Time Dependence of Chance

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Introduction

Do I have a non-zero chance of honoring the deadline that I already missed yesterday? David Lewis would say no: what is past is not chancy anymore (Lewis, 1980). This view that chance is time-dependent is often considered to be a platitude. Indeed, it fits very well with the everyday senses of chance and time. A critic of this platitude who misses deadlines often must reconsider these concepts. For this purpose, Hoefer objects that such time-dependence assumes an outdated, A-theoretical understanding of time (2011, p.554). Antony Eagle responds: The time-dependence of chance stands regardless of what theory of time one accepts, the past is not chancy, simply because it's not susceptible to causal influence from the present (Eagle, 2014).

First, I argue that the B-theoretical, eternalist account of time is incompatible with Eagle's default position on the admissibility of information to chance functions. Secondly, I show that in the eternalist framework, the criterion of susceptibility to causal influence commits Eagle to a non-chancy future, hence leads to a contradiction. Showing that Eagle's problems can be avoided by abandoning eternalism, I conclude: The time-dependence of chance indeed depends on what theory of time one accepts.

§1 provides a brief background of the debate. In §2, I lay out the incompatibility of Eagle's position on the admissibility of past information with eternalism and investigate how susceptibility to causal influence works under eternalism. I then conclude with the resulting implications.

1. The Debate

According to the Principal Principle (PP), rationality requires us to adjust our subjective credence about an outcome to our estimate of the objective chance of that outcome occurring, conditional on all the available information about the chance value (Lewis, 1980). Lewis gives a sufficient condition that makes a piece of information *admissible*: 'the sort of information whose impact on credence about outcomes comes entirely by way of credence about the chances of those outcomes' (Lewis, 1980, p.92). In this framework, he highlights that past is not chancy:

> Suppose the proposition A is about matters of particular fact at some moment or interval tA, and suppose we are concerned with chance at time t. If t is later than tA, then A is admissible at t. The Principal Principle applies with A [as

> admissible information]. If X is the proposition that the chance at t of A equals x, and if A and X are compatible, then
> $1 = C(A \mid X \wedge A) = x$.
>
> Put contra positively, this means that if the chance at t of A, according to X, is anything but one, then A and X are incompatible. A implies that the chance at t of A, unless undefined, equals one. What's past is no longer chancy. The past, unlike the future, has no chance of being any other way than the way it actually is. This temporal asymmetry of chance falls into place as part of our conception of the past as 'fixed' and the future as 'open'. (Lewis, 1980, p.93)

Note that Lewis grants admissibility to information about the outcomes of past events, and emphasizes that the temporal asymmetry of chance implies an open future. In response, Hoefer argues that information about past outcomes should be inadmissible to the chance functions; as they only carry the truth of the outcome, they don't arise entirely from any credence about the objective chances (2007). He is also in line with Lewis' emphasis that the temporal asymmetry of chance implies an open future:

> Unless one is committed to the 'moving now' conception of time, and the associated view that the past is 'fixed' whereas the future is 'open' (as propensity theorists seem to be . . .), there is little reason to make chance a time-dependent fact in this way. I prefer the following way of speaking: my coin flip at noon yesterday was an instance of a chance setup with two possible outcomes, each having a definite objective chance. It was a chance event. The chance of heads was 1,2. So 1,2 is the objective chance of A. It still is; the coin flip is and always was a chance event. Being to the past of me-now does not alter that fact, though as it happens, I now know A is false. (Hoefer, 2007, p.554)

Hoefer uses strictly B-theoretical language; accordingly, "now" is a relative, relational term and cannot have any determining effect on an objective property of the world, such as chance. He later argues that the widely rejected A-theoretical understanding of time is essential to the concept of propensity (2011). His position on the time-dependence of chance seems to be derivable by applying modus tollens to Lewis' implication. If we reject A-theory, we can infer the negation of the time dependence of chance.

Although Eagle finds the admissibility debate unhelpful, he states that those who think the past isn't chancy, like Lewis, should be sided with the admissibility of such information, while those who don't should hold that information about past outcomes are inadmissible (Eagle 2014, p.129). His position about the admissibility of information about future outcomes, on the other hand, is the opposite:

> We can remain convinced that a yet to be tossed coin is fair, and has 0.5 chance of landing heads, even if we get information from a crystal ball that it will in fact land heads (which, since we actually have it, will be available information)……
> .. … It's not plausible to insist in defense of Handfield that the chance would have to be trivial in this case, no more plausible than insisting that a proposition is necessary once there is information that it is actually true. (Eagle, 2014, p.131)

Evidently, Eagle takes information about future outcomes to be inadmissible unlike information about past events, and this commits him to *the temporal asymmetry of admissibility*. However, he doesn't argue from the temporal asymmetry of admissibility; instead, he reiterates Lewis' straightforward point to yield the preferred picture of time irrelevant: "The pastness of past events in itself has no significance; it is the fact that such events are not susceptible to present causal influence that is significant" (Eagle 2014, p.155). He also explicitly defends that the time dependence is consistent with B-theory and eternalism. Accordingly, we don't need an objective distinction between past and future; the relative futurity and pastness provided by the B-theory are sufficient for time-dependence (Eagle 2014, p.154). Thus, according to Eagle, we can simply say that the outcomes in our relative past are non-chancy as they are not susceptible to change by causal influence, in contrast with the outcomes that exist in our relative future.

In short, Eagle holds that information about past outcomes should be admissible for PP, but more importantly, what makes past events non-chancy is not that they are objectively in the past, it is that they are not susceptible to causal influence. Chance varies over time and is made trivial by the outcome (Eagle 2014, p.157).

