Hempel's *Aspects of Scientific Explanation* (1965)

Hempel claims explanations are attractive for at least two reasons:

1. Intellectual curiosity
2. Practicality

He specifically is interested in the nature of explanations that empirical science is able to provide.

- A scientific explanation is an answer to a "why question". Specifically, it is an answer to an *explanatory seeking why question*.
- Requests for explanation require the aspects of the phenomena in question need to be clearly specified to have a clear meaning.
- Explanation (explanans) shows that the outcome "was to be expected" and reduces surprise

    – A why question asks something surprising and yearns for an explanation

Hempel's Description of the DN Model

Hempel deconstructs what he sees as examples of the DN model to characterize it. He claims that the DN model involves

- Antecedent conditions
- General laws
- A logical deduction

An explanation is therefore an argument that shows the explanandum was to be expected on the basis of particular explanatory facts and that the explanandum is a logical (deductive) consequence of them.

Hempel argues that the DN model encapsulates the Causal model

The following is an example of social science phenomena being explained by the DN model:

```
1  (i)  The price of oranges in O.C. doubles  <-\___  Explanans
2  (ii) The law of demand                      <-/
3  ----------------------------------------
4  Quantity of oranges demanded decreases
```

Like Nagel, Hempel claims this model is the best paradigm of explanation. However, similarly they have to answer the non-trivial question of what constitutes a "law".

Scientific Laws   Are laws simple conditionals? That is, are they a simple if-then statement such as

> If there is a pear in this specific basket, it is sweet

Universal conditions succeed in certain ways, however they fail to capture counterfactual and subjunctive conditional statements.

- Subjunctive conditional

    - if-would statements; if water was placed on a stove, the water would boil
    - The statements are counter-to-fact as they speak to something that is not realized, but they are eventual

        * If a pear is put into the basket, does it automatically become sweet?

Counterfactuals are needed to express then many laws of nature and also capture causal statements. According to Hempel, these counterfactuals are hard to deal with.

Hempel claims causal explanation conforms to the DN model - Causal attributions presuppose laws - Individual causal statements are rephrased in terms of "general events"

The explanations that fit best to the DN model are generally physical theories that have a deterministic character. This is because these kind of explanations are structured such that there is a given state and the laws deterministically explain an outcome

Explanation vs. Prediction   Hempel believes that prediction and explanation are similar, and in certain cases equivalent in their informing. However, the following example offered refutes this claim. This diagram outlines the structure of syphilis and how it develops.

```
1       Primary
2          |
3       Secondary
4          |
5       Latent
6      /      \ (28%)
7  Nothing  Tertiary
```
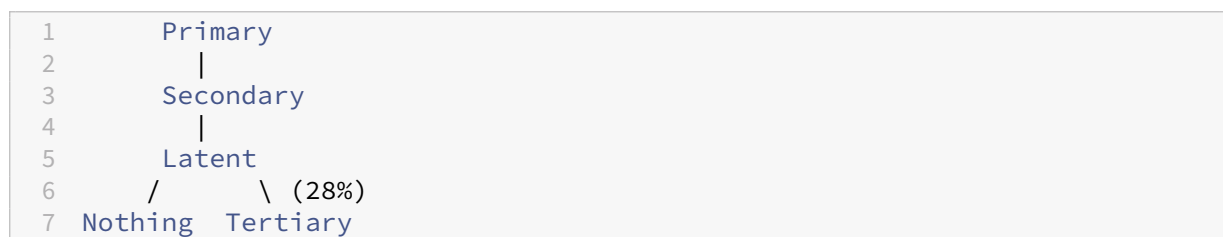
Notice that the final stage only has a 28% chance of happening. Specifically, in the tertiary phase, the patient would develop paresis. In this instance, bacteria would explain paresis but it would not predict it. Therefore there must be some distinction between explanation and prediction.

Hempel responds to this by characterizing it as a case where we do not know all the conditions in the explanans. An even better response is "is paresis only caused by syphilis". This argument struggles under more counterexamples. Consider the measles.

The measles have a symptom where small dots appear inside the mouth (Koplik spots). The interesting part is that they are pathognomonic: they are only caused by measles. That means that the predictive power of Koplik spots is extremely large as it perfectly predicts the disease the person has. However, **the spot's don't explain measles**.

Problems for the DN model

1. Flagpole example

   - To find the length of a flag poles shadow, it appears that the explanans is the height of the flagpole and the angle of the sun above the horizon plus laws about the propagation of light. From these, the length of the shadow can be deduced.
   - This seems fine, however it is possible to flip the outcome with the initial conditions and still have a DN model like explanation. That is, the height of the flag pole is explained by the length of its shadow and the angle. This is very worrying as it is a proper DN model explanation of something that doesn't feel like an explanation.
   - There is an asymmetry in explanations and specifically a direction of explanatory power that the DN model struggles to capture.

