05. Explanation. Part 3: Alternatives to DN.

I. Unification Account

A scientific explanation of a fact (particular or general) is a demonstration of how the fact can be derived from a **unifying set of argument patterns**.

**Set of argument patterns** = basic principles (axioms, theorems, etc) that (may) underlie a theory.

**Unifying power**: a set of argument patterns $T$ is unifying if it scores high on the following properties:

1. **Scope**: The greater the scope of $T$, the greater the number of conclusions that can be drawn from $T$.
2. **Simplicity**: The greater the simplicity of $T$, the smaller the number of argument patterns in $T$.
3. **Stringency**: The greater the stringency of $T$, the smaller the range of applicability of $T$.

**Ex.** General relativity can be thought of as a unifying set of argument patterns that can be used to describe a certain class of phenomena. Arguably, the set has great scope, great simplicity, and great stringency (it only applies to certain phenomena; namely, phenomena that experience the gravitational force; and it prescribes the behavior of such phenomenon in very restricted ways). Astrology, on the other hand, is not stringent: you can apply its descriptions to almost any phenomenon you experience. (Any event you experience in the course of a day is bound to have been “predicted” by your daily horoscope, given a flexible enough interpretation.)

**General Idea**: To scientifically explain a fact, you have to demonstrate how it can be embedded in a unifying theory. This explains the fact by showing how it is related to other facts.

**Four Characteristics**:

1. **Unification explanations are derivations.**

   A derivation = A sequence of justified steps; each step being explicitly shown to follow from the preceding ones.

   **Note**: Contrast with DN-type explanations, which are arguments (recall, arguments are sets of sentences with one being a claim and the others reasons given for the claim).

   In an argument, you don’t have to explicitly show how each sentence follows directly from the last. This allows irrelevant premises to crop up; in a derivation, there can be no step which is not relevant to the other steps.
2. **The unification account is committed to an Expectibility Thesis:** A unifying explanation must show how the *explanandum* is to be *expected* from the *explanans*.

   **Note:** This is not necessarily *nomic expectibility*, as with DN. In comparison to DN, one might say that unification replaces “law” with “unifying systematization” (*i.e.*, “theory”). But note the other main difference with DN given in Characteristic 1.

3. **Unifying explanations are not necessarily reductionistic.** One might think that to provide a unifying explanation of a fact is to show how that fact can be *reduced* to the fundamental facts that underlie the ultimate grand-unifying theory of everything. In particular, to provide a unifying explanation of a biological fact, you have to show how it can be reduced to facts in chemistry, say, or physics.

   **But:** The unification account *is* compatible with the possibility that biology, say, ultimately can never be reduced to physics. If this is so, you can still construct unifying explanations of biological facts; they’ll just refer to unifying theories in biology and make no reference to physics.

4. **The unification account is global:** A unifying explanation embeds a *local* fact in a larger, *global* theory.

### Problems with the Unification Account

1. **Problem of subjective standards:** How are we to judge which explanations are more unifying than others? *(same problem that the BSA account of laws faces)*

   **ASIDE:** Our text claims that the unification account also suffers from the *Problem of Irrelevant Conjunctions* (just as it claims the general regularity DN & DS accounts do). The claim here is that \( (K \& B) \) can be thought of as a set of argument patterns \( K = \text{Kepler’s Laws}, B = \text{Boyles’ Law} \); and \( K \) can be derived from \( (K \& B) \). But \( K \) isn’t explained by \( (K \& B) \). This is aimed at Friedman’s original account of unification. The account given above is due to Kitcher and it has a ready response to this criticism. According to it, one can say that \( K \) can also be derived from \( N \) (Newton’s theory of gravity), and \( N \) is a *better* explanation of \( K \) than \( (K \& B) \) because \( N \) is more unifying than \( (K \& B) \). One might claim that \( (K \& B) \) in fact *isn’t* a unifying explanation of \( K \) at all: \( (K \& B) \) has poor simplicity. But this response in turn faces the problem of subjective standards: Can we say that \( N \) is objectively more unifying than \( (K \& B) \)?
(2) **Problem of probabilistic explanations**: Some legitimate explanations give a low probability to their *explananda*, hence their *explananda* are *not expected* from their *explanans* (recall the syphilis and paresis example). Since the unification account is commited to an *Expectability Thesis*, it faces this problem.

**One response**: “Deductive Chauvinism” -- Claim that there are *no* legitimate explanations of inherently probabilistic facts.

To see how this folds out, consider the following distinction:

**Two Types of Probabilistic Explanations:**
(a) **reducible**: Given enough information, these reduce to explanations in which the *explanandum* can be logically deduced from the *explanans*.
(b) **irreducible**: The *explanandum* cannot be logically deduced from the *explanans*, regardless of how much further information is provided.

**Deductive chauvinism claims**: All probabilistic explanations can be reduced to “deductive” explanations. There are *no* legitimate *irreducible* probabilistic explanations.

**In other words**: While there may be inherently probabilistic events, Deductive Chauvinism claims such events cannot be explained (to the extent that inherently probabilistic events cannot be predicted with certainty).

