Review of: "Teleology, backward causation, and the nature of concepts. A study in non-locality of reason"

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1. This is a fascinating rumination on the topic of backward causality and how it relates to teleology. A major thrust of this manuscript involves whether concepts are “local” events rooted to specific points in space-time, or if instead they are nonlocal entities: that is, dimensionless entities existing independently of, and untethered to, space-time. The overall theme of concepts versus events is an important one, worthy of all the attention given in this manuscript.
2. The manuscript is meticulously and logically organized and carefully written, as befits a high-level philosophical treatment of ontology.
3. It would be helpful if the listed References all included dates (years) of publication.
4. Some of the most important philosophical ideas on causality come from David Hume, who in essence defined causes as phenomena preceding effects. Our very notion of causality depends on the concept of the forward passage of time. Hume and others (who obviously worked in a pre-modern physics world before developments in quantum physics) would hold that if time as we generally know it does not exist, or does not “move” as we generally presume it does, then causality is meaningless. [As the author states here near the start of section 5., “a purpose is always something belonging to the future of an action.” This is really what teleology historically depends on.] Please note that I offer this thought regarding Hume not as a criticism in opposition to this paper: rather, it shows why this paper is potentially so important in forcing us to address the topic of causality in a striking new way.
5. Although the author provides much food for thought, it would be nice to see additional commentary on or response to the small yet important existing literature concerning backward causality. There have been many discourses on backward causality, and specifically whether or not the idea makes sense and can occur. This manuscript properly takes account of some such sources, but there are other notable publications (for example, by Michela Bordignon and Hanoch Ben-Yami) that are neither cited nor dealt with here.
6. I am not an expert in quantum physics (I am an evolutionary biologist and philosopher of science), so I will leave it to specialists in that field to comment specifically, although I find it striking that many modern findings—for example, of quantum entanglement—cast serious doubt on traditional notions of causality.
7. I greatly appreciate that the author here considers how time and space operating at very small and very large scales (micro- and mega-) might have space-time effects that lead to different effects on causality. As an evolutionary biologist, I particularly appreciate the idea, often expressed by Richard Dawkins, that human minds evolved to comprehend time and space operating only on the “middle” (macro-) scale, and are stunningly ill-equipped to consider

tiny or vast distances over space and time. Thus regardless of whether micro- and mega- scales have different effects, we as humans (and probably other organisms too) are probably able to understand such scales only with great difficulty, if at all.

8. Although physics itself likely enables or prevents aspects of backward causation (and forward causation), I feel more qualified to comment on ways in which physiology affects it. It has been argued that limits to the human brain's processing speed and/or sensory perception (i.e., our becoming aware of some impinging sensory stimuli several hundred milliseconds or longer after they actually occur) means that traditional accounts of how we process or attribute causes and effects are unreliable.
9. There are also some great thoughts from the theoretical physicist Paul Davies on how people perceive time. Briefly, Davies argues that just as we occupy specific location in space, we might occupy single places in time, with only the illusion of time passing. Just as we continue to feel movement in space after we stop spinning or driving around a curve—because momentum on the fluid in our inner ears keeps bending sensory stereocilia, giving the illusion that we are still moving—it is possible that the constant moment-by-moment metabolic and other chemical processes occurring in our bodies means that things are always in flux, and we subjectively experience this as a one-way passage of time: a sort of story our brains make up to make sense of how we feel. There are many other such explanations that physicists provide for why we might feel as if we are moving through time even though we might not be. Obviously these things affect causality and teleology—and I understand that such things are not the subject of this paper, but I wish to point out that there are many other ways of thinking scientifically, not just philosophically, about causes and effects.
10. I do not disagree with the way the author outlines three versions of teleology, but I would caution that although this paper properly lays out and uses appropriate philosophical language to deal with teleology, other scholars, particularly in evolutionary biology, have considered these concepts quite effectively using different language. A prime example (with which the author of this piece is no doubt familiar) is Ernst Mayr's famous distinction between teleology versus teleonomy, the latter describing phenomena that *appear* to be goal-oriented but which in fact are explicable wholly via prior causes. Teleonomy is of course important because evolutionary biologists, like all scientists, eschew teleological explanations in favor of mechanistic explanations.
11. To that end, biologists never properly speak of the purpose of an organ such as a heart, because a purpose implies a goal, which evolution does not involve. Instead, biologists speak of the function of a heart. The key difference—which might seem trivial but which of course is fundamentally important—is that although hearts today indeed perform one or more functions, they did not evolve to achieve an intended purpose. Evolution generally works by modifying existing materials, and it is not difficult to imagine how muscle tissue used to move hard parts of an organism for locomotion could have been co-opted onto other internal parts of a body, such as a blood vessel or digestive tract, to propel liquids or solids through such tubes. It is also not difficult to see that hearts could exist as very different kinds of pumps, such as continuous rather than pulsatile pumps. Continuous pumps, like the fuel and water pumps in an automobile engine, are far more efficient than pulsatile pumps, which propel spurts of fluid followed by pauses in which nothing is pumped. If animal bodies had non-pulsatile pumps, they would not have to contend with high blood pressures and rapid changes in vascular pressure, nor with failures (such as aneurysms and strokes) that accompany

pulsatile pumps. In short, muscular hearts work quite well but could have been designed (with teleological foresight) much better than they actually exist. It is easy to look at phenomena in hindsight, but nature, unlike the human mind, cannot look ahead with foresight. As another example, insect wings are presumed to have originated as thermoregulatory structures to gather solar radiation and heat up an insect's body. Thus an explanation of how such wings came to exist can be given that does not involve flight at all, but rather involves one functional structure being exploited for a new function—a non-teleological and purely mechanistic (and therefore testable and falsifiable) explanation.

12. Concerning functional explanations, it is important to bear in mind that many objects or phenomena have intended/intentional functions, but also accidental or coincidental functions. If, while walking, I step on a worm, I would still probably not consider that my shoe's function is to be a worm-killer. A shoe can serve many functions. It can be, among countless other things in addition to a cushioning shelter for my foot, a hammer, paperweight, flyswatter, coaster, flower planter, or even a cup from which to drink. But I presume that all these functions are not what "caused" my shoe to be designed or constructed (i.e., to come into existence).
13. In short, I enjoyed reading the author's ideas about Kant and Wittgenstein, and about purposive and reflective ("as if") types of teleology, but because of different approaches (and terminology) in science, scientists generally speak of teleology only in the strict Aristotelian sense that the author lists here as his first idea of teleology. I don't dispute the assertion that many accounts or understandings of teleology combine the three concepts outlined here, but empirical and theoretical scientists have ways to address the concept of "purpose" non-teleologically. That said, this paper really made me think.