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Can Collective Causation Resolve the Paradox of Before-Effect?: A Critique of Yi's Solution

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【Abstract】 Recently Byeong-Uk Yi has attempted to provide a novel solution to the paradox of before-effect by arguing that, upon drawing our attention to the notion of collective causation, we realize that there is a straightforward solution to the paradox. My aim in this paper is to show that Yi's solution fails. To this end, after making explicit two sources of the puzzlement in the paradox of before-effect, I set two requirements one must meet to resolve the paradox. And I argue that Yi's solution cannot meet both requirements at the same time.

【Key Words】 The Paradox of Before-Effect, Zeno Series, Collective Causation, Benardete, Yi.

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1. Introduction

Since Zeno, philosophers have noticed that the concept of infinity raises deep paradoxes on space, time, motion, classes and chances. A few decades ago, Jose Benardete (1964) argued that the list should go on. He argues that the concept of infinity also generates an unnoticed paradox on causation by presenting three puzzles as three instances of what he calls the paradox of before-effect. Recently Byeong-Uk Yi (2008) has attempted to provide a novel solution to the paradox of before-effect. He argues that, upon drawing our attention to the notion of collective causation, we realize that there is a straightforward solution to the first two puzzles and the solution can *mutatis mutandis* be extended to resolve the third puzzle as well. Yi's solution shed new light on unnoticed conceptual space in which we may address issues on causation. However, I will argue that his solution fails. On close examination, there are two sources of the puzzlement in the paradox of before-effect which set two requirements one must satisfy to resolve the paradox. Yi's solution, as we will see, cannot meet the two requirements at the same time.

2. Yi's Solution

One of the puzzles Benardete presents is as follows:

> A man is shot through the heart during the last half of a minute by A. B shoots him through the heart during the preceding ¼ minute, C during the 1/8 minute before that, &c. And so on *ad infinitum*. Assuming that each shot kills instantly (if the man were alive), the man must be already dead before each shot. Thus he cannot be said to have died of a bullet would. Here again the infinite sequence logically entails a before-effect. (Benardete 1964, p. 259.)

Clearly this case is puzzling. Why then is the shooting case puzzling? Benardete seems to suggest that the shooting case is puzzling because it includes a before-effect – i.e., an effect that is temporally prior to its cause. After showing that the man must be already dead before each shot and thus that he cannot be said to have died of any single bullet, Benardete concludes that the man's being dead is a before-effect of the infinite sequence of shots: the man is dead even before what will kill him exists.

One might be tempted to admit the idea that the shooting case is paradoxical simply because it includes a before-effect. A moment's reflection, however, suggests that we should resist the idea. As Yi points out, from the fact that the man (call him Sam) must be already dead before each shot and thus he cannot be said to have died of any single bullet, it does not follow that Sam's being dead is temporally prior to its cause. (What is the cause of Sam's being dead in the first place?) What follows is only that "none of the shots causes his death individually" (Yi, 2008, p. 136).

What then causes Sam to be dead? To see Yi's answer, let t be the last instant at which Sam will be alive, and t_0, t_1, t_2, and so on be the instants that are after t by 1 minute, ½ minute, ¼

minute, and so on respectively.[1] Sam will be alive at t and before t. Now take some instant after t, say t_1. Why will he be dead at t_1? Once we draw our attention to the obvious possibility that plural things may collectively cause something, claims Yi, we can easily find the cause of Sam's being dead at t_1. So, he says, "[t]he obvious reason [why Sam will be dead at t_1] is that he will have been hit by many, infinitely many shots ⋯ by that instant: the bullets of those shots will have pierced his heart by then." And, clearly, Sam's death at t_1 is not temporally prior to those shots by t_1. Since t_1 is arbitrarily chosen, the argument can be generalized: for any instant t* after t, Sam's being dead at t* has as its cause the plural shots which reach Sam's heart by t* without being temporally prior to them.[2] This is Yi's solution.

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1) Benardete and Yi assume that the smallest units of time or 0-sized temporal 'atoms' exist. One might think that an obvious way to resolve the puzzle is to reject the assumption that there are instants, the assumption that has long received many espousers since Zeno and Aristotle. If one rejects the assumption, one might have what we may call the "no instants" view, according to which there are only finite sized, larger or smaller, intervals, but there are no smallest ones. Two remarks are in order. First, the no instants view is a radical view. As Arntzenius (2000, p. 188) pointed out, given the no instants view, it is not obvious how one could do mathematical physics in the familiar manner: "the development of the position of an object over a period of time cannot be represented by a point-valued function of x(t) from the real numbers to the real numbers." Secondly, there is no clear reason for thinking that the puzzle depends on the existence of instants. The puzzle can be constructed out of some finite sized time intervals instead of instants.