**Ex1**: Suppose an electron beam impinges on a potential barrier (think of a beam of electrons focused on a wall). The Schrödinger equation in quantum mechanics gives the probability for each electron in the beam to be reflected or to tunnel through. Suppose a given electron, $e_1$, tunnels through the barrier. We can ask:

*Why did $e_1$ tunnel through the barrier?*

We cannot construct a *derivation* with the conclusion “$e_1$ tunneled through the barrier”. All the Schrödinger equation gives us is the *probability* that $e_1$ will tunnel through (say it’s 0.80). The Schrödinger equation does *not* predict with certainty whether $e_1$ will or will not tunnel through.

**What this means**: We cannot construct a unifying explanation of why $e_1$ tunneled through.

**But**: The unificationist who is also a *Deductive Chauvinist* will respond that this is fine, since there are no legitimate explanations of inherently probabilistic events, and the actual event of $e_1$ tunneling through the barrier is just such an inherently probabilistic event.

**ASIDE**: Such a unificationist can explain why $e_1$ had an 80% chance of tunneling through the barrier (instead of, say, a 50% chance). This is entailed by the Schrödinger equation. But such a unificationist, again, says there is *no* explanation for why $e_1$ did in fact tunnel through.
**So:** A unificationist can claim that there are no explanations of inherently probabilistic events. A *physicist* might be satisfied with the claim that there is no explanation for why a particular electron tunneled through a barrier.

**But:** Does this work for explanations in the *social sciences*?

**Ex2:** Suppose an anthropologist studying the Yanomami indians of Brazil seeks an explanation of why the Yanomami attacked village *A*. The anthropologist has determined the following:

(a) The Yanomami *tend* to attack when resources are scarce;
(b) The Yanomami *tend* to attack when the military advantage is theirs; and
(c) The Yanomami *tend* to attack when their social influence is threatened.

**Note:** There are no factors that determine with *certainty* when the Yanomami will attack.

**So:** The event of such an attack is an inherently probabilistic event.

**So:** A unificationist who is a deductive chauvinist must claim that there is no explanation for why the Yanomami *did* in fact attack village *A*.

**But:** The anthropologist certainly will not be satisfied with this and will indeed claim that some form of explanation for the attack can be constructed.


**Moral:** Deductive chauvinism is a high price to pay as a response to the problem of probabilistic explanations. But if the unificationist does not adopt it, she is faced with the same sorts of problems that afflict the IS account.

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**II. Causal Account**

To explain an event is to provide information about what caused it.

**Two Characteristics**

(1) The causal account is *local*.

(2) Basic causal account claim: *Causal structure underlies laws and theories*. This is what gives them explanatory power. So all DN-type and unification explanations are causal explanations, but not all causal explanations can be viewed as DN-type or unification explanations.

**Problems with the Causal Account**

(1) *Problem of the nature of causality:* How are legitimate causal explanations distinguished from illegitimate explanations based on mere statistical correlations?
(2) **Problem of purely theoretical explanations:** Some theoretical explanations do not explicitly refer to causes.

*Ex* Why can’t you fit a left-handed glove on your right hand?

**Theoretical explanation:** Due to the topological properties of the left-handed glove and the right hand.

**Causal explanation:** Due to the resistance of the inner surface of the left-handed glove with your right hand.

**Claim:** Purely theoretical explanations count as legitimate scientific explanations. So the causal account cannot be a complete account of scientific explanation.

(3) **Problem of irreducible probabilistic explanations:** What caused the Yanomami to attack village A? What caused $e_1$ to tunnel? To provide causal explanations of irreducibly probabilistic events, we need a theory of probabilistic causation (and a theory of simple causation is hard to come by).

III. Pragmatics Account van Fraassen (1980) *The Scientific Image*

**Motivation:** Explanations are context-sensitive.

**Pragmatic Features of Explanations**

1. **Clarification of explanation-seeking question**
   What is the *explanandum* for which an explanation is being sought?

   *Ex1:* In the glove example, is the relevant question *What prevents me right now from putting this left-handed glove on my right-hand?* or is it *In general what prevents objects with opposite “handedness” from “matching up”?* The causal explanation is a more appropriate answer to the first question; the theoretical explanation is more appropriate to the second question.

   *Ex2:* The question *Why did Adam eat the apple?* will be responded to in different ways, depending on how it is interpreted:
   (a) Why did Adam eat the *apple*? (As opposed to a grape or an orange.)
   (b) Why did *Adam* eat the apple? (As opposed to Eve or the snake.)
   (c) Why did Adam *eat* the apple? (As opposed to throwing it at the snake, *etc.*)

2. **Knowledge-context of the explanation-seeker**

   The information content of the explanans of an adequate explanation will depend on the knowledge of the questioner.

   In the glove example, you would offer the causal explanation to someone unfamiliar with topology, whereas you might offer the theoretical explanation to a mathematician.
(3) **Interests of the explanation-seeker**

The content of the explanans of an adequate explanation will depend on the purpose for which the explanation is being sought.

Suppose a congressional committee is seeking an explanation for a plane crash in order to modify existing safety regulations. It will be more interested in explanations that refer to the procedures the crew went through (or failed to go through), as opposed to explanations that refer to principles in Newtonian dynamics.

**Relevant Distinction**

(a) **Ideal Explanatory Text**: a complete description (nomic, systematic, causal) of the *explanandum*. The full, gory details. (*Non-pragmatic aspect.*)

(b) **Explanation Information**: Accounts of particular aspects of the ideal explanatory text. (*Pragmatic aspect.*)

**Claim**: Scientific explanations are almost always requests for explanation information, and *not* for the ideal explanatory text.