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Musings on Quantum Music: Can Quantum Music Bring us Closer to Objective Beauty?

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Abstract

Quantum music is an idea to compose music based on a fundamental physical theory, quantum theory. One of the underlying theses of the project is that by merging a deep theory of physics with music one can provide a more interesting musical landscape.

An interesting problem opened by quantum music is whether this idea will, or will not, allow one to move closer to objective beauty, if such a thing exists. I will explore what the implications of quantum music are for this issue. Can the marriage of science and art permit the achievement of a richer set of aestetic outputs?

Keywords: Quantum Music, John Keats, Richard Feynman, beauty, truth, art, science

At some point in the history of ideas, the Sciences drifted apart from the Arts. This irreversible fracture started immediately after the Enlightenment, in the seventeenth century, and then it was brought to its peak with Romanticism. One of the central points of Romanticism is to regard the sciences as dull and dry, while the arts, including music, and literature, are elevated to the status of unique tools to grasp the realm of emotions — the only reality worth expressing in the arts, according to Romanticism.

The Quantum Music project is a powerful proposal to remedy that fracture, providing a bridge between the science and the arts, in order to create a form of 'multi-disciplinary' communication. Its basic tenet is something like this: let us take one of our most fundamental theories of physics, quantum theory; and let us take one of the main means of artistic expression, music; and let us try to merge them into a work of art.

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This seems like a brilliant idea. But, the important thing is, it has deep philosophical foundations. To see why, I shall start from one of the most celebrated poems of the Romantic era, by John Keats – a sort of Romantic manifesto, which contains these baffling words:

> Beauty is truth, truth beauty,—that is all
> Ye know on earth, and all ye need to know.
> (John Keats, *Ode on a Grecian Urn*)

It is ironic that this is the central motto of the Romantic manifesto, because, if one reads it carefully, this statement asserts a deep connection between the sciences and the arts – that very connection that Romanticism tries to deny. Because on the one hand, the arts and literature are grouping towards some ideal – something we can call *objective beauty*, that is out there to be grasped; on the other hand, science is tentatively searching for another ideal, truth; and since the poem equates the two, we must conclude that keeping arts and science as separate is fallacious. Science and the Arts are both striving to get at something that is beyond what we see directly, by imagining scientific explanations, in the case of science, and by conjecturing beautiful arrangements of visual material, or sounds, etc., in the case of arts.

Now, there is something important to be noted here. Nothing we currently known in science, including the laws of quantum theory that the quantum music project assumes, can be proven to be true. What know is that those laws have not yet been falsified by experiment; that they have not yet been proven to be mistaken. Likewise, in arts nothing can be proven to be 'beautiful'. What we can perhaps argue for, is that a given work of art could be improved, tentatively, in a certain way. This approach, which is rooted in the philosophy of Karl Popper's, gives a meaning to tentative progress in both arts and science, and also explains that neither science, nor art, consists of copying, or describing, nature. They both go beyond the appearance of things, in order to explain and reveal regularities that are hidden beneath the surface of what we perceive.

At any rate, Keats's intuition is right. Science and the arts have some profound similarities. They are enterprises tentatively to get closer to some ideal – we could call it beauty, in the case of arts, and truth, in the case of science. It is, I think, that intimate relationship between arts and science that drives the quantum music project.

Now, there is something interesting going on here – something that the quantum music project brings to our attention. This task that the quantum music people set to themselves is hard. This is because quantum theory is the expression of modern science, which has gone far, faraway from the capabilities of our senses. But music, and the arts in general, are confined within the boundaries of our senses – they are confined by what we can perceive, or what we can hear, or what we can feel. Science already went quite far away from our sensorial intuition with the theory of gravitation that Newton proposed: it is rather counterintuitive to imagine, for instance, that the Earth is spinning around the sun; and spinning around its own axis. But with quantum theory there are several more things that depart from what we are naturally

designed to perceive, by natural selection. There are things that are literally impossible to perceive through our senses: such as quantum superpositions, quantum entanglement, and so on. As explained in other contributions in this volume (Vedral 2018; Garner 2018), we do not see quantum features around us; we do not hear them *directly*. The world around us appears to be classical; and the way we interact with it, even when we listen to a piece of music, is through measurements, which make quantum features decohere. What we can have is 'indirect evidence' of quantum effects, in the laboratory .

The task of the quantum music project is therefore extremely challenging, and at the same time deeply enthralling. Science, by its very nature, goes beyond the immediate sensorial experience; but the arts as traditionally conceived are tied to our sensorial experience. So if we want to take the challenge of quantum music seriously and incorporate faithfully quantum effect into arts, we might have to adopt a radically new take on the arts. Attempting to express quantum effects in music opens up an entirely new set of problems for artists. We might have to end up inventing a new type of artistic expression – using music, in combination with other media. But how?

Currently, there are two main ways of capturing scientific ideas in the arts. One is by *analogy*: we take an interesting phenomenon that science has discovered and we try to render it by analogy with things we know about. For example, Picasso tried to capture the relativity of space and time that Einstein discovered through representing different perspective on the same painting, as in this example. Another example is the superlative fantasy trilogy by Philip Pullman. It is built around the idea of the quantum multiverse, which is one of the main features of quantum theory. Still, these are just analogies: they break down at some point. This is something we have to be careful with. There is often a risk of misunderstanding – which is why analogies have to be presented together with some explanation telling us that they are not quite the real thing. For instance, in the real quantum multiverse, no universe can communicate with another, because of the symmetries of quantum physics (Cf. Vedral 2018). But in the multiverses described in literature, the universes are permeable to one another.

