

## Then and back again - on the incompatibility of supersubstantivalism and time travel

The supersubstantivalist, grossly oversimplified, believes that material objects are identical to the space-time regions they occupy. The eventual possibility of backwards time travel is often used in philosophical discussion to shed light on our intuitions regarding temporal phenomena. Are these notions compatible? That is: is there some possible model, or world, where both supersubstantivalism holds and objects can travel backwards through time? In this talk I will present parts of a work in progress where I show that there are no such settings. If we assume that both notions hold, we end up with contradiction. This is because settings which involve time travel lead to problems of co-location, and co-location is prohibited by supersubstantivalism. It follows that if supersubstantivalism is considered a *metaphysical necessity*, then backwards time travel is *metaphysically impossible*. The converse also holds: if time travel is metaphysically possible, then supersubstantivalism cannot be a metaphysical necessity. I remain agnostic on which of these alternative one might prefer.

I show this by setting up an example of my own design, inspired by Hilary Putnam. He believed that one could discuss time travel rationally using space-time diagrams and I employ this method in my argument — this allows us to clearly illustrate that time travel leads to problems of double occupancy. A body which changes its direction through time will always pass through an earlier instance of itself. From there, it is easy to apply some mereological principles to show that time travel is incompatible with supersubstantivalism: supersubstantivalism does not allow for co-location of material objects. If we want to hold on to the notion that supersubstantivalism is necessary, and time travel possible, the only way out seems to be to argue that any instance of co-location is actually an instance of fusing — that the two bodies compose a single object. I will show, however, that this defence leads to strange paradoxes, such as regions being both black and white all over.

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