Theories, laws and explanations

Part of the problem of Hanson’s radical view: concept of theory - ***Types of Theory***

* 3 types of theory that need to be distinguished to understand what their role is in science

1. Categorical T. = Constitutive of the way we reason, without them no phenomena would be a phenomena that we’d recognise. How we formulate the organisation of the world
2. Interpretative T. = Classification, language. Not only I can see an object, I can classified it and I have a word to express it. Important, in science we need them to form our background knowledge. Basic terms for understanding of phenomena
3. Explanatory T. = Theories are explanations, specific hypothesis, they are answers to solutions of partiuclar problems. If we think of theories in science we think of them in 3 meaning

***Scientific Theories***

* Are explanatory tools
* How do they achieve that task (explaining)? Explanatory power of scientific theories is achieved by theories by means of the laws they are based on. T. Are systematical arrange of laws, explanatory because of what these theories allow us to do vis-a-vis the phenomena (Their explanatory power depends on the scientific laws they are based on)

*Ex: Thermometer*

A mercury thermometer immersed in hot water decreases abruptly its temperature, but then its temperature has a swift rise

Why?

A hypothetical scientist comes in and tells me - Why observe that

He organises his answers by means of two groups of statements

1. **Initial Conditions**: Includes a series of contingent conditions (ie the thermometer made of glass..circumstances)
2. **General Statements**: Adds one or two general statements concerning in this case the thermic expansion of mercury and conductivity of glass. These types of statements have to do with general feature of the parts that make up my experiment.

* Resorting to these general features is important, they give sense to what we see. We are able to say why something happens besides the various scientific laws or how a substance behaves.

**C. Hempel’s** view of explanation

This is the underlying idea of scientific explanation that we find in this view supported by Carl Hempel.

These general statements are scientific laws, this is why according to this view, this particular type of explanation are **law driven**, to the point if only we can resort to laws than we can tell that’s an explanation

If laws are so important we need to figure out what they are

*Scientific Laws*

* Laws are general, they have a universal form (beyond the single phenomenon we are observing) and they must be relevant. They should matter when we come to find out what we are observing within a particular phenomena.
* They assert a uniform connection between different empirical phenomena or between different aspects of empirical phenomena.
* Laws are not exceptional, he knows the problem with them and wants to turn to a more probabilistic view

*Examples of Laws*:

* Whenever such and such happens **>** Such and such will happen
* Laws are general, they have the capacity to generalize

**Format of explanation**

Why can we claim the scientific explanation entirely relies on these statements that describe scientific laws?

Because every time we try to explain why a certain fact occurs, all we need to do is to refer to a general law of the type that I have listed here for example.

All these laws have mathematical representations. Once we have a law, we have an explanation.

Explanation is an argument (he believes logic says it all), it is divided in:

* Premises (**Explanans sentences**) [describe the initial condition L, describe the general laws C]
* Conclusion [E] (**Explanandum sentence**) […]

Explanation is the actual inference. Finding a logical format and what the explanation is composed of, is what people are interested in (not if it is true, that’s a further question).

This is how the format of an explanation will look like:

*The deductive-nomological model of explanation:*

* From premises to a conclusion
* Derivation happens **only if there is at least one true law** among the premises (“nomos” in greek). If the law is true, then the law will lead deductively to a correct explanation

*Queries*

1. How do we know that a **law is true**? What explains the uniformity stated by the law? We know it is not a small matter. What guarantees if X then Y?
2. How do we know that the **generality** expressed by a law is **not accidental**?
3. Are we entitled to say that, “if X then Y”, then X is the cause of Y”? Are all laws implicitly causal? [NOT ON THE EXAM] - Causal interpretation of these laws - Whether all laws are more or less

*Features of scientific laws*

* Statemens of Unversal Form
* Statements that assert a uniform connection between different empirical phenomena
* Take that form: “If F then G” —> “Whenever F then G will follow”

**Query 2: form of universality/generality**

* Before, statements like “i.e.” are not acceptable
* How can we distinguish accidental generalization and scientific laws?
* There is a logical test to apply to seemingly universal statement that helps to discriminate bad candidates for laws

**Test of proper universality for laws**

* Test is to say: a statement of this type supports, or can be translated on an, example
* \*red not sweet.
* The test is the test of counterfactuals (contrary to facts)

*Counterfactuals - As tests for scientific laws*

* Peculiarity of these counterfactuals is that they are not about actual state of affairs, rather of what would have been the case if the antencedent would not be applied.
* A general (genuine) scientific law is able to support the test of counterfactuals (which is a test for genuine universality or a logic confirmation of the capacity of these statements to be applied to example that have not been empirically tested yet).

