

## **Creative musical processes in real time?**

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We are living at a time when new situations are being redefined and created. Information crosses paths and parts of its contents are exchanged. New information is generated and the minute it is born, it too enters into the exchange dynamic. Due to the relationship between the amount of information involved in the process and humans' limited ability to assimilate it, this is also a time of confusion and fraud, of a loss and distortion of values. Sometimes, concepts change in response to real changes in the world, due to collective necessities. Other times, concepts change because someone tries to change the world according to their own needs. But whether due to needs that are more or less linked to the state of the world or more or less determined by imaginary needs generated at a symbolic level, many redefinitions of concepts are linked to ideological motives and to load slips that those in power experience throughout the course of history. Certain terms are used—chosen, manipulated, and transformed—and that shapes people's outlook. Some things become true that were never true in the past and although they may have been born out of individual initiatives, they end up becoming collective and being used imprecisely, with no clear awareness of what that use might lead to or have led to at some time. When information, words, and concepts cross paths, the course of history is altered and also built. Replacing one term with another, a shift in meaning between one term to another, are sometimes collateral effects of strategies with no purpose other than convincing as many people as possible of something that intrinsically had nothing to do with the change that was introduced: noise is generated. These processes pollute the world of ideas. Just as we are concerned about conserving the environment (though, oddly enough, much less attention is paid to sound environments) or about the pollution of space as more and more artificial satellites orbit the earth, so should we be concerned about preserving our intellectual environment, which is packed with confused ideas.

In social groups, periodically certain magical terms arise that serve to establish the groups' boundaries and create a sense of belonging among its members. Merely saying those words gratifies the speaker with a reinforcement of the intensity of their sense of belonging. The term "real time", which is subject to the semantic transformation dynamics I have alluded to, is one of them. Nothing is found on the borders of the time when it happened, and certainly not when we speak of those aspects that intervene in the collective imagination that makes up a culture. Even if solely because of how frequently it is used, we should look at how this term is used incorrectly. The history of "real time" systems starts with the use of computing machinery to carry out monitoring operations in the late 1940s and early 1950s. At that time, interest in computing

systems in real time was basically related to military applications. The term “computing in real time” probably originated with the Whirlwind Project, a flight simulator developed by IBM for the U.S. Navy in 1949, or perhaps with SAGE, the Semi-Automatic Ground Environment air defense system developed by the U.S. Air Force in the early 1950s.

The Oxford Computing Dictionary defines Real Time Systems as follows: “Any system in which the time at which output is produced is significant. This is usually because the input corresponds to some movement in the physical world, and the output has to relate to that same movement. The lag from input time to output time must be sufficiently small for acceptable timeliness.”

Real time science is a branch of computer science about the introduction of “real time” into computing systems. However, despite the fact that the term refers simultaneously to time and reality, in the context of that discipline, the expression “real time” does not refer to time and reality inasmuch as to a computer system’s capacity for establishing correspondences among different counting or measuring systems. This is perfectly compatible with the idea of a system that interacts directly and immediately with an environment with its own counting and measurement systems. In order for this interaction to work properly, precise correspondences must be established so that the computing system is able to understand, analyze, and forecast how the environment under its control will behave.

From another perspective, computing in real time can be defined as a type of computing where the accuracy of the system does not only depend on logical computing results but also on the time when those results are produced. It is about a set of problems that classic computer science does not address, which manifest as a consequence of considering time as a basic logical restriction, not as a capacity factor. Thus, the fundamental problem of computing in real time can be summed up as the absolute need to carry out tasks in a specific lapse of time. A solution is considered correct if and only if it is logically correct and it is produced in time. That need arises in very different areas of human activities.

In the 1960s, breakthroughs in hardware integration levels and increasing processing speed broadened the range of problems that computing in time could be applied to. That was when interest in non-military applications grew to the point where it led to developing those systems quickly.

