

Jacob Portes

Professor Thomas Ryckman

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The Process of *Reductio ad Sensibilem*

The idea that there exist laws of nature is hardly revolutionary. Most physicists would agree that the conservation of energy, the speed of light in a vacuum, and the charges of fundamental particles are all laws of nature. But the belief that the laws of nature can be explained – for example, that there is a *reason* electrons have a charge of $-1e$ – is much more contentious. Can laws of nature really have *reasons*? And while a whole slew of natural laws might be “explained” by more fundamental natural laws, can *those* fundamental natural laws be explained? The purpose of this paper is to argue that the laws of nature as defined by popular models of lawhood are indeed explainable according to the process of *reductio ad sensibilem*.

Let us first define “explainability” in the broadest sense *as the ability to be understood by somebody or something*. Then we can clarify what exactly we mean by “a law of nature” by framing our discussion according to the rival theories of deductive systems and universal necessitation. One popular theory, the deductive systems theory, defines laws of nature as laws that belong to a system of axioms and their logical consequences, *with the best combination of simplicity and strength*. This theory is Humean and anti-Realist in character. The second theory, the theory of universal necessitation, defines laws of nature as relations of necessity between universals. This can be expressed formally as $N(F,G)$, where F and G are universals and N is the contingent “law making” relation. This theory is associated with Realism and anti-Humeanism (Carroll).

One way of understanding the Humean view is that laws and current facts determine the future in a purely logical way. Laws themselves depend on what the facts are, and as such, are purely *descriptive*. The Realist view can be understood in the opposite way – that the laws of nature are the ontological ground of future facts, and thereby govern the future state of the universe. The laws are already present in the current state of the universe. Facts depend on what the laws are, and not vice versa. According to this understanding, the laws of nature are *prescriptive* (Beebe 578-580).

Neither the deductive system nor the universal necessitation theories address our issue of fundamental explainability. The former don't try to explain *why* the core axioms of nature are the core axioms of nature, and the latter doesn't attempt to clarify *why* the necessary relations of nature hold between universals. And whether the laws of nature are descriptive or prescriptive doesn't make them more or less explainable. So although there is no consensus as to what laws of nature are, we don't have to commit to either view in order to discuss the issue of ultimate explainability. At the same time, it is important to note that according to both theories, the laws of nature as we understand them are subject to change as we learn more about the world. This fact, combined with our definition of explainability, paves the way for the process of *reductio ad sensibilem*.

Now we can introduce the process of *reductio ad sensibilem* by way of example. Let us assume that the following is a law:

(1a) *Most drivers stop at red lights* (according to the purely descriptive deductive systems theory)

or alternatively:

(1b) Drivers must stop at red lights (according to the prescriptive universal necessitation theory). In the language of $N(F,G)$, *it is necessary that all things that drive cars must stop at red lights*

Now there could be many explanations as to why most drivers stop at red lights; (1c) one reason may be that they are taught to do so, and (1d) another reason may be that they don't want to get tickets. However, these answers are not quite satisfactory, as we could continue our inquiry further and ask why most drivers are taught to stop at red lights, and why tickets are given for driving through red lights. A more comprehensive explanation might be:

(2) Most drivers stop at red lights (or drivers must stop at red lights) in order to prevent car crashes

Now we understand that (1a) and (1b) follow from (2); that drivers are taught to stop at red lights in order to ultimately prevent car crashes, and that the police fine violators in order to ultimately prevent car crashes. Let us say that (1a) and (1b) are superseded by (2). At this point, most people would find this explanation of the original law sufficient - any further clarification would be unnecessary and superfluous. However, to a young child, further elucidation would be required. We might add the following clause to the explanation:

(3) Car crashes are undesirable because they result in injury and possibly death

At this point, a child would *understand* the original law (1). However, for an alien without any notion of injury or death, even further elucidation would be required:

