# A Song Turned Sideways Would Sound as Sweet

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**Abstract:** Markosian presents an argument against certain theories of time based on the aesthetic value of music. He argues that turning a piece of music sideways in time destroys its intrinsic value, which would not be possible if the Spacetime Thesis were true. In this paper I show that sideways music poses no problems for any theory of time by demonstrating that turning a piece of music sideways does not affect its intrinsic value. I do this by appealing to spatial analogies that highlight the similarities between spatial and temporal rotations.

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## Sideways Music

Markosian describes the Spacetime thesis as follows:

> (The Spacetime Thesis) The universe is spread out in four symmetrical and similar dimensions (each one orthogonal to each other one), which together make up an isotropic, four-dimensional manifold, appropriately called spacetime. Humans tend to perceive one dimension – the one we call 'time' – as different from the others in various ways, but in reality, no one of the dimensions is intrinsically different from any of the others (2019:1).

A consequence of this formulation of the view is that time is an axis around which objects can be rotated.[1] This is unlike the view that Markosian defends,[2] the Dynamic Theory of Time, which holds that time is very different from the three spatial dimensions, that A-properties exist, that the passage of time is real, that the past, present and future are ontologically distinct, etc. The sideways music thought experiment intends to pose a problem that is unique to the Spacetime Thesis since, according to Markosian's formulation of the dynamic view, time is not a dimension in which objects can be rotated.

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[1] Le Bihan (forthcoming) argues that Markosian's formulation of the Spacetime Thesis is at odds with modern physics and doesn't represent standard four dimensionalist views. I am inclined to agree, however, I intend this paper to be narrow in scope, so I generally accept Markosian's assumptions at face value and focus on a single argument. My goal is to show that the sideways music argument falls flat even within the framework that he lays out.

[2] See Markosian 1993, 2004

For his argument, Markosian assumes aesthetic realism – there are objective facts about aesthetic value independent of human consciousness.[3] He holds that aesthetic value is an intrinsic property of an object like a work of art, and therefore, rotating that object in space doesn't change that intrinsic value. Although we might *perceive* an object differently if it is turned sideways, its value remains unchanged despite our changed perspective. For example, if we want to fully appreciate the value of Salvador Dalí's *La persistencia de la memoria* after it has been rotated 90°, we might have to tilt our head to the side. Reorienting an object in space doesn't change its value. According to Markosian, in the four-dimensional world of the Spacetime theorist, this should hold for time as well.

Enter sideways music. Markosian imagines a situation in which Nina Simone plays beautiful seven-note melody in a concert hall. I've selected a beautiful melody to use as an example (see *fig. 1*). The melody consists of a sequence of hammer-strikes inside the piano, which together have positive aesthetic value.[4] Rotating the piano in space doesn't change the aesthetic value of the event sequence, nor does waiting for the earth to rotate 90° on its axis. But, the argument goes, try rotating that melody 90° in time. Instead of the gorgeous melody shown in *fig. 1*, we are confronted with a cacophonous jumble of notes sounding all at once (see *fig. 2).* According to aesthetic realism, the original and sideways versions of the melody should have the same aesthetic value. Markosian argues that they don't; the original is beautiful and has positive aesthetic value, whereas the sideways version has either no aesthetic value or negative aesthetic value. Therefore, time is unlike the three spatial dimensions in at least one meaningful way: rotations in time don't preserve intrinsic aesthetic value.

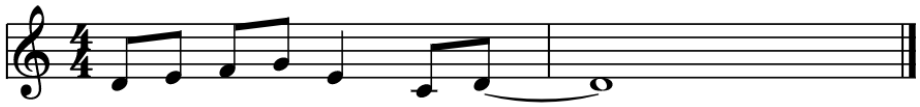


*fig.1 – beautiful melody*

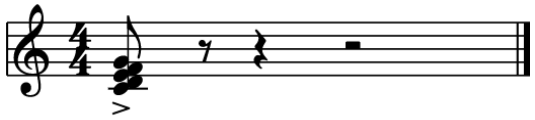


*fig.2 – cacophonous racket*

[3] This is, of course, controversial, but for the purposes of this paper, I will also assume aesthetic realism to ensure that the conclusion, sideways music doesn't tell us anything about time, applies equally across aesthetic theories.