2. The Inconsistency

Eagle's default commitment to the temporal asymmetry of admissibility relies on the notion of necessity. In the crystal ball thought experiment, he argues that a proposition about a future outcome isn't necessary once we know it's true; therefore, such information wouldn't trivialize the chance (Eagle 2014, p.131). This is plausible unless it is contrasted with past outcomes under eternalism.

In eternalism, the true propositions about the outcomes in the relative past are not more necessary or more certain than the propositions about the outcomes in the relative future. If past and future events exist completely equally, then there shouldn't be any categorical difference between the knowledge of their outcomes. A coin-toss from this morning is in the relative future of yesterday's toss, yet we have no intuitive

difficulty in assigning them with the same admissibility status. Likewise, tomorrow's toss is only in the relative future of this morning's toss, the same intuition should be applicable. Therefore, temporal asymmetry of admissibility is incompatible with eternalism.

One could object, of course, that the ontological equality of things doesn't entail equality in our epistemic attitudes towards them. For example, spatially distant things exist just as spatially near things do, but there can be obvious epistemic differences between them. This objection collapses quickly because the crystal ball removes the epistemic difference between future and past events by giving certain knowledge about the future outcome. In this sense, the visions in the ball are just reliable memories from the future, and our memories of the past are only crystal balls that look in the direction of our relative past to give us certain knowledge.

Lewis doesn't have this immediate problem of compatibility, as he explicitly states that the temporal asymmetry of chance falls into the "open future" picture of time (Lewis 1980, p.93), which is mutually exclusive with eternalism (Stoneham 2009). The only aspect of B-theory that Eagle adopts seems to be some temporal order. He leaves out the fundamental equality of future and past events regarding the admissibility of their information, hence the inconsistency. There are two ways of removing the inconsistency while maintaining that truth doesn't entail necessity: (1) He can hold that past is chancy, by admitting that mere true propositions about past events would not trivialize the chances. (2) He can abandon eternalism for A-theory, which is widely rejected among contemporary physicists and philosophers.

Let's turn to Eagle's main argument that the past is not chancy, simply because it is not susceptible to causal influence from the present. More intuitively put, past outcomes have no possibility to be changed by causal influence from the present. The argument becomes problematic when combined with the ontological equality of past and future. This equality entails that if we assume that future events are contingent, then past events are also contingent. We can integrate this eternalistic feature into Eagle's argument and reformulate the susceptibility to causal influence criterion as "Resistance to Change Argument" (RCA):

> *RCA*: A contingent outcome is not chancy if we know that the information about this contingent outcome is true and the outcome has no possibility to be different than it is as we know now.

Suppose that we have a crystal ball that enables us to look at the outcomes in our relative future, giving direct and certain information about them. Using this crystal ball, we know for certain that a coin we'll toss tomorrow will land heads. Now let's see if this situation meets the condition of the RCA. We know the truth of the contingent

outcome that coin lands heads, and we know that this outcome will never be any different than heads. The robustness of the outcome implies that between now and the time of the toss, the prediction has no possibility to change. Note that we don't have to assume any sort of determinism or necessity to meet the latter part of the condition, by only the virtue of the crystal, we just *know* that the outcome will never be any different than it is, heads. The condition was met easily, and the RCA committed us to believe that the future is not chancy, which we don't like. Therefore, we reject RCA.

The problem could be avoided by abandoning eternalism. In an open future account of time, our magical crystal would still be able to *look* at the future but would see nothing there this time, because future outcomes don't exist at all, yet. It is a logical certainty that what doesn't exist can't be hidden or uncoverable. It would be unintelligible to say that our crystal ball can also break the logic with magic.

A possible objection could be posed against reformulating Eagle's view as RCA, specifically for equating the causal asymmetry with the epistemic asymmetry which usually accompanies it. Even if the epistemic asymmetry is removed by the crystal, the causal asymmetry remains. We could concede that the future event is still causally preceded by the present while the past event is not, but this distinction is emptied by the fact that the knowledge of our causal destination is fixed once we look through the crystal ball, regardless of the variables of the causal chain that takes us there. The knowledge of the future outcome would be as resistant to change by causal influence as the knowledge of the past. In the end, what makes causal asymmetry significant for us in the first place is the epistemic asymmetry it often brings.

Another objection could be that our thought experiment doesn't meet the condition of RCA in the indeterministic eternalist framework. That is, one could say that the appearances on the crystal ball would continuously and instantly change depending on the decisions of the free agents and the consequences of indeterministic phenomena in the present. Although this concern is plausible, it excludes the possibility of the kind of crystal ball that gives certain information from the future, the kind which Eagle also uses in his thought experiment (Eagle, 2014, p.131). The argument can adequately show Eagle's inconsistency by using the same kind of crystal ball, even though such a crystal ball is not necessarily compatible with every form of eternalism.

Conclusion

Eagle's positions could not contain eternalism, and they could become coherent only when eternalism is abandoned. Thus, I have shown that the problem in Eagle's position arises from his attempt to be compatible with all views in the philosophy of

time. The upshot of all this is that anyone who wants to contemplate on time-dependence of chance should indeed pay attention to what conception of time she prefers.

If eternalism is the correct view of time, then there is no fundamental difference between past and future; and in that case, if we are comfortable with assigning only trivial objective chances to past outcomes, then we shouldn't be comfortable with assigning any non-trivial objective chances to future outcomes. If we are so eager to assign objective non-trivial chances to future outcomes, we better get used to the idea of a chancy past. Perhaps, a coin from 10 years ago still has the disposition to produce heads with a strength of 0.5; but maybe it is just that we never get to toss it again.

References

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