2) It should be noted that it is not part of Yi's solution that there must be *some particular instant* at which the plural shots by then cause Sam to be dead. If not, his solution would face an obvious objection: it is arbitrary to pick out one particular instant unless he gives no principled reason. As we

3. Collective Causation and Super-Collective Causation

Yi's solution essentially relies on the notion of collective causation. Is the appeal to collective causation legitimate? Yi seems to think that the appeal to collective causation is not problematic at all because we are all familiar with cases of collective causation. It is true that the notion of collective causation is well-understood: when a piano is too heavy to be hauled by one person, several people may do it together; when two stones hit a window simultaneously, both stones may break the window though each one is sufficient for the breakage.

However, the kind of collective causation on which Yi relies is not the one we find in the familiar cases. Let us say that plural things *jointly cause* something just in case each of the plural things is necessary, but not sufficient, for the effect and they together cause the effect. Several people collectively haul a piano by jointly causing the piano to be moved. Let us say that plural things *causally overdetermine* something just in case each of the plural things is sufficient for the effect and each of them actually causes the effect. Two stones collectively break a window simultaneously by causally overdetermining the breakage of the window.

But, the case at issue is neither a case of joint causation nor a

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see above, Yi says that, for *any* time after t, Sam's being dead at that time is caused by the plural shots by that time. So, Yi's solution is not committed to such arbitrariness. I thank an anonymous referee for raising this possible problem with Yi's solution.

case of causal overdetermination. Why will Sam be dead at t_1? On Yi's solution, the plural shots by t_1 collectively cause Sam to be dead at t_1. If the plural shots are to jointly cause Sam to be dead at t_1, it must be the case that each of the plural shots is necessary, but not sufficient, for Sam's being dead. But, each of the plural shots, by hypothesis, is sufficient for Sam's being dead. So, the plural shots by t_1 do not jointly cause Sam to be dead at t_1. If the plural shots are to causally overdetermine Sam to be dead at t_1, it must be the case that each of the plural shots is sufficient for the effect and each of them actually causes the effect. But, recall that none of the plural shots causes Sam to be dead. So, the plural shots by t_1 do not causally overdetermine Sam to be dead at t_1. If the plural shots by t_1 collectively cause Sam to be dead at t_1, they do so neither by jointly causing it nor by causally overdetermining it. Let us say that plural things *super-collectively* cause something just in case the plural things taken together cause the effect though none of the plural things is a cause of the effect. According to Yi's solution, the plural shots by t_1 super-collectively cause Sam to be dead at t_1.

Super-collective causation is similar to causal overdetermination in some respects. In both cases, each of plural things is sufficient for an effect. One of the two stones alone is sufficient for breaking a window. Similarly, one of the many shots alone is sufficient for killing Sam. In both cases, it is wrong to think that one of the plural things is the *only* cause of an effect. It is not that only one of the two stones is the cause of the breakage of the window. Similarly, it is not that only one of the many shots

is the cause of Sam's being dead.

Nevertheless, there is a crucial difference between super-collective causation and causal overdetermination. In the case of causal overdetermination, each of plural things is a cause of an effect, but, in the case of super-collective causation, none of plural things is a cause of an effect. The reason why we should not think that only one of the two stones is the cause of the breakage is that each stone has equal claim to be the cause of the breakage. But, the reason why we should not think that only one of the many shots is the cause of Sam's being dead is that each shot does not have claim to be a cause.

This observation helps us see what is peculiar to super-collective causation. When plural things jointly cause or causally overdetermine something, the causal work of the plural things is grounded in the causal work of each of the plural things: each of the plural things partially or sufficiently contributes to the causal work of the plural things. In the familiar kinds of collective causation, collective causal work is somehow grounded in individual causal work. On the other hand, when plural things super-collectively cause something, the causal work of the plural things is not grounded in the causal work of any of the plural things. The plural shots cause Sam to be dead but each of the plural shots individually makes *no* causal contribution to Sam's death – not even a partial one. Super-collective causal work is in no sense grounded in individual causal work. It is irreducibly collective.

