

ARE THE LAWS OF NATURE NECESSARY OR CONTINGENT?

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Are the laws of nature necessary or contingent? That is to say, could the laws of nature have been other than they actually are or must they be as they are?

This raises some deep issues that have preoccupied philosophers for some time - issues that do not normally preoccupy scientists because they do not analyse the notion of a law much beyond the point of saying that they are general claims about the way nature behaves, i.e., they have a wide application in a large number of cases.

To answer the question, we need first to consider the notion of necessity and the related notion of contingency. These are so-called "modal" notions. Other modal notions include those of possibility, impossibility, non-necessity, and non-contingency. All play a crucial role in philosophical thinking about matters to do with logic, metaphysics, morality, law, etc. This is because none of these modal notions is univocal in meaning. There are, so to speak, different "species" of the generic notions of necessity, contingency, possibility, and the rest.

Consider the notion of possibility for example. One can ask whether a given state of affairs is logically possible, physically possible, legally possible (permissible), morally possible (permissible), and so on. For each of these "species" of possibility, the concept of possibility can be explicated in terms of consistency with the relevant kinds of laws. Thus, a statement of state of affairs is logically possible if and only if it is consistent with the laws of logic, physically possible if and only if it is consistent with the laws of physics, legally possible (permissible) if and only if it is consistent with the laws of the land, and so on.

On this analysis, the laws of physics are what determines the range of what is physically possible and what is physically impossible; the laws of the land determine what is legally possible; moral laws or principles determine what is morally permissible; and so on.

We are now getting closer to answering the original question. Let us take it that by "the laws of nature" one means that set of all laws of the kind that determine the behaviour of objects in nature. The laws of physics will be included; and so will the laws of chemistry, etc.

The question then arises, as asked, whether the laws of nature are logically necessary or logically contingent.

The brief answer is that they are logically contingent. By that we mean that both they and their denials are consistent with the laws of logic. To suppose that they were logically necessary would be to suppose that their truth followed from the laws of logic. But if a statement is such that its truth follows from the laws of logic, then its denial would involve a violation of the laws of logic, i.e., would involve a

contradiction. Since it is clear that the truth of any of the laws of nature cannot be derived from a consideration of the laws of logic alone, and that one would not be contradicting oneself were one to deny their truth, it is clear that the laws of nature are not logically necessary but logically contingent.

That's the brief answer. For a deeper understanding of the rationale for giving it, we can invoke the idea of a possible world.

What is this? This actual world is just one possible world. But it could differ in many ways, thereby constituting different possible worlds. You could be wearing different clothes today than those you actually have on; or you could be sitting in a different position than the one you are in, and so on for other features of you, and not just you but everyone else. The objects that make up the actual world could have different properties and be arranged differently, these differences constituting yet other possible worlds. Even the number of objects that make up the actual world could have been greater or fewer, thereby making further possible worlds. Intuitively we can say that a possible world is one way this world could be. There is an infinity of possible worlds (what order of infinity will be left open).

Consider now laws of nature. And suppose that the actual world obeys a given number of such laws. Now different possible worlds can obey the same laws of nature. To see this just imagine the same laws of motion applying to different arrangements of objects or even different kinds of objects. But in yet other worlds the laws could have been different. Newton in his *Principia* envisages just this. He showed in Book III that in our actual world the force of attraction between two bodies is proportional to the inverse square of the distance between them. But in Book I he considers a number of different attraction laws, some which are simply the inverse of the distance between bodies, or the inverse cube of the distance, and so on. He also works out how bodies moving about an attracting centre would behave according to these three different laws. It is easy to envisage any number of different inverse laws – in fact an infinity of them according as the denominator multiplies the distance by 1, or 2 or 3 or 1.7, 2.75, 4.81 and so on indefinitely. Given any law of nature that can be qualitatively expressed, we can readily envisage that there are possible worlds in which the quantities like mass or distance or force could stand in different mathematical relationships. We can also envisage ways in which qualitative laws could also vary. Thus possible worlds can vary not only with respect to the objects in them and their properties, their arrangement and their number; they can also differ according to the laws of nature that hold in them.