The idea of “real time” in composing is a metaphor that comes from the domain of signal treatment machines. It had, and still has, a clearly defined meaning for the machines that make sounds and music. But above all, it does in its design theory, as a limit which its productions should aim for but never reach: it is an ideal, not a goal. It is clearly utopian: the notion that a machine could respond at the same time information arrives. Obviously, that is impossible. In this area, all we can expect is a decrease in the time elapsed between information arrival and the

subsequent response. That time will never be zero, because we have not been given the key to the door to infinity. We never have, and we never will. Therefore, attempting to do something in “real” “real time” is, essentially, a metaphor for divinity. Art often attempts to do that, and it is quite common in music, as well, especially after WWII. A fascination with the technical (in general terms, not only in engineering) produced, following the 1950s, characters including major musicians who attempted to imagine, predict, and foresee, accurately and without ambiguity, how written music would behave acoustically merely by reading it. A second attempt at divinity is directly related to the romantic notion of the artist. Luigi Nono had already warned that such attempts were useless, but he went much farther by suggesting that it would be a lie for any creator to attempt to be an innovator while simultaneously knowing beforehand what the exact result would be of the interpretation of what he or she had written. There would be no experiment if it were known ahead of time. The person’s work would be crafts, not art.(1) Therefore, just as the prioritization of the masculine in gender terms is due to the predominance of sexist social tendencies—which may indeed be unconscious, but are quite clear nonetheless-, the use of an extreme term whose existence outside the purely imaginary leads to considerable contradictions should not be seen as harmless or unrelated to ideas that are very hard to justify rationally. “Real time” does not exist outside of the mind, unless we use language improperly. A century after the Theory of Relativity was presented, any claim that it exists in the physical world is a typical post-industrial utopian fiction. This is how a very useful tool for theorizing can become part of the collective imagination and can be manipulated, an instrument and also a symptom of the alienation mechanisms that are part of a context that venerates the technical and submits to its dominion, hardly considering its implications.

In classic electroacoustic music, the use of magnetic tape (2) in synch with the productions of traditional instruments recorded live often leads to significant formal and functional contradictions. The content of the tape is fixed forever, while the live performances can always include the unexpected. In fact, until the piece has finished, no one knows what will happen. This dialectical situation, which actually implies no impediment in the aesthetic field, has been seen in certain circles as restrictive and above all, as creating formal rigidity. Art has always lived in restrictions, however. I think the best is yet to come of the opposition between what is fixed forever and what is unpredictable in nature. There are options that have only been mentioned a few times.

What comes to mind right now, as an example, is the dream in the cabaret in Mulholland Drive, by David Lynch, where the musicians, in perfect playback, tell you that what you hear is not what you see, even though it looks that way. Everything is recorded. The singer falls to the floor, suddenly struck down, but the pre-recorded voice keeps on singing as if nothing had happened. Skillful use

of cinematographic resources heightens the blend of the stable and the ephemeral into a product on a fixed medium, causing a tremendous effect.

I do not mean to question here the use of so-called devices for generating and treating sound in real time. It would not be honest, nor do I have any reason to do so, as I use them nowadays because they help me make music. I find them very useful, on stage and when alone in the sound studio. The only thing I question is letting “real time” become a slogan. It is not the cure-all for problems in creating music. There is no cure-all, of course, but it is even more inconceivable such a thing would be a technical device.

Generating and treating sound in real time brings up new problems. They are very interesting but no less so than those of reproducing unalterable sounds. In fact, the two worlds have much more in common than it might seem.

The first one I want to take into consideration is that, for a listener who does not know about the existence or absence of causality between the sound flow he or she is immersed in and the performer’s gestures, it is impossible to be completely certain that what is seen is not the cause of what is heard. One may object that you can always tell if a performer is using pre-recorded sound. That is not entirely true, however. We have just been exposed to poor sound techniques and performers who need to rehearse more. Magnetic tape is a clock. One has to take the appropriate time references out of it. One must be able to forget about the chronometer while playing music for a magnetic tape, since the tape already has one, which one hears, not sees. Suddenly, another ghost appears here that destroys the performance of any kind of music: listening, and its higher cognitive function, attention. Measuring the time for listening to prerecorded material is hard and so is maintaining the right amount of tension for the necessary amount of time as well as generating the sound at the right moment. When one tries to find satisfactory possibilities in contexts where its density is close to zero, though it never reaches zero, the problem of difficulty is not really a problem. Rather, it is an eventuality. From the performer’s perspective, finding an excellent performance is like finding a needle in a haystack. It takes a monumental amount of work and one is never completely certain one will find it. Once it is found, the access ways must be kept clear so it is not lost in the ether, but that is another matter altogether.