It seems clear (and I think Yi will agree) that finitely many

things cannot super-collectively cause something. A window has been broken. Stone 1 didn't make any causal contribution to the breakage. Stone 2 didn't do so either. It would be mysterious if, nonetheless, it were the case that Stone 1 and Stone 2 collectively caused the window to break. To generalize, for any n, when each of Stone 1, Stone 2, ⋯ and Stone n does not make any causal contribution to the breakage, it would be a big mystery if, nonetheless, it were the case that Stone 1, Stone 2, ⋯ and Stone n collectively cause the window to break.

It seems to me to be mysterious if things suddenly change when we consider infinitely many stones: it is no less mysterious to think that infinitely many stones collectively cause the window to break even if none of them makes any causal contribution to the breakage than to think that finitely many stones collectively cause the window to break even if none of them makes any causal contribution to the breakage. If one finds finite super-collective causation mysterious, it seems to me that one should find infinite super-collective causation mysterious as well. Saying that Sam's being dead is super-collectively caused seems to me to be no more than saying that the death is mysteriously caused.[3)]

3) Hawthorne (2000) argues that the mereological fusion of the infinitely many shots is the cause of Sam's being dead. On the basis of Hawthorne's proposal, one might try to explain away the mystery of super-collective causation, claiming that a mereological fusion is ontologically prior to its parts and thus that the fusion of infinitely many shots has its own causal work which is irreducible to the causal work of its parts. If the idea that a whole is ontologically prior to its parts is not implausible as Schaffer (2010) makes a case for it, it might be the case that Yi is wrong to think that

Perhaps I am wrong. What should be drawn from the above consideration might be only that we should enlarge our notion of causation to include super-collective causation. So, I will not insist that what I have considered poses a decisive problem for Yi's solution or that the notion of super-collective causation is incoherent or unintelligible. Nonetheless, this much is certain: contrary to what Yi suggests, our prior commitment to collective causation is not supportive of Yi's solution and the notion of collective causation on which Yi's solution relies is more puzzling than it might first seem.

4. Two Requirements

Let me assume that the notion of super-collective causation is intelligible. Does then Yi's solution resolve the puzzle? To answer this question, we need to clarify what makes the shooting case puzzling. One thing is for sure: it is not that the shooting case is puzzling because it includes a before-effect. To claim that Sam's being dead is a before-effect, one must show that Sam's being dead is temporally prior to its cause. And, to do so, one must identify the cause of Sam's being dead first. However, it seems that our predicament is not that we are forced to think that

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Hawthorne "invokes the fusion of the bullets as an idle detour"(2008, p. 135; fn 6). But, this is not to say that the appeal to the priority of a whole to parts solves the paradox. Its role is only to make more sense of the notion of super-collective causation.

Sam's being dead is temporally prior to the cause we identified but that we don't know how to identify its cause in the first place.[4)]

It is not the existence of a before-effect but our conceptual difficulty with the notion of before-effect that plays a key role in creating the puzzlement. Given the description of the shooting situation, intuitively, it seems that, if Sam is dead, his death is due to one of the shots. Consider one particular shot as the putative cause of Sam's being dead. But, we soon realize that the putative cause cannot be the genuine cause of Sam's being dead because, if we assume so, since Sam must be already dead before the putative cause, Sam's being dead would be temporally prior to its cause – i.e., Sam's being dead would be a before-effect. So, if before-effects are banned, any putative cause must not be the genuine cause. The shooting case is paradoxical because, though Sam is dead, given the ban on before-effect, there cannot

4) It should be noted that what makes the shooting case puzzling is not simply because the case includes some uncaused event. Quantum events might be uncaused events. But we would not find them as puzzling as the shooting case. Even if there are no causes of quantum events, our concepts do not rule out the possibility that they have their causes: positing their causes would not incur any serious conceptual difficulty. On the other hand, in the shooting case, it seems that our relevant concepts dictate that there *can* be no cause of Sam's death. The existence of the universe might be uncaused. But we would not find the uncaused existence of the universe as paradoxical as the shooting case. Even if the existence of the universe is uncaused, the existence of the universe preserves our notion of causation with respect to familiar things other than the universe as a limiting case. On the other hand, in the shooting case, our notion of causation is jeopardized within the familiar domain.

be the cause of his death.

This gives us one requirement any proper solution to the puzzle must meet: In order to resolve the puzzle, one must identify what is or what are causally responsible for Sam's death *without violating the ban on before-effect*. Let us call it the before-effect requirement.