(3a) Injury results in pain, which is undesirable

(3b) Death is undesirable

Hopefully the alien would have some sense of desirability and undesirability, and finally understand why most drivers stop at red lights (1). Let us call this method of adding on layers of

information within an explanation the process of *reductio ad sensibilem*, which can be roughly translated as the “reduction to the sensible.” This process takes into consideration the fact that different amounts of information are required to explain laws to different people. For the case of adults, the prevention of car crashes (2) is a sufficient explanation, while for a child, the avoidance of injury and death (3) make enough sense, and for an alien (3a) and (3b) are necessary additions to the explanation. In each case, the person trying *to understand* the explanation (i.e. the adult, the child, and the alien) has different sets of knowledge about the law and details pertaining to the law (such as the knowledge of cars, traffic lights, car crashes, pain, and the like). For the law to be understood by the alien (the most extreme case), it is just a matter of adding more detail to the explanation. The adult arguably knew much more about the world such that a single explanatory clause (2) was sufficient.

So how does this pertain to our original question about the explainability of laws of nature? The crux of the argument is that the explanation of a law is just the accumulation of relevant information until *it makes sense to the person trying to understand the explanation*.

The history of science shows that it is often the case that additional information contributes to the efficacy of an explanation and to the process of *reductio ad sensibilem*. For example, after protons were discovered, physicists knew that protons had a charge of $+1e$. However, they didn’t know *why* it had that particular charge. When they discovered quarks, they knew that up quarks had a charge of $+2/3e$ and the down quarks had a charge of $-1/3e$. With this new knowledge, they were able to delve one level deeper into the explanation of that particular law of nature. Why does the proton have a charge of $1e$? Because it is made up of two up quarks with a charge of $+2/3e$ each and one down quark with a charge of $-1/3e$ for a total of $+1e$. Now as of yet, there is no satisfactory explanation as to why quarks have these particular charges, and

the process of *reductio ad sensibilem* has not terminated. With regard to the question of why protons have charge $+1e$, we could understand ourselves as the child or alien at point (2) in the explanation above.

We also see in the history of science the convergence of various explanations to a single unified explanation in the same manner that (1a) and (1b) are superseded by (2). The unification of magnetism and electricity is a good example of this. We can only hope that more and more explanations will be superseded until a very small number of explanations have a lot of explanatory power. It is by this process that “fundamental laws” are superseded by simpler, even “more fundamental” laws. This addresses the following objection: How can we be sure that the axioms essential to the deductive system theory are explainable in the same way as the rest of the laws? Because even these axioms are subject to change, they too can fall under the rubric of *reductio ad sensibilem*.

Again, the point is that additional information can contribute to the explanation of a law. If we apply this to the explanation of laws of nature, we can argue in the cases where the explanation of a law isn't clear, the scientific community *doesn't have enough information* to understand the law. Only the accumulation of additional information via scientific inquiry can possibly shed light on the law until *it makes sense* to the scientific community.

There is not enough space in this short essay to address all the possible objections to this theory of *reductio ad sensibilem*. Isn't it possible for people to believe that they understand something when in fact they don't? Maybe the definition of explainability above is too broad? Are there not conceptual flaws in the example above? We could briefly argue that history has shown that even if the scientific community believes in a certain paradigm, if it is not entirely sound, individuals eventually expose erroneous beliefs and shift the paradigm. Also, any

narrower definition of explanation would not be able to satisfy all the possible uses of the word “explanation!” For example, more technical understanding of explanation such as the “Deductive Nomological” understanding relies heavily on the use of laws of nature *in the explanans*. But if we must explain the fundamental laws of nature by using other laws of nature, then we are stuck in a circular argument! And while there are possibly conceptual flaws in the example above, there are countless (possibly more robust) examples that can replace it.

Hopefully we have laid the foundations for the theory of *reductio ad sensibilem*. Does it allow for the laws of nature – even the fundamental ones – to be explainable? Most certainly! It characterizes the search for explanation of natural law as the *accumulation of additional knowledge*, and the *superseding of multiple explanations* by fewer, more potent explanations, until the natural laws *make sense* to the scientific community. The logical extreme of this theory is a sort of “unified theory” with a “unified explanation.” It is probably only a matter of time before this neologism becomes a standard in philosophical discourse!

Works Cited

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