Once we have an intuitive grasp of the notion of a possible world we can define what it is for a proposition to be contingent, or to be necessary. A proposition p is contingent =df p is true in at least one possible world and false in at least one other possible world. This fits the case of the laws mentioned above. We can envisage that the laws which hold true in this actual world will also hold true in some other possible worlds as well. Thus if we suppose that Newton's laws are true of this actual world (strictly they are not, but let's go along with the assumption) then Newton's laws will hold true in a (vast) number of possible worlds including this one. The same laws can hold of objects that can differ in their number, arrangement and

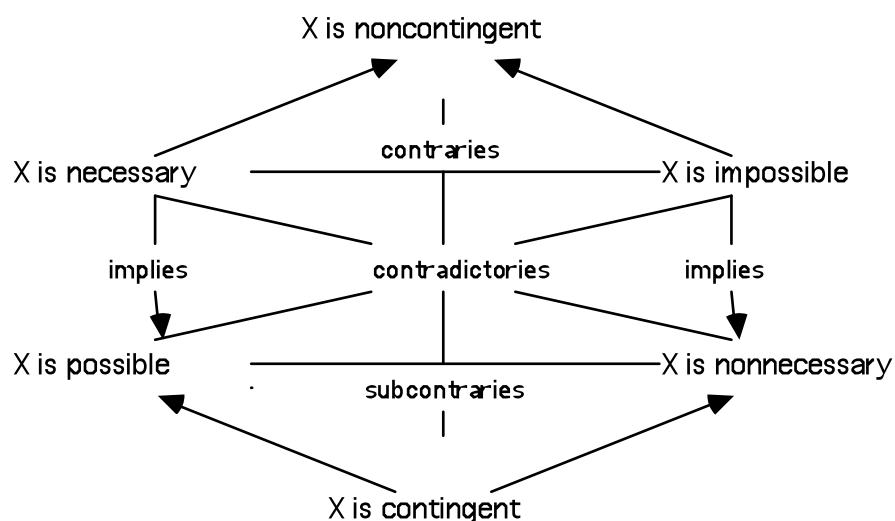
properties from the objects of this world. But there is at least one possible world in which these laws do not hold (in fact there is an infinity of such worlds). Granted this, the laws of nature are contingent. In general we can say that natural laws hold true of a range of possible worlds; but they do not hold true in all possible worlds and are in fact false in other possible worlds.

What do we mean by necessity? A proposition p is necessarily true =df p is true in all possible worlds: and a proposition p is necessarily false =df p is false in all possible worlds. Clearly these definitions do not apply to laws of nature; but they do apply to the propositions (or laws) of logic and of arithmetic.

Once more, then, we reach the conclusion that that the laws of nature are logically contingent.

ADDENDUM:

The relationships between the generic modal notions mentioned above, together with a couple more, can be displayed on the following MODAL SQUARE OF OPPOSITION.



On this diagram, the arrows stand for implication. Thus " x is necessary" implies " x is possible"; " x is impossible" implies " x is non-necessary"; " x is contingent" implies " x is both possible and non-necessary"; and " x is non-contingent" is implied by both " x is necessary" and " x is impossible". To say that " x is necessary" is a contrary of " x is possible" is to say that these statements can't both be true but can both be false (i.e., that the truth of one implies the falsity of the other, though the falsity of one does not imply the truth of the other). To say that " x is possible" is a subcontrary of " x is non-necessary" is to say that these statements can both be true (as when x is contingent) but can't both be false (i.e., that the falsity of one implies the truth of the other, though the truth of one does not imply the falsity of the other). To say that two of these modal statements are contradictories of each other is to say

they can't both be true and can't both be false (i.e., that the truth of one implies the falsity of the other, and that the falsity of one implies the truth of the other). Thus "x is necessary" and "x is non-necessary" are contradictories, as are the pairs "x is impossible" and "x is possible", and "x is contingent" and "x is non-contingent".

This modal square enables one to prove that although "necessary" and "contingent" are "opposites" (i.e., can't both be true), their logical opposition is that of contrariety, not contradiction.

Translating these logical relationships into talk of possible worlds, we can say:

P implies Q =df there is no possible world in which P is true and Q false (i.e., Q is true in all possible worlds, if any, in which P is true)

P is the contradictory of Q =df there is no possible world in which both are true and no possible world in which both are false (i.e., they are exclusive of one another and exhaust all possibilities)

P is a contrary of Q =df there is no possible world in which both are true but there are possible worlds in which both are false (i.e., they are exclusive of one another but do not exhaust all the possibilities; hence there are many contraries of any given proposition)

P is a subcontrary of Q =df there are possible worlds in which both are true but no possible worlds in which both are false (i.e., they are not exclusive of one another but do exhaust all the possibilities)

As already noted the logico-syntactical relationships displayed on the above diagram are preserved through various semantical interpretations such as those involving: (a) the logical modalities (proposition P is logically contingent just when P is neither a logical truth nor a logical falsehood); (b) the causal or physical modalities (state of affairs or event E is physically contingent just when E is neither physically necessary nor physically impossible); and (c) the deontic modalities (act A is morally indeterminate just when A is neither morally obligatory nor morally forbidden).

In none of these cases does "contingent" mean "dependent" as in the phrase "is contingent upon". Yet just such a notion of contingency seems to feature prominently in certain formulations of the so-called Cosmological Argument, all created objects being said to be contingent beings and God alone to be a necessary or necessary being. Conceptual clarity is not furthered by assimilating this sense of "contingent" to the others.