Yi also seems to take the before-effect requirement as his guiding idea as he emphasizes that his solution identifies what are causally responsible for Sam's being dead at a certain instant – i.e., plural shots by that instant – without implying that Sam's death is a before-effect of the identified causes. If the before-effect requirement is the only requirement to be met, Yi's solution might seem to resolve the puzzle. However, the before-effect requirement is not the only thing one must satisfy to resolve the puzzle because, on close examination, we will find another source of the puzzlement other than the ban on before-effect.

I scoop a chunk of snow (call it Charlie) at t and change its shape into a snowball. Charlie's shape keeps changing. But, obviously, Charlie does not change its shape by itself: Charlie's previous shape alone does not entail its later shape. I do something to change Charlie's previous shape into a later one. So, my action is at least a partial cause of Charlie's shape at an instant after t. Charlie's shape or the state of being shaped in general is "malleable."

However, not all states are malleable. We will all die at some point. And, once we die at some instant, our being dead, by its

nature, holds at any instant after that instant. Some people might honor our death. Some people might act as if we were not dead. Nevertheless, they cannot do anything – not even partially – to our being dead. Once we are dead, there can be no causal work to be done to our being dead. Let us say that a state is *rigid* just in case, once it holds at some point, the state, by its nature, holds at all points after that point without allowing any causal influence on its being held.[5] Our being dead or the state of being dead in general is rigid.

With the rigidity of death in mind, let us return to the shooting case. Recall that our predicament arises from the fact that there can be no first instant at which Sam is dead: for any bullet which reaches Sam, previous bullets reach Sam before the bullet. If we suppose that t is the last instant at which Sam is alive, the fact can be characterized as what we may call Temporal Infinite Regress in the following way:

Temporal Infinite Regress: For any t* after t, if Sam is dead at t*, there must be some prior instant t** such that Sam is dead at t**.[6]

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5) A certain state might be rigid only apparently. Suppose that there is a powerful chain – so powerful that, once one thing is fastened to another with the chain, the two things can never be separated by anything physically possible. In this case, once the two things are chained at some instant, the state of the two things being fastened together holds at any time after that instant. But, the perpetual hanging-together is not due to the nature of the state of being fastened in general. Thus, the state of the two things being fastened together is not rigid in the current sense.

6) *Proof*: Assume that, for some instant t* after t, Sam is dead at t*. Note that there are (infinitely) many bullets which reach Sam's heart before t*. If

Given the fact that the state of being dead is rigid, Temporal Infinite Regress entails that, for any t* after t, all shots (and any other things) at t* or after t* cannot (even partially) cause Sam to be dead because there is some prior instant t** before t* at which Sam is already dead. Sam is already dead at t**. So, there can be no causal work to be done to Sam's being dead at t*. Nothing at t* or after t* makes a causal contribution to Sam's being dead. The same goes for any instant after t. No shot is the cause of Sam's being dead though Sam is dead. This explains why the shooting case is paradoxical.

This observation gives us another requirement any proper solution to the puzzle must satisfy: In order to resolve the puzzle, one must identify what is or what are causally responsible for Sam's death *without violating the rigidity of death*. Let us call it the rigidity requirement.

It should be noted that, as we have just seen, one can find the shooting case puzzling without considering the ban on before-effect because the rigidity of death alone may lead us to the puzzlement. Thus, even if one does not take a stand on the possibility of before-effect,[7] as long as one admits that the state

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Sam, nonetheless, were not dead before t*, it would be the case that none of the bullets before t* can kill Sam, which contradicts the assumption that each shot can kill Sam instantly. So, there must be some instant t** before t* at which Sam is dead at t**.

7) Suppose that a fortune teller "sees" a future event and predicts that the event will occur. If this is really possible, her prediction would be a before-effect because her prediction is temporally prior to its cause: the existence of the future event causes her to see the event and her seeing the event causes her to make the prediction. Is this case really possible? I do

of being dead is rigid, one should find the shooting case paradoxical. Consider some shot which reaches Sam at t* after t. Sam is already dead before t*. Why can't we think that Sam's being dead is nonetheless caused by the shot at t*? If we accept the ban on before-effect, we can't: Sam's being dead would be a before-effect of the shot at t*. But, even if we do not rely on the ban on before-effect, we can't think that Sam's being dead is caused by the shot at t* if we accept that the state of being dead is rigid: since Sam is already dead before t*, nothing at or after t* can make a causal contribution to Sam's being dead.