*Query 1: Reasons to assume that a law is true*

* True **Ceteris Paribus**: Laws hold true only when we can rule out external influences/interferences that are beyond the scope of the laws in question
* He is aware that scientific laws are not literally true but rather proximately true, or are true ceteris paribus (all things been equal). It is devised in such a way to divide from interferences
* Scientific laws work under very **ideal conditions**, they eliminate all those elements that can compromise the law

**Cartwright** - Do scientific laws lie? *Laws deal with ideal, not real phenomena*

* **All laws of nature lie because they only apply to highly idealized conditions**. They are ceteris paribus. In fact they deal with ideal (and not real) phenomena.
* We can use them but there is still a problem of how they work within in particular circumstances.
* Do not describe nature as it is, they are designed to describe a simplified or a peculiar version of nature. A version that we are in control of because it’s us that put the conditions in place.
* Interferences are left out

Why are laws so important then?

Once we have a law, we have an explanation.

* It because of how the laws are formulated that we are able to understand
* If we accept that there is a correlation, what explains the regularity of the uniformity itself?
* We can accept as a matter of necessity, “if x then y”
* How can we explain the actual uniformity?

*What explains the uniformity stated in a law? -* ***Hempel***

* We infer empirical regularities from **laws of broader and broader scope**, to include also laws which sometimes make use of terminology which does not only refer to empirical correlations.
* What matters is that the explanatory inference is the same.

*Example: Newton’s law of gravitation*

* Gravitation cannot be observed
* If it is true then certain empirical correlations can be explained

*Complete pictures of explanations (from bottom up)*What matter is that the inference is the same at each level, the model does not change.

* 2nd order theories: still more penetrating explanation on the basis of more comprehensive laws
* 1st order theories: set of assumptions using comprehensive laws
* Empirical Laws: non accidental correlations between relatively observable/ measurable magnitudes
* Descriptions (data): simple account of individual facts or events

Criticism about this way to proceed - *Explanatory power of a law*

* Degree of generality of the law
* Same explanatory inference

*Problems with law-law-entered account of explanation*

* The very idea of explanation
* The model of theory in this account

*First* ***problem with Hempel’s model***

Explanation amounts to being able to fit a phenomenon within an observed regularity

* Fitting phenomena into observable regularities does **not** count as **an explanation**. In fact an explanation goes **beyond the discovery of co-occurrences between types of events**.
* We do not want to regress to another longer explanation. We just want to know what bring this about.
* It is not the knowledge that does the explanation but the existence of the molecules and their behavior. The explanation amounts to postulating the existence of certain entities that are explanatory responsible to what we observe at empirical level.

*Newton’s law of gravitation*

1. Start from a basic description… (Tycho’s observations) How do we explain this?
2. More general law… (Kepler’s first law of planetary motion)
3. We need to move up another level to explain what goes on at a lower level (Newton’s law of gravitation)

The question is how can we explain the regularity of an elliptical motion?

* According to the level picture we refer back to Newton’s law

*There are two way of describing this law F= GmM/r2 - Different Explanation*

1. In one case we are just stating the correlation between F, G, M and R
2. In the second case we are asking why that correlation obtain on the assumption that there is a universal thing

* The difference is that rather than differ, **we make our explanation depend on some entity** (gravity) or a mechanism, **which is responsible for the explanation we want to account for**. The most challenging aspect of this idea of explanation some postulate we cannot observe, not even in principle. It something that we postulate because if a series of things we believe make sense.

**What are theories instead?**

* Hempelian case: we are only aware of the logical structure. When we start thinking about postulating, we are not just interested in how a entity works but also what that entity is
* Scientific Theories are Ontological Maps of the inner constitution of the world (this explains why phenomena behave the way they do at the observable level). Useful to see what it is really out there.

*Challenge*, often they postulate things that go beyond what we can observe. Sometimes you can postulate things that do not even exists.

Venturing into the real of the unobservable

* Theories become risky devices
* They might postulate entities that turn our not to exist..

*How do we know that our theories do not lie?*

1. **Scientific Realist** who put forward the challenge of the previous question. They try to give us reason to believe, all in all there is a world that exist independently
2. Other philosopher of science: **Social Constructivist**

* Our theories lie, nothing exist beyond our theories.
* They might be something used in science, but the real explanation is beyond our comprehension.