2. John and Birth control

   - Consider the following explanation

     - John Jones is a male who takes birth control pills regularly
     - All males who take birth control regularly fail to get pregnant
     - Therefore John Jones fails to get pregnant

   - The issues are twofold

     - The explanation is valid under the DN model but over includes irrelevancies and is not a good explanation
     - In order to rule out the second point as a law, some principled system to do so is needed. This requirement is very hard to satisfy or have a describable system

   - These problems are often solved by appealing to causes

     - The flagpole example would be solved as the shadow is an effect of the height

Defense of Laws in the Social Sciences: Kincaid

Orientation

- "Physics worship" and the idea that Physics is the paradigm of science

- Scientists and philosophers doubted that the social sciences produce explanations because they don't have any well confirmed "laws"
  - "social sciences are doomed to inexactitude"
  - Fighting words: exact, formal, hard science vs special, inexact, and soft science
    - Problematic when used to suggest the illegitimacy of a science

Kincaid will argue for the existence of law's in the social sciences

Argument's Against Law's in the Social Sciences

1. Social kinds are multiply realized

   - Money is realized in different physical things such as gold coins, zinc coins, or paper money
   - Gresham's Law: Bad money drives out good money. Money in this law is realized by many properties and specifically social functionality and not necessarily physical attributes
   - Suggests that there is no systematic connection between the physical and social and hence a problem for using social kinds in laws
     - This argument has led some to argue for the autonomy of higher level sciences from physics due to their inability to capture these higher scale concepts like money

A first issue is that a systematic connection rule's out laws and explanation in other sciences and every day life. It necessitates type-type connectivity and therefore would argue that there is nothing explanatory at a high level. Furthermore, sciences such as biology and computer science would be ruled out as exact, which is a hard pill to swallow. The argument rules out too much as explanatory to be reasonable.

2. The social realm is not "closed"

   - Social systems are not closed systems since they depend on physical and biological factors
   - A closed theory is complete. That is, it describes and explains in its own terms all the forces acting in its domain

Kincaid argues against this, claiming that:

- Physics is not closed in this manner. The physical universe is affected and influenced by events that are biological, social, etc.
- The expectation that a law should only utilize language from a single theory is unwarranted

3. Social involves psychological factors which cannot figure in in laws

   - There cannot be laws about mental states, hence ruling out the social sciences

Kincaid argues against this in a three-fold manner.

- Behavioral theory explanations should not be singled out as Belief-desire psychological theories, the better ones are cognitive psychological theories
- Attacks on psychological explanation often focuses on the weakest examples to rule out the whole
- Most social science proceeds at a macro-level of social behavior, hence independent of individual behavior and mental state

Macro-Laws

Some scientists argue against the existence of explanatory Macro-Laws, claiming

- Macro-laws are inadequate until they have a specified underlying mechanism that makes them possible. This mechanism must be stated in individual terms

Kincaid pushes back, saying mechanisms aren't needed to establish causation or explanation

- Many methods can establish causality without an underlying mechanism
  - Causal cognition, intervention experiments (randomized control trials), germ theory

Furthermore, requiring mechanisms leads to and infinite regression

- It is always possible to ask what allows the mechanism to play it's causal role
- The burden of this regression would rule out more than social laws, it would rule out much of current science

Production of Laws

Many claim that the social sciences haven't produced any laws, something backed by 3 claims

1. Alleged laws in the social sciences lack generality
   - Macroeconomics doesn't apply to primitive societies

A problem with this is that it assumes generality is all or nothing property, but that is not true. Generality is a degree/spectrum. Newton's Law's are arguably under this conception not general since they don't apply to numbers.

It is better to fix a domain, then assess the law's generality in that domain. Additionally, Kincaid argues that perfect should be the enemy of the good. That is, something that is a probabilistic explanation may not be a perfect law or explanation, but it still can have immense utility.

2. Alleged laws in the social sciences are only accidental generalizations, not laws

This argument presupposes a difference between laws and law like statements that are accidental generalizations

3. The purported laws are deduced from false assumptions or have unspecified ceteris paribus clauses

Ceteris paribus => All being equal; Holding other variables fixed

Requiring the specification of precise ceteris paribus clauses would negatively inflict harm upon physics.

Success of Social Science

Kincaid asks why the social sciences have failed to often provide well conformed social theories and why there has been lackluster progress? That is, why are there only a handful of successful laws in the social sciences?

- Social science experiments are much harder to do
  - Technological challenges and ethical challenges
- Values in the social sciences are more involved
  - This is true for all sciences, but at a greater extent in the social sciences as the values have greater implications spanning concerns from the political, economic, sexual, racial, etc.
- Historical reasons
  - People attracted to the social sciences are generally less math inclined
  - Social sciences aren't often given the proper resources (ex. grants and related funding due to biases)

Summary

Kincaid summarizes the arguments, highlighting that by giving up the presupposition of a simple marker that delimits