[4] From what I understand, Markosian holds that the aesthetic value of the music is found in the sequence of events – in the hammer-strikes themselves. This is a substantive assumption about the ontology of music that has serious implications for what it would mean to rotate a piece of music. I won't argue the point here, but I will provide two quick, intuitive reasons to think that the value of a piece of music might lie, at least in part, somewhere other than the physical sounds themselves. First, it seems like there is an important part of music that happens in the listener's mind. For example, talented musicians can do something called audiation where they can 'hear' a piece of music in their mind only by reading the sheet music. No instruments required. The second regards music that is never played. Imagine that we discovered a new, never-before-heard Bach manuscript – it would be very odd to say that is has no aesthetic value until it is physically performed on instruments. These are not meant to be taken as a conclusive argument, but merely meant to raise doubts about what it would even mean to rotate a melody.

I take Markosian's argument to be the following:

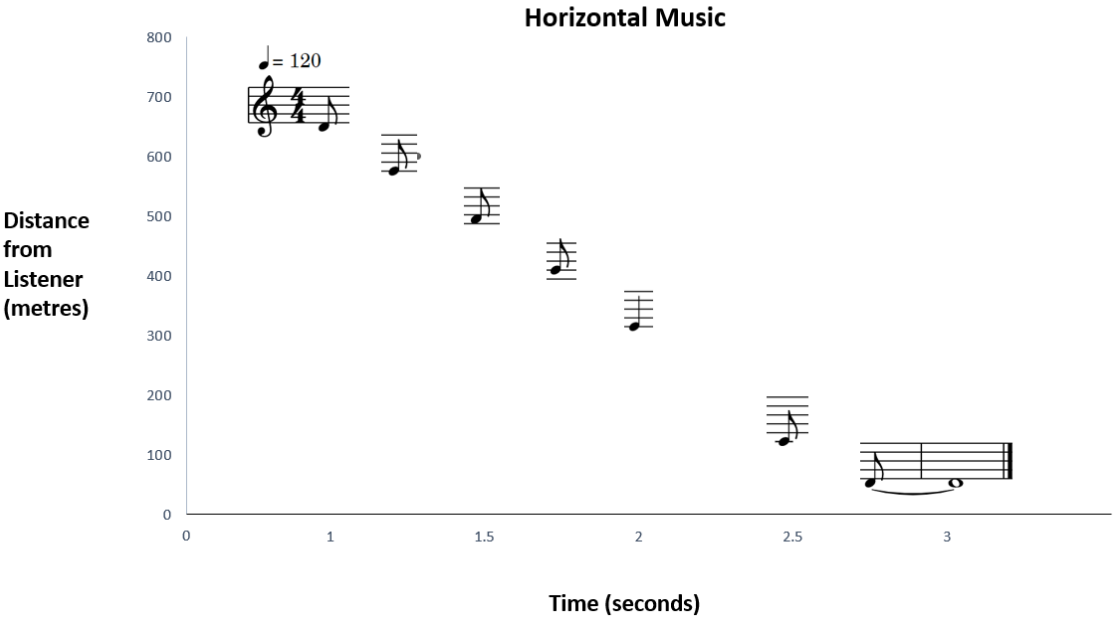
> (1) If the Spacetime Thesis is true, then turning a piece of music sideways does not destroy its intrinsic value.
> (2) Turning a piece of music sideways does destroy is intrinsic value.
> (3) Therefore, the Spacetime Thesis is false.

Markosian anticipates that the Spacetime theorist will likely try to reject premise (2) by arguing that rotating music in time doesn't affect its aesthetic value, though human consciousness is such that we aren't good at perceiving it. Several thinkers have recently aimed to do just this: Bnefsi 2020 gives an example of how a perduring subject could turn herself sideways in time using time travel to hear the music as it was originally conceived, while Liao 2019 offers an argument about beings that don't experience time linearly who might be able to appreciate the value of sideways music. I agree with the conclusions of these arguments, but they both appeal to fantastical thought experiments that posit something extraordinary about the hearer – a perduring time traveller and a higher dimensional being. Luckily for the Spacetime theorist, we don't need to appeal to the imaginary; as I show below, it's possible to refute premise (2) using a simple spatial analogy based on human listeners that holds for any theory of time.

## Horizontal Music

Imagine the same seven-note melody, now played by seven players on seven different pianos. The pianos are arranged from left to right with each player responsible for playing a single note. The pianists are highly skilled and have a wonderful sense of ensemble, so they can perform the melody so seamlessly that it is as if it were played by a single performer. This sequence of events – the hammers inside the pianos striking their respective strings – will have an intrinsic aesthetic value. Now, imagine rotating the line of pianos so that they are no longer arranged from left to right – now, they are ordered from back to front so that the player who plays the first note of the melody is furthest away from the listener and the player who plays the final note is closest to the listener. Because of the nature of sound, even when the notes are played perfectly in time, the sound from the most distant piano will take longer to travel to reach the listener. The effect is that, simply by rotating the melody in *space* rather than time, the listener will hear a distorted version of the melody. Given a few hundred meters of distance (and the amplification necessary for the sound to carry), we can even construct the example so that each note of the melody arrives at the listener's location at the exact same time (see below).[5] In this situation, the listener will hear the exact same cacophonous cluster-chord that we saw above in *fig. 2*.