Another issue related to using devices that work with sound in “real time” is, in the overall process of making music, establishing a point where its use is abandoned. Let’s consider the use of devices for treating and generating sound in real time during the performance of a work composed and performed in the classic manner, where a composer writes the music and later, on stage, a performer performs it. What is the point in feeding the listener’s imagination with the idea of “real time” in those conditions? In that case, “real time” ends somewhere between the

composer and the performer. Or to be more precise, just as public performance begins, because prior to that time, the performer must have spend hours and hours studying the piece, until an access to a perfect performance has been achieved. The composer-writer has not applied the concept of "real time" to this task. And the performer only does so during the public performance. So what is to be gained by announcing to audiences, whether expert or not, that what they are going to hear or have heard contains sound behaviors generated in real time? This widespread public communication of the methods used to make music bothers me because it is false and does not provide all the information. Instead, it hides it which can lead to confusion when pet words serve as talismans in certain contexts achieving, say, a larger audience or any other advantage not directly related to the excellence of the strictly musical contents. How can a live performance of an artistic work be given more importance at times than the intrinsic quality of that work? I see no reason aside from the logics of performance, of the shamanic act, of more use to politicians and cultural managers than to artists, the needs of the audience and the works themselves, as well as the ideas the works convey. All this interest in the reality of live acts is certainly legitimate but it cannot be completely separated from the state of things that have led to the media being held at the mercy of political interests to the detriment of other human activities. Finally, I'd like to address a phenomenon shown in the triviality of some interactive behaviors characteristic of works that are supposed to take place in "real time". Why should the gist of some interactive works have to be understood perfectly, effortlessly? Why is their discourse based on responses and actions that are perfectly predictable? When the use of devices that process sound in real time turns into a univocal response, say, pressing a button, that leads to the triviality I mentioned. Then one can appreciate an intelligible process that can satisfy minds that are fascinated by technique (engineering technique, in this case) or that are rigid and unable to accept innovations. But what happens in this case to those who look for magic in the act of listening? In my view, what is interesting about working with computers today is the possible complexity of the unpredictableness of their responses to actions taking place on stage. Not because that complexity is due to any particular process, usually based on artificial intelligence techniques, but in itself, because of the difficulty or impossibility of understanding the underlying procedure. Despite the fact that intellectually, the process used to achieve musical complexity is obviously interesting, it is seldom important for that knowledge to have a clear musical purpose at the time one listens to the product being performed on stage. Given this situation, once again it becomes impossible to know what gestures and actions produce responses. Thus, it is impossible to distinguish what is a response to an event and what isn't. Once again, it makes sense to questions the relevance of the fact that any given sound result was made due to a procedure in "real time". We either listen to music, or we appreciate the subtlety of the

programming resources expressed in the code. The situation is similar to that brought up by integral serialism, quite closely linked to the preventions I attribute to Nono, briefly mentioned above. We are not better musicians because we have written a fabulous program that makes music in “real time”, nor should its use influence our audience in the least.

Below a certain threshold of time separation, our mind cannot discern whether one event happened before another. This phenomenon occurs in sight, hearing, and the perception of crossed signals coming from different directions. This calls the idea of causality deeply into question: did an action occur before its supposed response or was it the other way around? Conscious experiences are ordered according to their relation to the event, to what happened, or to what may happen later on, depending on the past as well as their possible influence on the future and according to the distance in time from past and future events. The need to see something as a cause or effect can affect whether we see things as a cause or an effect. But what matters, as stated in the advertisement for Gabriel García Márquez’s memoirs (I am paraphrasing what I remember) is not what we have lived but rather how we tell it and how we remember it. Whether things happen in synchrony or not is a matter of scale, of resolution. We feel causality when we can relate events, and the closer together in time they are, the easier it is. That depends exclusively on our biological conditions.

