A song turned sideways would sound as sweet

Zachary Ferguson

1. *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. (Markosian 2020: 51)

A consequence of this formulation is that time is an axis around which objects can be rotated.[1] This is unlike the view Markosian defends, 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. (Markosian 1993, 2004). The sideways music thought experiment putatively poses a problem that is unique to the Spacetime Thesis since, according to the dynamic view, time is not a dimension in which objects can be rotated.

For his argument, Markosian assumes aesthetic realism – there are objective facts about aesthetic value independent of human consciousness.[2] He holds that aesthetic value is an intrinsic property of an object such as a work of art, and therefore, rotating that object in space does not 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 does not change its value. According to Markosian, in the four-dimensional world of the Spacetime Theorist, this should hold for time as well.

1 Le Bihan (2020) argues that Markosian's formulation of the Spacetime Thesis is at odds with modern physics and does not represent standard four dimensionalist views. I am inclined to agree, however, in this paper I 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 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 does not tell us anything about time, applies equally across aesthetic theories.

Analysis Vol. 0 | Number 0 | May 2020 | pp. 1–6 doi: 10.1093/analys/anaa026

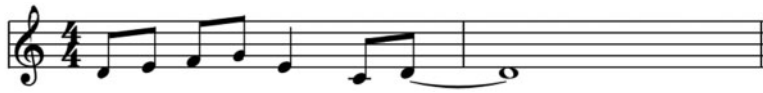

Figure 1. Beautiful melody.

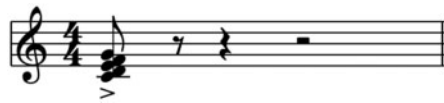

Figure 2. Cacophonous racket.

Enter sideways music. Markosian imagines a situation in which Nina Simone plays a lovely seven-note melody. I have selected a beautiful melody to use as an example (Figure 1). The melody consists of a sequence of hammer-strikes inside the piano, which together have positive aesthetic value. Rotating the piano in space does not 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 Figure 1, we are confronted with a cacophonous jumble of notes sounding all at once (Figure 2). According to aesthetic realism, the original and sideways versions of the melody should have the same aesthetic value. Markosian argues that they do not: 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 do not preserve intrinsic aesthetic value.

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 its intrinsic value.
(3) Therefore, the Spacetime Thesis is false.

Markosian anticipates that the Spacetime theorist will likely reject premise (2) by arguing that rotating music in time does not affect its aesthetic value, although human consciousness is such that we are not good at perceiving it. Recent attempts to do this include Bnefsi 2020 and Liao 2019. 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, it is possible to refute premise (2) using a simple spatial analogy based on human listeners that holds for any theory of time.

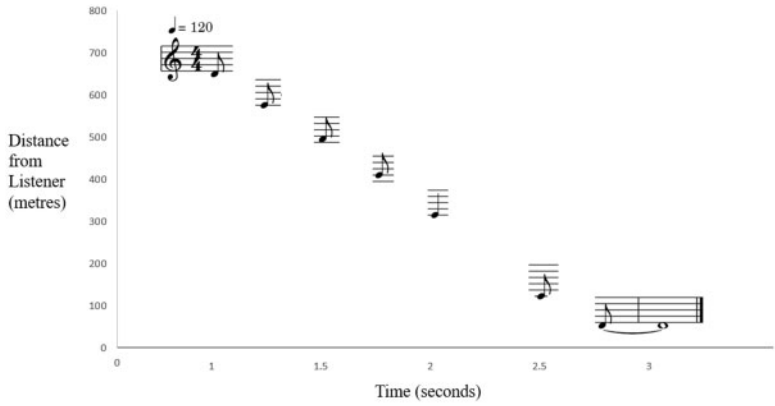

Figure 3. Horizontal music.

2. *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 playing a single note. The pianists are highly skilled and have a wonderful sense of ensemble, so they can perform the melody as seamlessly 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 ordered from back to front – 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 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 metres 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 (Figure 3).[3] In this situation, the listener will hear the exact same cacophonous cluster-chord that we saw above in Figure 2.

My example shows how we can recreate the same appearance of negative aesthetic value without any appeals to manipulations in time. Human sound perception is such that we can only hear the sounds as they arrive at our ears; however, this should not affect the aesthetic value of the melody if we hold that aesthetic value is mind-independent, as Markosian does. By his own lights, the

3 Sound travels at about 343 m/s through air at 20°C. Each bar in 4/4 time performed at 120 BPM takes two seconds to play, and each quaver lasts 0.25 seconds. For each quaver subdivision of the melody, the pianos would need to be placed 85.75 m apart for the entirety of the melody to arrive at the listener's location at the same time.

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* is no different. What changes is the listener's ability to appreciate that value. We simply are not 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 is not.

At least some works of art need to be experienced from the correct angle to be properly appreciated. When we considered rotating the Dalí painting 90°, we could appreciate it properly by turning our heads. But other manipulations, such as hanging it backwards, turning it to face the wall, make it impossible for us to appreciate it; while it does not 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 were a way to rotate music temporally, we would not be able to fully appreciate it 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. Until now we have been considering full 90° rotations, but rotations of other amounts are equally possible. Rotating a painting 90° sideways 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 will not impede our appreciation 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[4] 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 cannot be considered to have no or negative aesthetic value. We only get the cacophony that Markosian is worried about with very specific rotations.

4 If our melody played at 120 BPM were rotated 30° in time, it would *sound* as if it were played at 138.57 BPM. There is, of course, a difference between these tempi, but a difference of 18 BPM is not enough to seriously affect most listeners' ability to appreciate a melody. For example, interpretations of a vague tempo marking like *andante* (walking pace) can 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 0.06 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.)

What these examples show is that what originally seemed like a 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, it would not tell us anything about the nature of time because it would be just as sweet.[5]

University of Wisconsin
Milwaukee
WI 53201-0340, USA
zdf@uwm.edu

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5 I would like to thank Peter van Elswyk, Joshua Spencer and Yasha Sapir, whose suggestions helped to make this paper clear and concise.

Abstract

Markosian (2020) 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.

Keywords: A-Theory, B-Theory, spacetime, dynamic theory of time, music, aesthetic value, art