

Comments on Shen Pan's "Dynamic Music, Non-Dynamic Time"

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Ned Markosian's "sideways music" argument for a dynamic theory of time has generated a lot of response. If one measures the richness of an argument by the number of distinct ways in which it can be attacked, then Markosian's argument is rich indeed. Shen Pan has added three new attacks, all of which in my view have merit. The first is a version of what I think is the most central attack, namely, that even if Markosian succeeds in showing that the temporal dimension is not exactly similar to the spatial dimensions, that does nothing to support the dynamic theory of time. For it is no commitment of its rival, the static theory. I will return to this at the end of my comments when I consider Markosian's argument within the context of a relativistic spacetime. But first I want to focus on Shen's second attack. I think it is important to consider two different versions of this attack because they target different premises of Markosian's argument.

It will be useful to have a version of Markosian's argument on display. It is presented as a *reductio* of what he calls "the spacetime thesis", but Markosian is not consistent in what he takes this thesis to be. Sometimes he takes it to include a list of doctrines that together he calls the static theory of time. But the official version, the version explicitly used in the argument, is more succinct. It requires that the four-dimensional spacetime be "isotropic", and that no dimension "is intrinsically different from any of the others". Call this the *extreme* spacetime thesis because it requires that time be intrinsically *exactly like* space, not just *similar* to space.

That is too extreme even to apply to Newtonian physics, let alone relativistic physics.¹ But it will be useful to first consider the argument under the extreme version, since that gives it the best chance of success. Here is my formulation of Markosian's argument:

1. *The extreme spacetime thesis*: Spacetime is a four-dimensional manifold with all four dimensions exactly similar.
2. Any material object or event may be arbitrarily rotated in spacetime.² (From 1)
3. The intrinsic properties of a material object or event are preserved under rotation.
4. Aesthetic properties are intrinsic.
5. Aesthetic properties are not preserved under rotation.
6. *Contradiction*.
7. Therefore, the extreme spacetime thesis is false.

Shen Pan does not think that Markosian's argument is sound, but it is not clear, under this formulation, which premise he wants to reject. He gives Markosian, for the sake of argument, the controversial premise 4, that aesthetic properties are intrinsic.³ And he seems also to accept premise 5, that "sideways music" differs from ordinary music in its aesthetic properties. That suggests that he must be rejecting premise 3, that intrinsic properties are preserved under

¹ An example of a manifold that satisfies the extreme thesis is four-dimensional Euclidean space, E^4 . But this should not be confused with Newtonian spacetime.

² Note that 'may' denotes *geometric* possibility, not *physical* possibility. Note also that by 'arbitrarily', I mean this: for any material point of the object/event and any point of the spacetime, there is a rotation after which that material point occupies that point of spacetime.

³ He writes: "Markosian's argument assumes ... that aesthetic value is an intrinsic feature. ... So, one way to resist Markosian's argument is to take it as a refutation of aesthetic realism, à la Markosian. But this is not the response strategy that I will pursue ..."

rotation. But premise 3 seems to me unassailable on the most natural understanding of rotation. We need to take a closer look at Shen's argument.

Shen distinguishes, rightly, between the claim that music is dynamic and the claim that time is (intrinsically) dynamic. And he accuses Markosian of wrongly assuming that the former claim entails the latter. But that assumption is not a premise of the argument as Markosian presents it, so if Shen is right, it is somehow being smuggled in. That is, without the assumption, one or more premises would lose its support. Let's focus on the aspect of musical dynamism that depends on temporal direction (or orientation). Shen's crucial observation is this: although the dynamic aspect of music requires that time have a direction, it is compatible with the direction of time being extrinsic to the geometry of the spacetime manifold. It may arise from asymmetries in the distribution of the material objects and events that occupy spacetime. But here I want to press further. For this might happen in either of two ways. It might be extrinsic to the geometry of spacetime, but intrinsic to the material event, the dynamic musical passage. Or it might be extrinsic to both. Let me illustrate this distinction.

Consider a musical passage such as Markosian's seven-note melody by Nina Simone. Suppose first that its temporal orientation is determined by physical phenomena extrinsic to the passage. For example, suppose, as one prominent theory holds, that the direction of time is grounded in the low entropy state of the big bang. On this view, the intrinsic features of the passage will be physically compatible with that passage having either temporal orientation. Only when the passage is placed within the context of the entire universe, is there a fact as to its temporal orientation. In this case, aesthetic properties, which both Markosian and Shen allow depend on temporal orientation, will be extrinsic to the musical passage, and so premise

4 will be false. But Shen accepts premise 4 for the sake of argument. So this is not the sort of account of the direction of time that Shen should have in mind.⁴

