of this class.