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On the Nature of Chance

Everyday we make decisions regarding what we believe will happen in the future. This means that we must have some ideas or beliefs about what the future will hold, or how certain events will occur. Of course, I think it is safe to say that no one really knows the future, and so people take a chance on their decisions. Now, one cannot talk about chance without first talking about probability. Thus, I will first talk about probability, then I will follow up on interpretations of objective probability and then I will close on my analysis of these interpretations.

We use probabilities all the time everyday, yet we rarely stop to think about what exactly a probability is. Usually when we think of probabilities, we think of statistics or some other math related thing, and you are not wrong to do so. Functionally, a probability is a mapping between expressions and a real number between zero and one, inclusive. Conventionally, mapping an expression to the value of one means that expression is guaranteed, whereas mapping an expression to zero means that expression is impossible. Expressions are usually treated as events, though sometimes this is not the case. Regardless, probability is a measure. What exactly this measure is of is up for debate, but usually we treat probabilities as a measure of belief (Santario). If I think it is probable that it will rain tomorrow, I have a lot of belief that is will rain tomorrow. However, this does not seem adequate when thinking of what probability can capture. Probability can also capture things which people have no beliefs in. That is, probability can be independent of individual belief. A fair coin will land head 50% of the time, regardless of my thoughts on the matter (Hájek). This interpretation of probability is called objective probability.

The interesting thing about objective topics, is they are to theoretically exist outside of a person's judgement or opinions, yet we need some way to think about them. Objective probability is no different. There are a few interesting ways to think about the concept of objective possibility. I will discuss the idea of frequentism, a very mathematical way of thinking about the problem, and then David Lewis's Principal Principle, a theory based on his notion of a 'best system' view of the world.

The first notion I will touch on is the very intuitive and simple idea that probabilities are ratios, and chance the value of this ratio. This notion is typically how your stat professor introduces the idea of probability, and it is not a far-fetched idea. If I hand you a 20 sided dice, tell you it's fair, and then ask you for the probability that if rolled, it will land on a prime number, you will tell me its 8/20 or 40% or .4. That is, out of the 20 sides of the dice, 8 of the values are prime. Generalized, the probability of an event is the number of events which include said event occurring and the total number of possible events. That is, suppose we roll that 20 sided dice. There is a future in which 19 is rolled, and there is another future where 7 is rolled, and so on. The number of futures which satisfy our conditions (lands on a prime number) divided by

the total number of futures (20, one for each side of the dice), is the probability. Complications arise when we think of complex problems where the number of futures can be ambiguous or hard to conceptualize.

In the previous dice example, there is a relatively simple interpretation of which futures we were looking for. However, there may be cases where this is not the case. Thus, two approaches have been considered, a finite(or actual) theory, and a hypothetical theory. A finite frequentist will only consider events which have already occurred (Hájek). Thus, initially, had there ever only been one roll of the 20 sided dice in known history, and it had come up '5', then the probability that the dice rolls a prime is 0. On the other hand, a hypothetical theorist would act similar to what we did, and think of hypothetical futures (Hájek). Of course this means the calculation is limited by the ability of the calculator (so had you forgot to account for a possible future, the calculated probability would be incorrect). Both accounts may leave much to be desired, however, this accounts are what many people use on a daily basis and may be a useful heuristic.

On the other hand, some believe that chance and probability is merely just a description about matters of fact in the world. David Lewis has endorsed this idea of Humean Supervenience, that is everything supervenes on local matters of fact. Thus, in order for this viewpoint to hold, Lewis must give an account of chance that is compatible. He does so by giving his best systems account of chance whose goal is to show that chance supervenes on local matters of fact. The best systems view, put very simply, says that there is a set of descriptions or laws which, starting with certain assumptions, allows you to deduce all truths, depending on the logical system used (Lewis 1994). Now, there are various logical systems or laws which we can start out with. Some of these are more simple than others, some cover a wider range of topics, and some are stronger than others. In the case of chance, we consider a logical system that pertains not only matters of fact, but also the chances of various outcomes of events (Lewis 1980). There are laws which are probabilistic, and these laws will state the chance of things happening, which is similar to the notion of objective probability. Thus, the chance of some event A occurring, is whatever the best systems of chance state the probability to be.

There is one major issue with the best systems account which Lewis was initially wary of, but then believed he found an answer to. The best systems account does not take into account, or fails to recognize cases of undermining futures (Lewis 1994). That is, while a law may say that a chance of some event is X, the actual chance of said event is something not X. Now this may seem odd because the laws in the best system dictate what the chances are, but here is the problem. Suppose that there is a future that is very unlikely which consists of anomalies. This future, as stated before, has a very low chance of happening. However, should this future come to pass, the probabilistic laws would be different than what current laws say about the event (due to the anomalies) (Lewis 1994). This is because laws are fixed by what happens throughout history. Thus, these events coming to pass could contradict the truth about present chances.

However, despite the problem of undermining futures, which Lewis calls 'the big bad bug', Lewis believes he found a solution using admissibility (Lewis 1994). This is because, via the best systems account, information about chances is in part information about the future.

Depending on the proposition, the information revealed could be minimal or a lot. Thus, Lewis claims that admissibility comes in degrees inversely proportional to the amount of information revealed (Lewis 1994) That is to say, information about chances which reveal very little, are more admissible than chances which reveal a lot about the future.

While admissibility is useful for helping solve the problem of undermining futures for Lewis, it is my belief that they are not helpful for solving the problem of undermining futures of frequentists. Hypothetical frequentists cannot make anything admissible, because they must consider every case, no matter how outlandish, as we are trying to take a ratio of possible worlds where some event could happen. Actual or finite frequentism however does not care about future possibilities when calculating a chance probability so there is no reason to solve the problem of undermining futures for a finite frequentist. Finite frequentism only cares about events that have actually occurred in the past (Hájek). That being said however, I believe that Lewis's claim of a best systems account of laws is more practical, although more complicated, then the frequentist viewpoint.

While on the surface, a frequentist's point of view may be similar to what we do everyday making probability calculations, I do not believe that this is actually what happens. I will immediately reject the idea of finite frequentism, because while we may learn using bayesean reasoning, I think that we definitely consider future conditions and possible futures when calculating a probability for the future. However, when we take our math test, a finite frequentist's account may be what we are looking for. Instead, I want to focus on one thing that a hypothetical frequentist must allow: infinite sequences (Hájek). When we are asked the probability of a fair coin landing heads, a hypothetical frequentist must consider an infinite sequences of tosses and make a judgement about how many of those events land heads. Thus, for more complicated calculations, a hypothetical frequnetist must consider all possible futures which some event could occur. I believe this calculation to be impossible, and not reasonable for calculate. Instead, we need to approximate and create a reasonable expression of the future to calculate the chance of an event to occur. I think that this ability to restrict calculations to the reasonable realm (via admissibility) is why I will have to side with the best systems about proposed by Lewis. If I want to calculate the chance that taking a car will lead to an early demise, I don't want to consider the cases which are absurd like an alien invasion, or my spontaeously combusting behind the wheel. While these events have a non-zero probability, I would like to make these cases admissible. The flexibility of the best systems account is just more promising than that of its frequentist counterpart.

References

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