So suppose instead that the passage's temporal orientation is determined by physical phenomena intrinsic to the passage. Perhaps the simplest way this could be so is if there is a fundamental relation of singular causation, and the temporal orientation of a temporally extended event is determined by how this asymmetric causal relation applies to the temporal parts of the event. But now, when the passage is rotated, the properties and relations among the parts of the passage are rotated as well, including the causal relation. So the rotated passage will be no less dynamic than the original passage. That suggests that it is premise 5 that should be denied, that the aesthetic properties are not preserved under rotation. And, indeed, that seems to me to be the right thing to say about this case. For suppose that we rotate, not just the musical passage, but the passage along with its surroundings, including the person who is listening to it. Then the passage will be no less pleasing to the listener; for we have rotated all the causal relations that are involved in perception of the music: in the passage itself, in the listener's brain, and in the space between them. It is no different than the case of rotating the portrait 90 degrees in space. Only when we also rotate our head 90 degrees can we properly perceive the portrait's aesthetic properties. Yet we do not think that the rotated portrait is any less beautiful in itself. Now, if Shen nonetheless accepts premise 5 – and I see no evidence in his paper that he doesn't – then he must be rejecting premise 3, that intrinsic properties are preserved under rotation. And so he must think that it is here that Markosian is smuggling in the assumption that dynamic music requires dynamic time.

⁴ However, the fact that he cites Albert, who is a leading proponent of this account, suggests otherwise.

But how can premise 3 be false? By definition, when we rotate a material object or event, we rotate all its parts and hold fixed all the properties of the parts and relations among the parts. But since the intrinsic properties of the whole are determined by the intrinsic properties and relations among its parts, the intrinsic properties will be preserved under rotation. There is one caveat here: I am assuming, as I think is Markosian, that rotations are isometric transformations, that they preserve the distances between points. If that were not required, then rotations in spacetimes that are not isotropic would not need to preserve the intrinsic shape of an object, or the intrinsic properties that depend on its shape.⁵ But that is not relevant to the current argument. Given the extreme spacetime thesis with its claim that spacetime is isotropic, any transformation that could plausibly be called a rotation will be isometric, and thereby preserve shape. Thus, although I think Shen's attack on Markosian's argument based on the distinction between dynamic music and dynamic time is successful, it leaves me unsure how to interpret that attack. I thus ask Shen: where precisely do you think Markosian is smuggling in the illicit assumption? Which premise or premises of the argument does it require that one reject?

I conclude by briefly considering what we should say about Markosian's argument if we accept only a weaker spacetime thesis according to which the temporal dimension is (in some respects) similar, but not exactly similar, to the spatial dimensions. Since I assume that a

⁵ There is a more general notion of rotation that, for example, would allow one to speak of rotating an object in a Riemannian space with variable curvature. Under such a rotation, the distances between points may change resulting in "tidal forces" within the object. Intrinsic properties are not preserved under such rotations of this more general sort.

plausible spacetime thesis should be in line with current physics, let us consider the case of four-dimensional Minkowski spacetime, the spacetime posited by Einstein's special relativity. (The considerations below also apply to the curved spacetime posited by Einstein's general relativity.) We still have that spacetime is a unified four-dimensional manifold, but it is not isotropic: in any reference frame, the temporal dimension is distinguished from the spatial dimensions by the intrinsic geometry of the spacetime. Time and space are alike in some respects, different in others. Whether this counts, all things considered, as a view on which space is similar to space is a question too vague to be of interest. But certainly the main doctrines of what Markosian calls the "static theory of time" are compatible with Minkowski spacetime.

It is amusing to note that, in the context of Minkowski spacetime, Markosian's "sideways music" argument loses its intuitive force. For if we rotate a seven-note passage, say with the notes played on a piano about one second apart, the rotated passage will have the notes being played simultaneously but with each note about 200,000 miles from its neighboring note, nearly the distance to the moon.⁶ Not much of a cacophony there!

But let's get serious. The proposed rotation that turns the passage sideways is not a legitimate rotation in Minkowski spacetime: no timelike connected sequence of events can be rotated into a spacelike connected sequence of events if rotations are required to be isometric, to preserve (spatiotemporal) distance. For the events in the timelike sequence have a negative spacetime interval between them, and the spacelike sequence has a positive spacetime interval

⁶ Note that in Minkowski spacetime there is a single unit for measuring temporal and spatial intervals. If time is measured in seconds, space will also be measured in seconds, where a second of space is a light-second, the time it takes light to travel across that space.

(under the usual sign convention). The only legitimate rotations in Minkowski spacetime are given by the Lorentz transformations, and no such transformation can serve as the basis for Markosian's "sideways music" argument.

More generally, as soon as one switches out the extreme spacetime thesis for a less extreme, but physically more realistic, spacetime thesis, the inference from premise 1 to premise 2 of the argument fails: it will no longer be the case that any material object or event can be arbitrarily rotated in spacetime. The differences between the temporal and spatial dimensions will constrain what rotations are geometrically possible. In particular, the rotation that Markosian thinks destroys the dynamic aspect of a musical passage by turning it sideways will be off the table. Once we take seriously what physics tells us about the difference between time and space, Markosian's argument never gets off the ground.