It is worth noting that we can extend the rigidity requirement to explain why Benardete's third puzzle is paradoxical. The puzzle goes as follows:

> A man decides to walk on mile from A to B. A god waits in readiness to throw up a wall blocking the man's further advance when the man has traveled ½ mile. A second god (unknown to the first) waits in readiness to throw up a wall of his own blocking the man's further advance when the man has traveled ¼ mile. A third god ⋯ &c. ad infinitum. It is clear that this sequence of mere intentions (assuming the contrary-to-fact conditional that each god would succeed in executing his intention if given the opportunity) logically entails the consequence that the man will be arrested at point A; he will not e able to advance beyond it, even though not a single wall will in fact be thrown down in his path. The before-effect here will be described by the man as a strange filed of force blocking his advance forward. (Ibid., p. 259)

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not know. But, it seems clear that this case seems to be too contentious to be something to which one may appeal in order to deny the before-effect requirement.

The above case is surely paradoxical. Why is the god case puzzling? It seems clear that we cannot explain the puzzlement by claiming that the god case involves a before-effect. Again let us call the man in the case Sam. If Sam cannot proceed beyond A, it seems to be because some wall or walls will block his advance. But, the description of the case ensures that no wall will be thrown down. So, in this case, there seems to be no cause, not even a putative one. We do not have any resources which allow us to talk about a before-effect.

It is also unclear whether we can think that the ban on before-effect plays a role in creating our puzzlement. In the god case, it seems that there is no *putative* cause in the first place because if Sam cannot advance beyond A, it would be due to walls thrown down by gods. But, in fact, no wall will be thrown down! This makes it hard, if not impossible, to think that the source of our puzzlement is the ban on before-effect.

On the other hand, we can explain why the god case is paradoxical in light of the rigidity requirement. Why is it the case that Sam cannot advance beyond A? This question is obviously equivalent to asking why it is the case that, for any position p after A, Sam is unable to advance beyond p. To see why we may think that there is no cause of Sam's being unable to advance beyond p, we should first note that Sam's being unable to advance beyond p is a rigid state. Suppose that, for some position p, Sam is unable to advance beyond p. If so, to prevent Sam from advancing beyond q for some q after p, one does not have to do anything: if Sam is unable to advance beyond p, for

any position q after p, it directly follows that Sam is unable to advance beyond q. And, once Sam is unable to advance beyond p, one *cannot* do anything to causally contribute to Sam's being unable to advance beyond q. If Sam is in the state of being unable to advance beyond p, then the state of being unable to advance further holds at p and, thereby, it follows that the state holds at all positions after p without allowing any causal influence on its being held. Sam's state of being unable to advance beyond p after A and the state of being unable to advance beyond some spatial position in general is rigid.

This helps us find a structural similarity between the shooting case and the god case. Just as Temporal Infinite Regress serves to generate the puzzlement in the shooting case, its spatial analogue which we may call Spatial Infinite Regress serves to generate the puzzlement. To see this, we should note that Spatial Infinite Regress holds in the god case as follow:

> Spatial Infinite Regress: For any position p after A, if Sam is unable to advance beyond p, there must be some prior position q such that Sam is unable to advance beyond q.[8)]

8) *Proof*: Assume that, for some position p after A, Sam is unable to advance beyond p. Suppose, for *reductio ad absurdum*, that there is no position q prior to p such that Sam is unable to advance beyond q. Then, there must be some position r between A and p such that Sam occupies r. But this is impossible because, since Sam can occupy r only by advancing positions before r, there must have been walls thrown down before r which would block Sam's advance. Thus, there must be some position q prior to p such that Sam is unable to advance beyond q.

Given the fact that the state of being unable to advance beyond some position is rigid, Spatial Infinite Regress entails that, for any position p after A, all walls and any other things at p and after p cannot (even partially) cause Sam to be unable to advance beyond p. For any position p after A, there is some prior position q such that anything at p and after p can make no causal contribution to Sam's being unable to advance beyond p. So, Sam cannot move forward beyond A although nothing causes Sam to be unable to advance beyond A. This explains why the god case is paradoxical.[9)]

As we have seen, we can explain why the shooting case and the god case are paradoxical on the basis of the rigidity requirement. Since Benardete's second puzzle is essentially the same as the shooting case, we are now given an opportunity to have a general account of the paradox of before-effect. A puzzle of before-effect is a puzzling situation where a rigid state holds but it lacks its cause because, since there is no first point from which it holds, for any point after a relevant lower bound whether temporal or spatial, the state already holds before the point, which prevents anything after the lower bound from making