There is however another way in which the arts can capture these phenomena that science describes. This is via certain tricks that harness the way we perceive the world around us; the way our eyes, and ears, happen to be working. This is perhaps more interesting for the quantum music project, because it gets closer to the phenomenon of interest, capturing it in a more direct way.

A classic example of this is the representation of a three-dimensional space on a two-dimensional page: the painters in the renaissance introduced linear perspective, in order to represent the three-dimensional arrangement of objects on a two-dimensional surface. The representation is faithful, and can almost perfectly deceive our eye. Likewise, we have other types of optical illusions. They make us feel like something is there, which is not quite there – as in this curious image where the same street is portrayed, but it looks like the two streets are different. Why? Because we use the first as a reference for the second, and viceversa. So, the two pictures look different, but they are actually the same pixel by pixel (Figure 1).

Figure 1. *An optical illusion*

Now for each of these two cases, it is important to think of what the analogue for quantum music is.

- How do we come up with better analogies for quantum effects? (Easier)
- How to can we be realistic – can we create an analogue of optical illusions to recreate, to some extents, quantum features which are inherently inaccessible to our senses? (Harder!)

Perhaps for the second point we need a complex combination of music as traditionally conceived; a rich set of elaborations and renderings (virtual reality tools); as well as words and stories, to explain the connection with quantum theory. This is a fantastic challenge. As a relic of Romanticism, there still is a certain hesitation in merging art and science; some say it is just fashion; some say it is equivalent to reducing art to a servant of the sciences; and some others say that science, when translated into a work of art, is often misunderstood, or betrayed; some even think that science takes away from the beauty of the arts. But, as we see with quantum music, this is not quite right. Merging the two can provide a richer artistic landscape: it leads to a set of deep new problems, which when addressed may even provide a new artistic form – unifying different existing forms, such as music, into a new organic complex that allows one to express these ideas that contemporary physics has discovered. This is perhaps what the quantum physicist Richard Feynman (1918–1988) had in mind when writing these reflections:

CHIARA MARLETTO

MUSINGS ON QUANTUM MUSIC:
CAN QUANTUM MUSIC BRING US CLOSER TO OBJECTIVE BEAUTY?

I have a friend who's an artist and has sometimes taken a view which I don't agree with very well. He'll hold up a flower and say "look how beautiful it is," and I'll agree. Then he says "I as an artist can see how beautiful this is but you as a scientist take this all apart and it becomes a dull thing," and I think that he's kind of nutty. First of all, the beauty that he sees is available to other people and to me too, I believe. Although I may not be quite as refined aesthetically as he is ... I can appreciate the beauty of a flower. At the same time, I see much more about the flower than he sees. I could imagine the cells in there, the complicated actions inside, which also have a beauty. I mean it's not just beauty at this dimension, at one centimetre; there's also beauty at smaller dimensions, the inner structure, also the processes. The fact that the colours in the flower evolved in order to attract insects to pollinate it is interesting; it means that insects can see the colour. It adds a question: does this aesthetic sense also exist in the lower forms? Why is it aesthetic? All these kinds of interesting questions only add to the excitement, the mystery and the awe of a flower. They only add. I don't understand how they subtract. (Richard Feynman, "Ode to a Flower," BBC, 1981)

So, Feynman would say, go forth and explore the quantum music world. It can only add to our delight in understanding physical reality, and appreciating beauty. May it be the start of a new Enlightenment, this time leading to a re-marriage of arts and science, through music and the foundations of quantum theory.

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Кјара Марлето

Размишљања о квантној музици:
Да ли нас Квантна музика може приближити објективној лепоти?

(Сажетак)

Овај рад представља својеврстан епилог, или коду, тема посвећеног квантној музици. У једном моменту у историји људских идеја, науке су се одвојиле од уметности. Ова неисцељива фрактура десила се одмах након просветитељства, у седамнаестом веку, да би достигла свој врхунац у раздобљу романтизма. Једно од централних уверења романтизма јесте да су науке досадне и сувопарне, док су лепе уметности, укључујући музику и књижевност, уздигнуте до статуса јединствених алата помоћу којих можемо да продремо у свет емоција — које,

према романтичарима, представљају једину реалност коју вреди изразити помоћу уметничких дела.

Пројекат *Квантна музика* (*Quantum Music*) даје фасцинантан предлог за превазилажење ове руптуре, креирајући мост између науке и уметности, који омогућава мулти-дисциплинарну комуникацију. Његов основни принцип могао би се описати овако: узмимо једну од основних теорија физике, квантну теорију, и једно од главних средстава уметничког изражавања, музику; затим, покушајмо да их фузионишемо у ново уметничко дело. Дакле, квантна музика је идеја да се компонује музика базирана на квантној теорији, а један од основних постулата овог пројекта јесте да се прожимањем физике са музиком може створити интересантнији музички пејзаж.

Један занимљив проблем који је отворен пројектом квантне музике јесте питање да ли ће нам ова замисао омогућити да се приближимо објективној лепоти, ако тако нешто уопште постоји. У овом тексту истражујем које су импликације квантне музике по овом питању. Да ли спој науке и уметности може омогућити настанак естетски вредних резултата?

Кључне речи: Квантна музика, Џон Китс, Ричард Фејнман, лепота, истина, уметност, наука