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From Lifting a Turtle to Writing Code
Keynote on the 5. International Csound Conference in Cagli

I would like to speak about two aspects of creating music in our field of computer music. The first aspect concerns the relationship between listening to music and creating music. I will play a game in which I consider composing as immediate continuation of listening. The second aspect will focus on the relationship of what we want to create as composers, and how we code it in Csound. I will try to reflect whether programming is an activity which is just another step of thinking music, or whether programming is something very different — a laborious, merely technical manner perhaps, a torture which we have to accept only because we can produce by it the sounds we want to produce.

So this talk is about listening, about creating, about coding, about music. But what is music? My preferred answer currently is a story from ancient Greece. This story claims to relate the origin of music, and this is what it tells. Once upon a time someone walked his way. Suddenly he stumbled. In this moment a sound arose. The person stopped and looked down. It was a dead turtle he had stumbled on. The flesh had already dissolved, but some sinews were still intact. So he raised the dead body, embraced it and plucked it again. The greek harp, the Kithara was born, and by this the music.

I also believe that this story tells us the origin of music. Let us look how music came into being. First the accident. Something is lying in our way, and we stumble. This happens. That a sound arises at the same time, this is also nothing particular. What would we have done? Perhaps I would have cursed and continued my way. Then there would have been no music. But this mythic human is able to be astonished, he is able to be surprised, he can perceive the particularity. He is able to listen, to listen in an emphatic sense. Before there was no music, but now, by the tuned senses of this person, by this mind, music comes into being. It comes into being exactly in this moment. This man, or woman, is, for the moment of listening, nothing but listening. And as he is so completely filled by listening, he cannot prevent stopping. Without thinking about it. Listening is the leader now, and the result is stopping. It is simply not possible to continue as before, when we listen like this. We must stop. The common, the well-known way is broken. Music arose, exactly in this moment of listening. And this music is, in this way of listening, always *new* music. What in this particular moment leads to the surprise, to take notice, is the new, the unusual, the particular. Ten others would have heard the same, but for them it would not be something particular. Nothing particular, only one of the numerous trivial sounds in the world. The story not only describes the origin of music, it also describes the origin of contemporary music. And now the last decisive point. This mythic human does not simply continue his way, after his attention to this particular sound. He does not only look at this sound. Moreover, he leans downwards. He takes the sound-producing body. Let us look a bit closer to this action. We know the bowing from a greeting, or from religious ceremonies. It means: I am below you, I resign my power, I let pass. The emphatic listening which leads to creativity, this listening goes together with this kind of giving up. It is activity by letting happen. It is creation by following, not by conquering.

In bowing, in touching the dead body of the turtle, the earth is touched, too. The earth from which we come and into which we go again, eventually. In the moment in which the mythic person touches the turtle lying on the earth, it also unites with the earth — the earth which in many languages is called mother. We are in contact with this mother when we follow the hearing and raise the dead but sounding body. There are two gestures in this suspension. First it resembles to raise and embrace a small child. Then, once the sounding body is held by us, it becomes an extension of our body, and at the same time to a tool, or latin *instrumentum*. A tool, but not a tool to work on another material, but a tool of its own. A body which is supposed to sound, and as this sounding body is an extension of our body, our body sounds by it, too.

Listening lead to doing; listening triggered activity. And this action, the pluck of the turtle's sinews by the mythic human, itself leads to another listening. Aha, there are different sounds when we pluck here or there. Pitches are present and require understanding and order. The story claims that in this way the Kithara was created — so we can imagine the mythic person to construct something by a material that

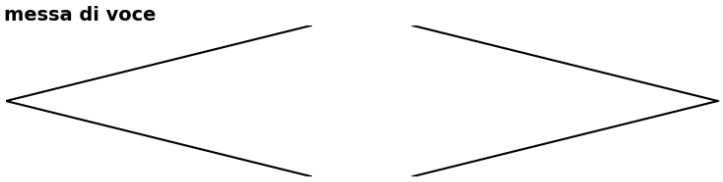
can, first, reproduce the sound of the turtle, but then also expand and develop it. From listening, we come to building instruments.

In Programming we speak of a Read-Eval-Print Loop (REPL). In the myth about the origin of music we see the first cycle of another loop. It starts with listening to something. Then we try to figure out what the sound requires. And then we work it out, and this leads to a sounding result, so that the loop starts again: We listen to the output, we figure out what to do, we put it in effect, and so on.