9) The state of being dead is rigid on the grounds that the state must hold at some particular time and it automatically holds after that time. This might tempt one to think that the notion of rigidity has a direct bearing on the notion of time direction. But, it should now be clear that it is not so. The state of being unable to advance beyond some spatial point is rigid on the grounds that the state must hold at some particular location and it automatically holds after the location. The sense of 'after' is clearly not temporal. I thank an anonymous referee for asking me for an explanation of the relationship between the notion of rigidity and that of time direction.

a causal contribution to the state.

To sum up this section, in order to resolve the puzzle of the shooting case, one must meet the before-effect requirement and the rigidity requirement. In other words, to resolve the puzzle, one must identify what is or what are causally responsible for Sam's being dead without implying that Sam's being dead is a before-effect or it is not rigid.

5. Yi's Solution Reconsidered

With the two requirements in mind, let us return to Yi's solution to the puzzle of the shooting case. Consider an instant t_n after t which is the last instant at which Sam is alive. Surely, Sam will be dead at t_n. Why will he be dead at t_n? According to Yi's solution, the (infinitely) many shots which will have reached Sam's heart by t_n super-collectively cause Sam to be dead at t_n: the plural shots by t_n cause Sam to be dead though none of the plural shots is a cause of it. So, on Yi's solution, the following is true:

(1) The plural shots by t_n super-collectively cause Sam to be dead at t_n.

But, there is nothing special about t_n. So, on Yi's solution, for t_m which is after t and before t_n, Sam will be dead at t_m because

the following is true:

(2) The plural shots by t_m super-collectively cause Sam to be dead at t_m.

Now it seems that (1) and (2) conflict with the fact that the state of being dead is rigid. Given (2), Sam is dead at t_m. Given the rigidity of death, it follows that Sam is dead at any instant after t_m, and that nothing after t_m can make a causal contribution to Sam's being dead at any instant after t_m. So, since t_n is after t_m, nothing at t_n or after t_n can causally contribute to Sam's being dead at t_n. Since the plural shots by t_n in (1) exist at t_n or after t_n, it follows that the plural shots by t_n do not make any causal contribution to Sam's being dead at t_n. This contradicts (1).

In the argument, I assumed that the plural shots by t_n exist at t_n or after t_n. If, however, the assumption were false, (2) would not contradict (1). Can one deny that the plural shots by t_n exist at t_n or after t_n or, equivalently, that the plural shots by t_n do not exist before t_n? It seems not. The plural shots by t_n essentially include a shot at t_n. But, at any instant before t_n, the shot at t_n does not exist yet. So, the plural shots do not exist at any instant before t_n. The plural shots by t_n exist at t_n or after t_n. Thus, given that the state of being dead is rigid, (2) contradicts (1).

Since t_n and t_m are two arbitrarily chosen instants after t, the argument can be generalized. On Yi's solution, for any instant t* after t, there is some instant t** prior to t* such that the plural shots by t** super-collectively cause Sam to be dead. So, given

that the state of being dead is rigid, it follows that, for any instant t* after t, no things at t* or after t* can make a causal contribution to Sam's being dead at t*. If there are some things which cause Sam to be dead, those things must exist at some instant after t. So, no things cause Sam to be dead. The mystery has come back. Yi's solution fails because it fails to meet the rigidity requirement.

Unless one denies that the state of being dead is rigid, Yi's solution seems to fail. Would it be possible to insist that what the shooting case shows is that the state of being dead is not rigid? If the state of being dead is not rigid, one may causally contribute to someone's being dead even after he or she is dead. But, to do so, what could one do? People might try to "kill" someone by defaming him or her even after his or her death. But, even so, they can in no genuine sense kill the person when he or she is already dead. One cannot resolve the puzzle by insisting that the state of being dead is not rigid without creating another sort of puzzlement which is no less paradoxical than the original one is.

So, it seems to be not an option to deny that the state of being dead is rigid. How then would Yi respond to my argument? As far as I can imagine, Yi might try to respond by making two revisions. What the above argument shows is that, for any *two* instants t_m and t_n where t_m is before t_n, the plural shots by t_m causally preempt the plural shots by t_n, and that, since any instant has always some prior instant, no plural shots can make a causal contribution to Sam's being dead. So, Yi

might revise his solution to the effect that there is a *unique* instant such that plural shots by that instant and only those shots super-collectively cause Sam to be dead. What then would be the privileged instant? The only plausible candidate would be the last instant (call it T) at which the last shot reaches Sam's heart: the plural shots by T or, simply, the total shots super-collectively cause Sam to be dead.

