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Appendix A: Bronstein's Dream Game

White: David Bronstein
Black: David Bronstein

1. d4 Nf6 2. c4 e6 3. Nc3 Bb4 4. Bg5 h6 5. Bh4 Qe7 6. Nf3 d6 7. Qa4+ Nc6 8. d5!? ed5: 9. cd5: Qe4! 10. Nd2 Qh4: 11. dc6: 0-0 12. a3? Ng4 13. g3 Qf6 14. ab4:? Qf2:+ 15. Kd1 Ne3+ 16. Kc1 b5! 17. Qb3 Be6 18. Qa3 Qe1+ 19. Nd1 Qd1:+ checkmate.

0-1

On the invariance and intrinsicality of four-dimensional shapes in Special Relativity

YURI BALASHOV

Are shapes of objects intrinsic to them? David Lewis (1986: 202–204) famously urged that they should be and used it to favour perdurance over endurance. Some philosophers have resisted this by contending that relations

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to times do not make spatial shapes objectionably extrinsic.[1] Special relativity (SR) adds a new dimension to the issue by relativizing three-dimensional (3D) spatial shapes not just to times, but to *times-in-frames*, due to Lorentz contraction.[2] What stands behind all the different 3D shapes, however, is an invariant four-dimensional (4D) shape of the spacetime region swept by an object throughout its lifetime. In fact, the invariance, and hence intrinsicality, of the 4D shapes in SR can be used to defend four-dimensionalism about persistence against three-dimensionalism[3] – if 4D shapes are indeed intrinsic in SR.

In a recent note, however, Matthew Davidson questions the intrinsicality of 4D shapes in SR. He considers three 4D objects, o, o_1 and o_2, in fast uniform relative motion, where o persists for only a minute:

> o_1 and o_2 see the entirety of o's 4D shape by perceiving a series of 3D shapes. The 4D shape o_1 'sees' is different than the shape o_2 sees due to differing amounts of Lorentz contraction; the 4D shape will be spatially thinner and will have a longer lifespan for o_1 than for o_2. Thus, it looks as though we also need to relativize 4D shape to reference frames; thus, 4D shape also is not intrinsic (Davidson 2014: 58, with minor changes in the notation).

This conclusion and the reasoning behind it are in error.

Let us set aside a potentially misleading 'seeing' metaphor[4] and focus on what really matters in the situation envisaged by Davidson: the various 3D and 4D shapes o actually *has* in different reference frames, no matter whether anyone 'sees' them. To fix ideas, suppose a 600-ft-diameter spherical object pops into existence at $t = 0$, persists at rest for 60 s, then goes out of existence. The shaded rectangle in Figure 1a represents the 4D shape of o in its rest frame (x,t), with two dimensions of space suppressed (the real 4D shape of o is hyper-cylindrical). The 3D spatial shapes of o at successive moments of time in (x,t) are 'horizontal' cross-sections of the shaded region, all featuring 600-ft-diameter 3D spheres. (The perdurantist will refer to them as temporal parts of o in (x,t).)

1 See, for example, Haslanger 2003 and references therein.

2 For a detailed account, see Balashov 2010, especially chapters 4 and 8.

3 As is done in Balashov 2010. For discussions of this argument, see Gibson and Pooley 2006, Gilmore 2008, and Sattig, forthcoming, chapter 8.

4 The visual appearance of rapidly moving objects is a combined result of two separate effects, the Lorentz contraction in the direction of motion and the fact that seeing requires receiving light emitted by the object's various parts when they arrive simultaneously at a particular point. See, in this connection, Weisskopf 1960.

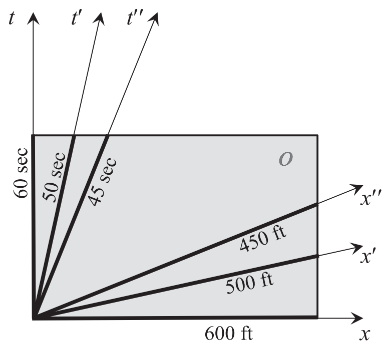

Figure 1a.

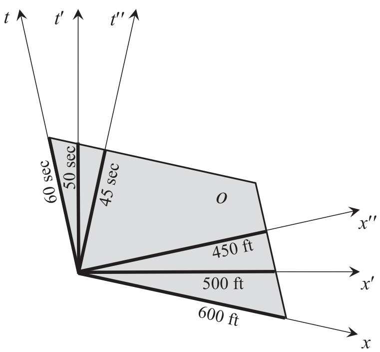

Figure 1b.

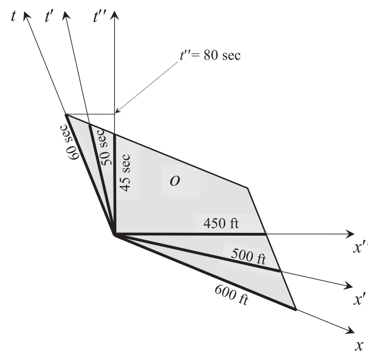

Figure 1c.