The freedom with which people turn to using real-time sound processing devices has a point especially in the context of the practice of improvisation. And even more so if one thinks of it as something that is part of the entire process where the music is created. From the point of view I am describing, improvisation does not take place only on stage. It happens throughout the constant sculpting which, by virtue of different feedback, leads to the culmination of work, during the process of writing applications for real time sound processing and during the generation of sound material fixed on a given medium, as well as while making decisions while performing on stage. An objection might be raised that improvisation means something else, that improvisation is a synonym for composing on stage during the performance (3). In “real time”, it has been added in some contexts, but we have already examined the effects of using the term outside the strictly theoretical realm of designing computing devices to monitor certain means. Ideas like these generate logical conflicts that are hard to solve because it is strictly impossible, with all that that implies, for musical flow to be born out of anything other than a communion between performers and listeners at the magic moment of performance. Composition from scratch while performing is, in some sense, analogous to the idea of “real time”, a limit we can tend towards because there is a reason to do so. It is another utopia (4). However, it is good to distinguish between a utopia and our own imagination because once again we are in danger of falling into a delirium of divinity. How many hours does an improviser spend working and exploring the

possibilities offered by the materials that will be threshed out during the improvisation process? How many truly new ideas will occur to the performer while on stage?

In my view, there are two vitally important aspects influencing the quality of improvisation. They are not always perceivable by listeners, nor do they occur necessarily during the performance. One of them is the underlying, essential work so that the flow of sound and musical materials during the performance are what they are and not something else. The second equally important aspect is listening. Unless one is trained in the practice of listening attentively with full awareness, self-criticism, placing oneself at some distance from one's own sound and music productions, and measuring its effect on other musicians and the audience are impossible. I wouldn't dare to call any sound generating activity improvisation if it is not monitored and modulated according to multiple feedback based on listening to the environment. Once again, though this process does indeed take place while performing on stage, it also happens off-stage and it is essential in the preparatory stages, especially if there is more than one musician.

Improvisation has always been a part of the prior preparation of materials and of subsequent transcription, which may vary in accuracy. Therefore, is there any point to giving special emphasis to creation at the exact moment of performing? Any why not do so in the phase of study and research, of equal importance? It is clear that music that is not performed live lacks the freedom that characterizes music improvised while being performed. But that is quite different from improvisation as a creation during the performance. The difference is the one separating humanity from divinity. More than a difference, it is an impossible feat. It is not my intention to question the merits of improvisation or the genre known as free improvisation, which arises at times of an increase in political options and attitudes that favor the struggle for basic freedoms. In this text, I only aspire to focus attention on the improper use of language that can occur if one does not also allude to everything that is not named when uses terms that serve as talismans, so terribly oversimplified, such as "real time" or "creation during performance time". The similarities between the two are obvious and so are the paradoxes generated by their use. They evoke needs that are ineffable, imaginary, symbolic, and magical, so characteristically human, that come into existence out of lack of infinity, divinity, and transcendence.

(1) There is no bibliography available on this point. I refer to my numerous stimulating conversations with Luigi Nono in Freiburg in the 1980s.

(2) In this text, I use the term "magnetic tape" for historical reasons. Obviously, nowadays the functions of that device are performed by other mediums. In this article, I will use it as a synonym for audio CDs, CD-ROMs, or any type of memory, in a computer for example, that suffers no modification during the performance of a piece of music.

(3) "Improvisation is the activity of, to some extent, creating and constructing a piece of music in the same time as it is being performed." [Christian Munthe <http://www.shef.ac.uk/misc/rec/ps/efi/fulltext/ftmunt.html>]

(4) It will not happen after a time of fasting and being "incommunicado", as stated on part of the "sheet music" for Aus Den Sieben Tagen, by Karlheinz Stockhausen.