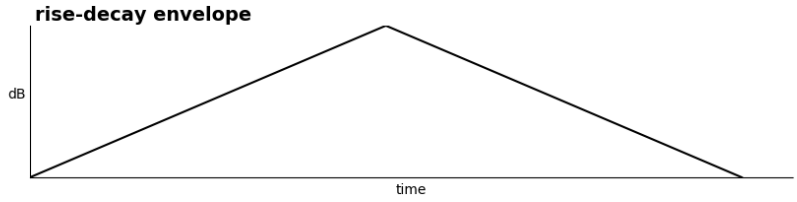
The story touches the origin of music. Not the origin of music many thousand years ago, but the origin of music again and again, also today, also right now, potentially also right now. And this is the game I would like to play now: Can we also go with this method without method for composing electronic music? Can we go in this in starting with the most fundamental and simple sound we have in electronic music? I will play a sine tone with two seconds duration, with middle D (Midi key 62) as pitch and -12 dB as intensity. Let us listen to this sound and figure out what it requires, what it asks us to do.

<Code and sound: two seconds sine>

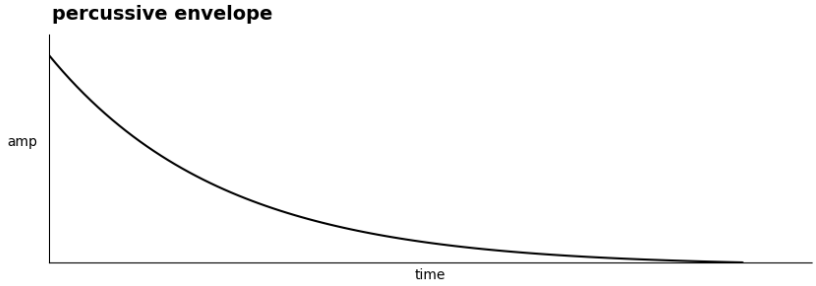
In my perception the sound is not happy with the way it is born and it dies. This sound wants an envelope. One envelope? Two? Three? — As I feel it: two. And I hear two different characters in this moment. The first one is increasing and decreasing, like the old *messa di voce*:



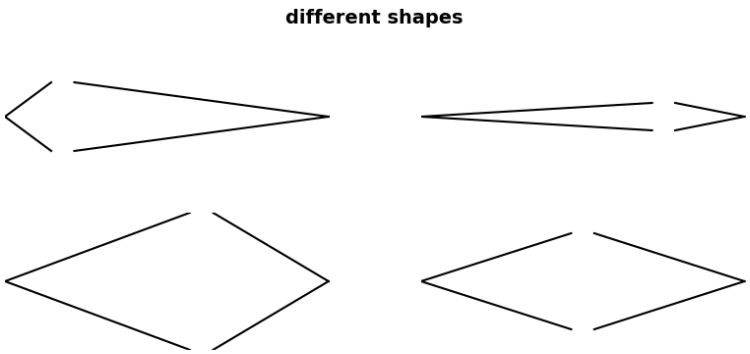
Or a bit more technical: a linear rise and decay over time, in decibel:



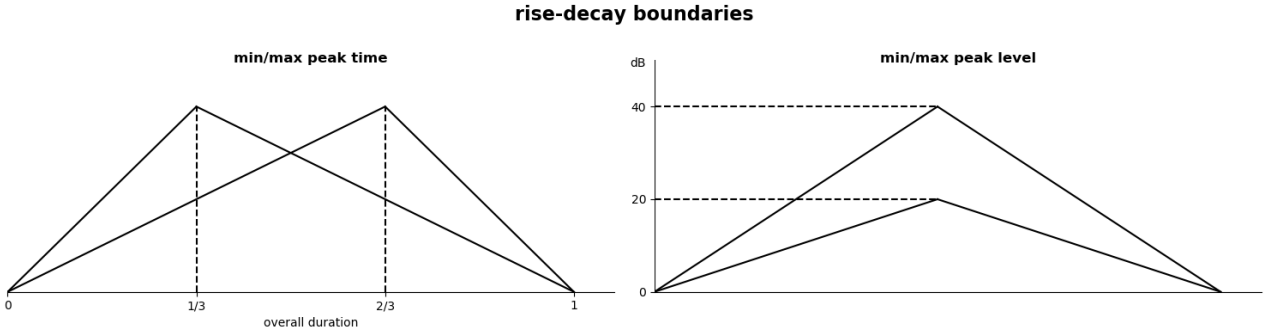
the second envelope, the second character is percussive, somehow reminiscent of plucking the Kithara:



Now we have two quite different types, and we should not forget the differences and deviations within these types. Certainly dogs and cats are different, but also one dog can be very different from another one, and the same for cats! So here go some of many possible variants of the *messa di voce*:



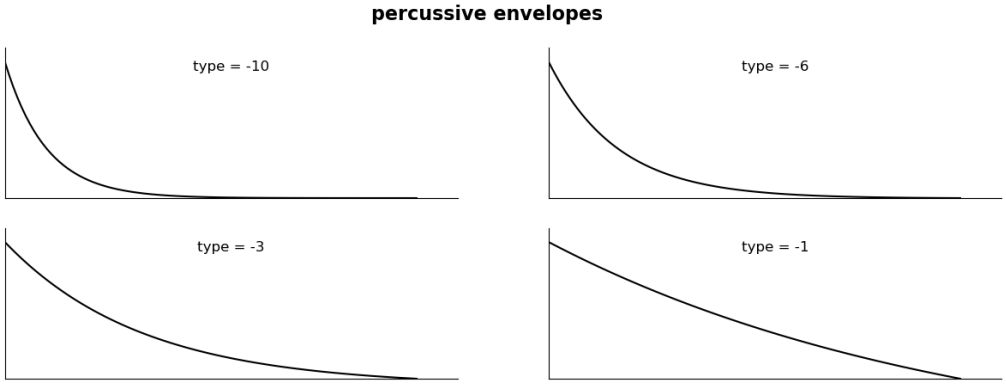
Looking at these variants, we find two parameters which can describe the different shapes. The first parameter defines the position of the peak relative to the overall duration. The second parameter describes the volume difference between the peak and the minimum volume (at start and end). Once we can describe the different shapes like this, we can realize deviations in defining a range in which random choices occur. Let, for instance, the peak be between 1/3 and 2/3 of the duration, and the loud-soft difference between 20 and 40 dB:



This can be written like this as code. Let us listen to four realizations:

<Code and Listen>

The percussive tone has, except duration, pitch and volume, only one parameter: the steepness of the curve:



I already use here the *type* parameter of Csound's *transeg* opcode. By means of this opcode it is very easy to achieve the different curvatures within a chosen range. I will write this, and then again let us listen to four random variants, all having the same volume and duration:

<Code and Listen>

But what about the duration actually? Do we also here find a certain range, with a minimum and a maximum possible duration? — Yes, and interestingly, the minima and maxima are rather different in both characters.

The *messa di voce* can be very long, say ten seconds. It can have a duration of two or three seconds. About one second turns out to be the minimum of what is still perceived as *messa di voce*. If the duration is below this limit, it becomes to an undefined short tone which not any more shows its *messa di voce* character.

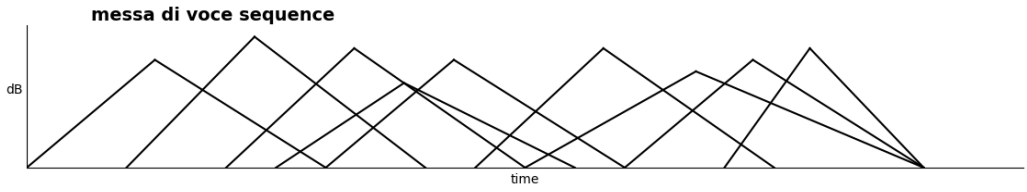
This is quite different for the percussive tone. This character can definitely be shorter than one second. One tenth or even one hundredth are interesting variants here, still in the scope of this species, resulting in the latter case in a noisy timbre.

<different examples to listen>

We see that if we really listen to these simple tones, they obtain a specific range of parameters. This expands to more dimensions when we not only speak about isolated singe tones but about groups of tones. For the percussive character the main dimension which opens up is the distribution in time. I will play a sequence of percussive tones twice; first in an ametric succession, afterwards in a metric succession.

<Listen>

Which density, which rhythm, which development perhaps from one rhythm to another one — these are some questions which the material suggests here. For the *messa di voce* material, another dimension opens up. This material seems to require something different: it is not happy to stay always on the same pitch. Let me play a sequence of *messa di voce* tones again twice. At first with always the same pitch, then with small pitch deviations.