Now consider the same situation in the rest frames (x',t') and (x'',t'') of o_1 and o_2, moving relative to o.[5] The corresponding 3D spatial shapes of o at successive moments of time in (x',t') and (x'',t'') are again the 'horizontal' cross-sections of the shaded region. Their series are rather different from the series of o's 3D shapes in its rest frame. In (x',t') and (x'',t''), o emerges as a single point 'from the right,' then 'grows' to an ellipsoid with 500-ft or 450-ft cross-sections along the x direction, then shrinks to a single point 'on the left,' eventually going out of existence. As should be expected, the 3D shapes of o are relative to times-in-frames, due to Lorentz contraction (Figures 1b and 1c).

5 For simplicity, the velocities of o_1 and o_2 in the x direction are chosen so that the contraction/dilation factors $\beta = 1/\sqrt{(1 - v^2/c^2)}$ between (x',t') and (x,t), and between (x'',t'') and (x,t) are, respectively, 6/5 and 4/3. o_1 and o_2 themselves are omitted from Figures 1b and c.

Crucially, however (and contrary to Davidson), the *4D* shape of *o* – the hyper-cylindrical shape of all three shaded regions in Figures 1a–c – is *the same*. It is filled up by different series of *o*'s 3D shapes in different reference frames; but the result of this filling up is the same 4D shaded 'world-volume' of *o*. The fact that it *looks* different in Figures 1b and c[6] is due to the inevitable distortion in representing non-Euclidean relations inherent in relativistic spacetime in purely Euclidean diagrams. Figures 1a–c depict the *same* 4D state of affairs from different perspectives associated with different inertial reference frames. Davidson's mistake originates in a confusion of the invariant 4D shape of *o* in Minkowski spacetime with its *projections* on the spatial (and the temporal, see below) axes of particular reference frames. Once this confusion is cleared up, the invariance, and hence intrinsicality, of 4D shapes in SR is vindicated.

I end by offering another correction to Davidson's reasoning in the above-quoted passage. He says that the 4D shape of *o* will have a *longer* frame-relative lifespan in (x'',t'') than in (x',t'). In fact, this shape will have a *shorter* 'lifespan' in (x'',t''), namely 45 s, than in (x',t'), where it is 50 s, and both are shorter than the proper lifetime of *o* in its rest frame (60 s). I put 'lifespan' in quotes because it is not immediately clear what the lifespan of a *shape* is. On a charitable reading of Davidson (reflected in Figures 1a–c), the 'lifespan' of the 4D shape of *o* in (x'',t''), say, is simply the duration of its *projection* along the t''-axis, that is 45 s. This hardly has much to do with the *lifetime* of *o itself* in (x'',t''). A much better candidate for the latter role would be the lifetime of any *material part* of *o*, *as determined in* (x'',t''). Consider, for example, the leftmost material part of *o*. *Its* lifetime, as determined in (x'',t''), is in fact *longer* (80 s, see Figure 1c) than its proper lifetime (and the proper time of the whole object *o*) in its rest frame, due to relativistic time dilation.

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6 And that certain line segments *look* longer than others, where they should be shorter. It is also notoriously difficult to draw such diagrams 'to scale.'

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Inconsistency in Sartre's analysis of emotion

SARAH RICHMOND

Anthony Hatzimoysis disagrees[1] with my claim, set out in Richmond 2010, that Sartre's *Sketch for a Theory of the Emotions* (hereafter *Sketch*)[2] offers two lines of reasoning about emotional experience that are in clear conflict with each other. He argues that we can and should read Sartre's text in a way that avoids attributing inconsistency to Sartre and he goes on to show how – in his view – this can be done.

Although Hatzimoysis offers an interesting way of expanding on something that Sartre says, his suggestion about how one might read the text does nothing to remove the central inconsistency that I have discussed: with respect to *that* aim, Hatzimoysis's suggestion is a red herring. *Pace* Hatzimoysis, the inconsistency remains.

To recap my claim: in the *Sketch*, Sartre's *dominant* line of thought about emotion is that it is a 'magical' strategy, to which people resort when they encounter practical difficulty, to escape that difficulty. They do this by changing its appearance, i.e., by making it disappear. And these difficult appearances are altered by altering the *consciousness* of them.

Sartre puts it like this:

> [Emotion] is a transformation of the world. When the paths before us become too difficult, or when we cannot see our way, we can no longer put up with such an exacting and difficult world. All ways are barred and nevertheless we must act. So then we try and to change the world; that is, to live it as though the relations between things and their potentialities were not governed by deterministic processes but by magic.[3]

For Sartre, emotion is not something that the subject passively undergoes; it is a purposive, irrational and escapist strategy. The 'purpose' of emotional

1 Hatzimoysis 2014.

2 Sartre 1939.

3 Sartre 1939: 39-40.

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