The second necessary revision is the weakening of the rigidity of death. Suppose that the total shots and only the total shots super-collectively cause Sam to be dead. But, this still violates the rigidity of death. Sam is dead even before T: there are (infinitely) many shots which reach Sam before T. So, given the rigidity of death, it follows that nothing or no things at T can make a causal contribution to Sam's being dead. This contradicts the supposition that the total shots cause Sam to be dead because the total shots exist only at T or after T because the total shots essentially include the last shot but the last shot does not yet exist at any instant before T. So, Yi must weaken the rigidity of death. Let us say that a state is *indirectly* rigid just in case, once it holds, nothing at or after the point at which *its cause* (not the state) exists can make a causal contribution to the state being held. Given that the total shots (at T) cause Sam to be dead, the indirect rigidity of death deprives all things *after* T of their causal contribution to Sam's being dead. But, the causal work by the total shots remains intact.

Once the two revisions are made, Yi might have a revised solution to the puzzle along the lines of his original solution: the

total shots and only the total shots super-collectively cause Sam to be dead at any instant after t. Let us call it the revised solution.

The revised solution relies on the weakening of the rigidity of death. But is the indirect rigidity of death good enough to accommodate what is behind the rigidity of death? I am not so sure. But, in any case, it will not matter whether the indirect rigidity of death is correct because, even if the revised solution meets the indirect rigidity of death, it fails to meet the before-effect requirement. According to the revised solution, the total shots super-collectively cause Sam to be dead at any instant after t. Consider Sam's being dead at t* which is between t and T. The total shots exist at T or after T. But Sam is dead at t* even before T. Doesn't this entail that Sam's being dead at t* is a before-effect of the total shots?

Yi might think not. When Benardete defines a before-effect, he presupposes that the cause of a before-effect is a *single* event. Yi extends the definition to cover cases of collective causation as follows (Ibid., p. 136; fn 7):

> (Y) The effect of some events, which collectively cause it, is a before-effect if and only if it is temporally prior to *any* of the events.

Given (Y), Sam's being dead at t* would not be a before-effect of the total shots because Sam's being dead at t* is temporally posterior to some of the total shots.

But, is (Y) a correct extension of the original definition? What if we define a before-effect in the case of collective causation as follows?

> (Y*) The effect of some events, which collectively cause it, is a before-effect if and only if it is temporally prior to *some* of the events.

Given (Y*), Sam's being dead at t* would be a before-effect of the total shots because Sam's being dead at t* is temporally prior to some of the total shots. To deny that Sam's being dead at t* is a before-effect of the total shots, Yi must provide good reason for accepting (Y), but not (Y*). But it is unclear to me what could be such reason.

I have no intention to argue that (Y*) is correct or better than (Y) because I think both (Y) and (Y*) are on the wrong track or at least irrelevant in the present context. Suppose that some plural events collectively cause another event *e*. To determine whether *e* is a before-effect, according to (Y), we should consider whether *e* is temporally prior to some of the plural events. However, considering whether *e* is temporally prior to some of the plural events would have no point if none of the plural events is a cause of *e*. Why would we think that *e* is a before-effect of *e** on the ground that *e* is temporally prior to *e** if *e** is after all not a cause of *e*? So, if the plural events *super-collectively* cause *e*, since none of the plural things is a cause of *e*, whether *e* is temporally prior to some or any of the plural events would not

have any bearing on whether *e* is a before-effect. Thus, Yi cannot help himself to (Y) to deny that Sam's being dead at t* is not a before-effect because (Y) is useless in determining whether an effect is a before-effect in the case of super-collective causation.

On the other hand, it seems there is a clear sense in which Sam's being dead at t* is temporally prior to its causes. Recall that the total shots *taken together* cause Sam to be dead at t* while none of the shots is a cause of Sam's being dead at t*. Their causal work is irreducible to any causal work of each of them. So, the causes of Sam's being dead at t* would not exist unless the total shots exist. Sam is dead at t*. But, the total shots do not exist at t*: in order for the total shots to exist, (infinitely many) more shots after t* have yet to come. So, no cause or no causes of Sam's being dead at t* can be found at t* because the total shots do not exist before T. If the total shots super-collectively cause Sam to be dead at t*, Sam's being dead at t* turns out to be a before-effect. The revised solution fails because it fails to meet the before-effect requirement.