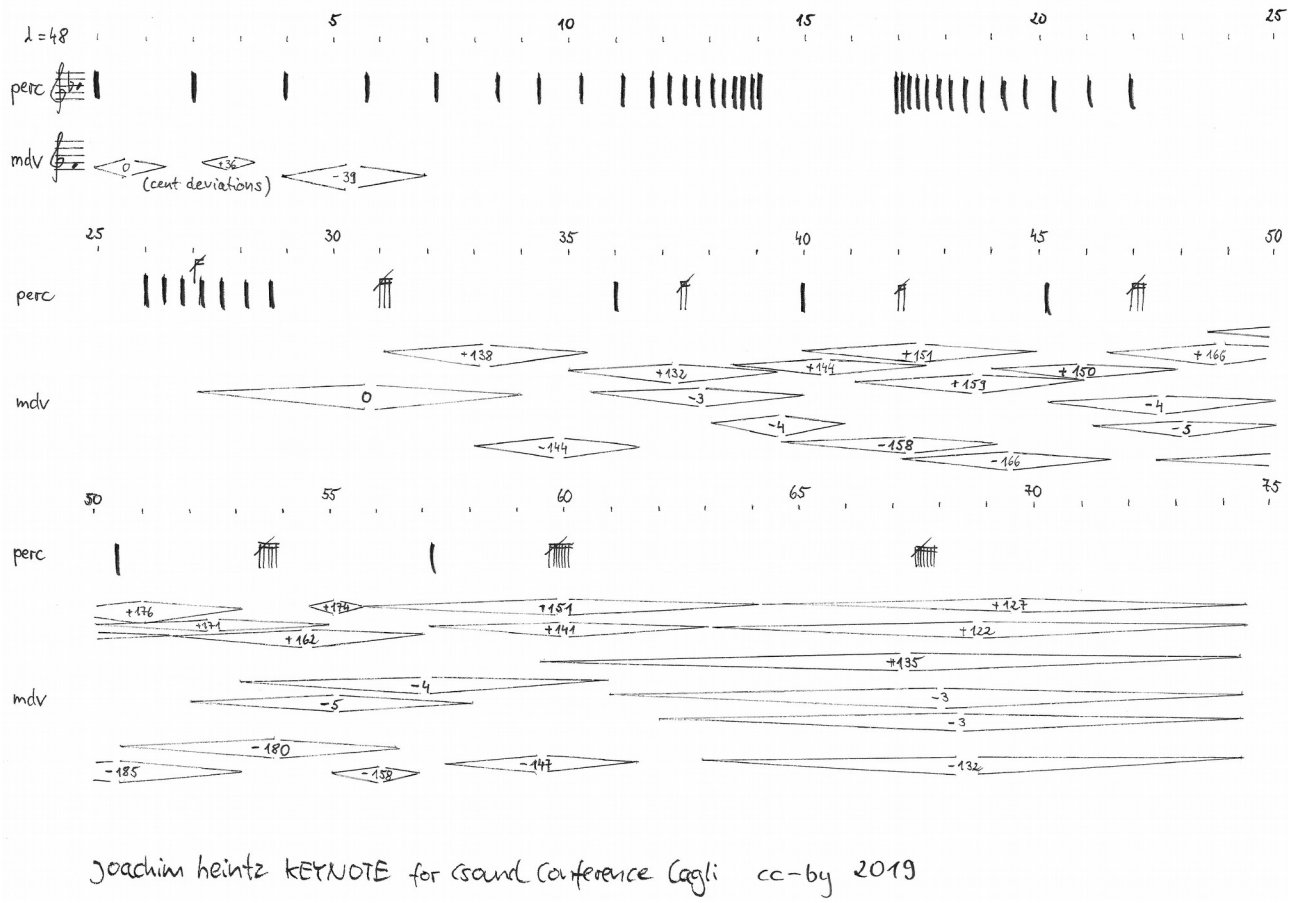


<Listen>

So, if you agree so far, we can say: This material wants to move in different pitches, and we must figure out these pitches. Do we move in a chromatic scale, or in a diatonic scale, or in a scale we have built by any other means? What is the direction: upwards, downwards, or are the tones, like in my example, oscillating around a central pitch? Or are we not focussing on the horizontal sequence but on the vertical events, thus working with intervals and chords?

It is very remarkable and possibly even somehow overwhelming for me to see the abundance of possibilities a material reveals when we listen to it, when we follow it. And that the dimensions and parameters which belong to one material are really specific to it — much less general than we are often used to assume. When this already emerges with such a simple material as we studied here, having two simple envelopes of a sine, how much more specifications will appear for more complex and more diverse materials.

Composing is then a decision for one of the many possibilities of the material. This is one small study for this simple material:



<listen to keynote.mp3>

Let us look once again at the relationship between composing and coding. I think we experienced in the examples here that in general both activities can go hand in hand. We could write in our code pretty straightforward what we wanted to achieve musically. What I experience as sometimes clumsy in Csound is the communication between the bigger units, the Csound instruments. The call of instruments via parameter fields is too abstract and suffers from some tedious limitations. I would very much like to work with keyword arguments, as for instance in Python. By this, our code would be much more readable. Another similar limitation is that it is not possible to send arrays to instruments.

But from technical details of the Csound programming language back to the main subject. I hope I could show that and how we can consider composing as immediate continuation of listening. Music comes to life when we experience the sound we listen to as something new, special, particular, exciting. Music arises when we follow the material in what we figured out in listening. Music is being created when we work out what we in our own particular listening considered as the sound's will.