[5] Sound travels at about 343 m/s through air at 20°C. Each measure in 4/4 time performed at 120 BPM takes two seconds to play, and each eighth note lasts .25 seconds. For each eighth note subdivision of the melody, the pianos would need to be placed 85.75m apart for the entirety of the melody to arrive at the listener's location at the same time.




This example shows how we can recreate the same appearance of negative aesthetic value without any appeals to manipulations in time. The nature of human sound perception is such that we can only hear the sounds as they arrive at our ears; however, this shouldn't affect the aesthetic value of the melody if we hold that aesthetic value is mind-independent, as Markosian does. By his own lights, the aesthetic value of our horizontal melody is no different once it has been rotated in space, just as the value of *La persistencia de la memoria* isn't. What changes is the listener's ability to appreciate that value; we simply aren't very good at hearing and appreciating horizontal music. We would expect the same of sideways music. If rotations in time are no different from rotations in space, we have no reason to think that the intrinsic value of sideways music is destroyed by the rotation, just as the value of horizontal music isn't.

At least some works of art, like landscape paintings and music, need to be experienced from the correct angle to be properly appreciated. When we considered rotating the Dalí painting 90°, the way to appreciate it properly involved turning our head. But other manipulations, such as hanging it backwards, facing the wall, make it impossible for us to appreciate; while it doesn't change the value of the work, we would be forced to manipulate it further if we wanted to appreciate it properly. It is the same with the temporal case; if there was a way to rotate music temporally (though I'm not sure how you could), we wouldn't be able to appreciate it properly from that 'angle' and would have to manipulate it further if we wanted to hear it in a way that is meaningful to us.

Another way to further illustrate the parallels between spatial and temporal rotations is to consider partial rotations. Up until now we have been considering full 90° rotations, but rotations of other amounts are equally possible. Rotating a painting 90° so that it is facing sideways and so that we are viewing it edge-on makes it very

hard to appreciate, whereas a 30° rotation will allow us to see *most* of the painting, and a mere 1° rotation won't impede our interpretation of the work at all. The same could be said of a piece of music rotated in time; while a 90° rotation would result in our hearing every note at once, a 30° rotation would cause us to hear a slightly faster version of the melody[6] and a 1° rotation would be indiscernible from the original. Hearing a melody faster than it was intended to be heard, much like viewing a painting angled 30° away from the viewer, is not the ideal way to listen to it. Nevertheless, an accelerated melody certainly can't be considered to have no or negative aesthetic value; we only get the cacophony that Markosian is worried about with specific kinds of rotations.

What these examples show is that what originally seemed like a unique problem for temporal rotations applies equally to spatial rotations, and what at first seemed to be a unique problem for the Spacetime Theory turns out not to be a problem at all. In summary, if there were such a thing as sideways music there would be nothing wrong with it, and it wouldn't tell us anything about the nature of time.

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[6] If our original melody played at 120 BPM were (somehow) rotated 30° in time, it would *sound* as if it were played at 138.57 BPM.* There is, of course, a difference between these two tempi. However, a difference of about 18 BPM isn't enough to seriously affect most listeners' ability to appreciate a melody. In fact, before the invention of the metronome, interpretations of a vague tempo marking like *andante* (walking pace) could – and sometimes still do – vary by several dozen beats per minute.

* We can graph the amount of time over which a listener would hear the melody using a circle with the equation $r=2$ in polar coordinates, or $x^2+y^2=4$ in cartesian coordinates. In this case, r represents the length of the original melody and x represents the amount of time in seconds it will take the listener to hear the melody. Rotated 30°, polar coordinates (2, 30°), gives cartesian coordinates ($\sqrt{3}$, 1), so the melody will take approximately 1.732 seconds to sound. This comes out to 15.47% faster than the original melody, 138.57 BPM. Using this same formula, a rotation of 1° would result in a difference of only .06 BPM. Thomas 2007 found that on average participants noticed tempo changes of between 2.70 and 6.31 BPM, so a rotation of 1° would be indiscernible.

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