In order to resolve the paradox of before-effect, one must meet the before-effect requirement and the rigidity requirement. Yi's solution fails because it fails to meet the rigidity requirement.[10] And the revised solution fails because it fails to meet the before-effect requirement. As opposed to Yi's claim, it is hard to think that we can resolve the paradox of before-effect straightforwardly by appealing to the notion of collective

[10] I did not consider whether Yi's solution fails to meet the indirect rigidity requirement. But it should be clear that it does not meet the indirect rigidity requirement as well.

causation.

If my argument is right, it does not help in resolving the paradox of before-effect to employ the notion of super-collective causation. How can one resolve the paradox then? I don't know. But, it seems that Yi's solution does not solve it anyway.[11)]

6. Concluding Remarks

I have argued that Yi's solution fails to resolve the paradox of before-effect by focusing on the shooting case. But it might be thought that my argument works only against Yi's solution to the shooting case but not his solution to the god case, and that my argument, therefore, fails to refute the appeal to collective causation altogether. I wish to close by making some brief remarks on Yi's solution to the god case.

Yi's solution to the god case has two prongs. First, he argues

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11) Two remarks are worth making. John Hawthorne (2000) also provided a solution to the paradox of before-effect which is similar to Yi's in important respects. I believe that my argument against Yi's solution, *mutatis mutandis*, will work against Hawthorne's as well. I will leave how it is so for another occasion. Secondly, it should be noted that it can be no solution to the paradox to simply claim that Sam's being dead is uncaused because, given the description of the shooting case, it is not possible to pick out the cause. (An anonymous referee suggested something in the vicinity of the claim as a possible solution to the paradox. But, recall that the fact that there is apparently no cause of Sam's death initiated the paradox. If one says that there is really no cause of Sam's death, one simply admits that the paradox is unsolvable: we must give up our notion of causation. See, also, fn. 4.

that, in order for the god case to be physically possible, the original case must be understood as some case including infinitely many particles or some other case in the neighborhood. In the second part, he argues that, in the reconstructed situation, the infinitely many particles collectively cause Sam to be unable to advance beyond A. I have no objection to the second part, for I believe that the reconstructed situation is a situation where infinitely many particles *jointly cause* Sam to be unable to advance beyond A. But, what Yi presupposes in the first part seems to me problematic. He presupposes that, in order for the god case to be an interesting puzzle, the god situation must be physically possible in the sense that it is compatible with actual laws of physics.

However, when we wonder whether some situation *can* happen, we do not have the physical reading of the modal auxiliary in mind as Yi does.[12] Rather we wonder whether the situation is among those situations where our relevant physical *concepts* such as time, space, motion, cause, effect, matter and so on more or less hold, not requiring that *all* actual laws of physics be true in the situation. The god case might be physically impossible in Yi's sense. But, there is a clear sense in which the case is possible in a broadly physical sense. And that sense, I think, should be sufficient for the set up of the god case. So, it seems the first part of Yi's solution does not get off the ground, which makes it hard to see how Yi's solution can work.

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12) Zoltan Szabo's draft "Tasks and Ultra-Tasks" (http://pantheon.yale.edu/~zs47/papers.htm) includes a useful discussion which is relevant to this issue.

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Can Collective Causation Resolve the Paradox of Before-Effect? : A Critique of Yi's Solution

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최근에 이병욱 교수는 집단인과개념을 이용함으로써 선행결과역설에 대한 새로운 해결방식을 제시하고자 했다. 이 논문에서 필자는 이병욱 교수의 해결방식이 우리 인과개념에 대한 지평을 확장시켜 주는 기여를 하지만 선행결과역설에 대한 만족스런 해결이 되지 못함을 보이고자 한다. 필자는 우선 선행결과역설에 우리가 직면하고 있는 수수께끼의 두 가지 원천을 밝히고, 이 역설을 해결하기 위해 반드시 만족시켜야 할 두 가지 조건을 제시할 것이다. 그리고 이병욱 교수의 해결방식은 그 두 가지 조건을 동시에 충족시킬 수 없음을 논증할 것이다.

주요어: 선행결과역설, 제논의 무한연속, 집단인과, 베나데테, 이병욱