Are laws of nature mere regularities?

Introduction

First of all, I will describe what I mean when I use the terms “regularity” (R) and “law of nature” (L). Having done this, I will explore the question, which can be seen as asking whether Ls and Rs are identical, or whether all Ls are a subset of Rs.

Regularities

I define a “regularity” as describing something which is repeated over a set of separate observations. I will distinguish between two types of such regularity: firstly (R1), those which involve a single phenomenon (such as the fact that whenever I visit the river, I observe flowing water), and secondly (R2), those which involve multiple phenomena (whenever I stroke my cat, he purrs; when I fill a kettle with water and switch it on, it boils). Obviously, these examples may be over-simplistic, and in reality we may find that they are somehow qualified: my car purs when I stroke him *and he's awake;* the water in the kettle boils *if the kettle is plugged in,* etc.. It might also be pointed out that in the case of R1, the observer is part of the regularity, but I will skate over that for now.

Of notable significance is the fact that this definition of regularities rules out anything which is necessarily true and can be known *a priori;* e.g. while it is true that whenever I add 2 and 2 I regularly end up with 4, this doesn't count as a “regularity” as I am defining it:

regularities describe the universe as we find it, not as it necessarily must be.

On this definition, Humeans might argue that it is not rationally defensible to expect past regularities to be any guarantee of the future behaviour of the world. Nonetheless, humans are constituted to behave in this way, and so regularities are useful since we successfully use them to make predictions about the future based on our past experience. This usefulness applies to both R1 and R2 type regularities: having previously observed flowing water in the river on a regular basis, I may decide to go there if I want something to drink; I know that in order to boil t he kettle, I have to make sure it's filled with water and switched on.

The fact that we have observed a regularity in the past doesn't necessarily result in our assuming that it will recur in the future. For example, if the first three National Lottery draws had been won by someone with blonde hair, it wouldn't be surprising should the fourth draw be won by a brunette. And in some cases, while we take past regularities to act as a guide to future events, we are not altogether surprised to see our expectations upset: the water may fail to boil if the kettle is broken, for example.

While we may learn of regularities by observed specific instances, we can form assumptions about future phenomena that do not involve the same specific objects and events which were previously involved. For example, on encountering an unfamiliar cat, I would expect it to purr when stroked (Aristotle uses the term *nous* to refer to that part of

our mind which is capable of generalising in this way). From this, the key points about regularities are that:

1. they are observed (we learn about them empirically)
2. they may or may not have a causal component
3. it is possible to form generalisations based on them
4. in some, but not all, cases, we use them as a guide to future events

Laws of Nature

Conceivably, the only reason we have seen "regularities" in the past is the result of nothing more than chance and coincidence: we are doing no more than recognizing pictures in the clouds.

But another explanation is that there is some underlying structure to the universe which is realised, or manifested, in the regularities that we observe and use to guide our behaviour. Such underlying structures are what are referred to as "laws of nature", and they can be used to explain the regularities that we see. Should these laws exist, we would not be able to observe them directly, but intuitively it seems that the more evidence we accumulate, we ought to be able to get closer to an approximation of their essence.

Should such laws exist, then they would be more powerful as predictors than "mere regularities": they would apply to entities of which we have no direct experience: we may use it to make predictions what stars might be like in galaxies that our beyond our limits of observation, or about the behaviour of an as yet undiscovered element which occupies an

empty spot in the periodic table. But there are limitations too: we can only do this when we have experience of similar, or related entities. We cannot be confident about the laws of nature that govern the what happened at the time of the Big Bang.

Another possibility is that while such a structure of universal laws does exist, the picture we have of it is completely wrong: it may be that there are various different combinations of laws which would result in the universe behaving in the ways that we have so far observed; perhaps we have found one of those sets which is consistent with our observations, and self-coherent, but nevertheless untrue. Kuhn argued that science undergoes paradigm shifts where a whole set of previously held beliefs has to be replaced; however, it may be that despite these shifts, which we see as moving us nearer to an "ultimate truth", it may be that the "reality" underlying our evolving set of beliefs is completely different to anything we will ever describe. Perhaps the "ultimate truth" is not something we would be able to understand in any case ("I don't understand it. Nobody does" - Richard Feynman "The Strange Theory of Light and Matter").

On this reading then, a "law of nature" is a fundamental truth about our universe which we deduce based on a series of empirical observations (i.e., it's not a necessary truth which we could know *a priori*). It's also generally true: while we see specific instances of events which obey a law of nature, we regard such laws as being applicable throughout space and time.

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From the definitions above, there are clearly common aspects between regularities and laws

of nature. In both cases they are a feature of the way the world is, rather than the way it has to be; they cause us to form associations and make predictions about future events. But unlike regularities, laws of nature attempt to describe something more general, consistent and fundamental. A regularity might be observed which is accidental (every time I go to the beach it rains), but a law of nature should hold in all cases. According to this account, laws of nature are not *identical* to regularities: they differ in the following ways:

1. we don't observe laws of nature directly
2. we make more extravagant claims for the ubiquity of laws of nature
3. we don't expect predictions based on laws of nature to be disproved
4. we regard laws of nature as having explanatory power

The last point is the one that most significantly distinguishes laws of nature from regularities. If I say the kettle boils whenever I switch it on, this may be true, but doesn't get to the root explanation of what happened. On the other hand, if we postulate a law of gravity, then we can use it to explain why the apple falls from a tree, and we don't have to go any further; the law is axiomatic and does not need to be explained (except, perhaps in terms of other natural laws). However, it is not clear what the justification is for investing laws with this explanatory power.

Laws then, are undeniably useful, but is it reasonable to say that they are any more than simplifications, or generalisations, of past observed regularities? In other words, are they no more than the result of aggregating sets of regularities, removing any accidental ones, and stripping them of their particulars?

The chief fact which might argue against laws of nature being anything special is that we

have seen occasions in the past where “laws of nature” have turned out not to be so. For example, while Newton's “laws of motion” were for some time taken to be “natural laws”, science has since shown that they do not seem to apply on very large or small scales. As new observations are made which conflict with our understanding of a law of nature, the law needs to be discarded, or qualified in some way. This doesn't seem different, except in scale, from the way that my expectations are upset by the failure of my kettle to boil a cup of water; it seems that a law of nature is only safe so long as we haven't yet performed observations in a way that invalidates it.

Conclusion

In conclusion, I think that while there may be “laws of nature”, in the sense that there may be some kind of governing set of structures which dictate how the universe behaves, we have no way to be sure that they do exist, and no way to be sure of what they are: those “laws of nature” that we use are no more than generalisations made based on observed regularities, and may or may not resemble any true laws of nature. It may be useful for us to behave as if we do have valid laws of nature, but this behaviour is not in itself any guide to the existence of such laws.

Bibliography

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