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Hempel on Laws and their Role in Scientific Explanation

Scientific explanations must meet two systematic requirements:

1. Explanatory Relevance: must provide necessary, not sufficient, conditions for adequate explanation.
   a. Galileo and satellites of Jupiter: Defective argument -facts are spurious and irrelevant to point at issue
   b. Physical explanation of rainbow: explanatory info given by physical account would constitute good grounds for expecting rainbow to occur under specified circumstances
   c. Physical explanation meets requirement for explanatory relevance
2. Testability: Statements must be capable of empirical test
   a. If no empirical findings could prove or disconfirm conception, it lacks explanatory power
   b. Test implications – conditions under which event will occur

The two forms of Scientific Explanation:

1. The Deductive-Nomological (DN) model *(deductive subsumption under laws of universal form)*
   a. Has the logical form: When all conditions of kind F are realized, conditions of kind G are realized.
   b. Divides into two parts:
      i. explanans sentences: laws and circumstances specifying explanatory info
      ii. Explanandum sentence: phenomenon explained
   c. Elliptical form- presuppositions of explanation (salt/ slush example and fever/ contaminated blood example)
   d. Laws need not be explained- same cause F, same effect G. Perier's mercury example- phenomenon explained by general laws and particular facts
2. Probabilistic explanations (*inductive subsumption under laws of probabilistic form)*
   a. Has the logical form: under certain conditions, constituting random experiment R, a certain kind of outcome (O) will occur in a specified percentage of cases.
   b. Can be divided further into two kinds:
      i. Statistical probability- quantitative relation between repeatable kinds of events. C(H,K)=r
      ii. Logical Probability- quantitative logical relation between definite statements. P(O,R)=r

- Examples: probabilistic law regarding connection between exposure and contracting disease, ie. Jim's exposure to measles makes highly probable that Jim catches measles

Important Distinctions

1. Universal Laws and Accidental Generalizations
   a. When explanandum is not particular event but a uniformity, explanatory laws exhibit uniformities laws = statements of universal form. accidental generalization-gold / rocks in a box examples where no disconfirming evidence is known.
   b. Law supports *counterfactual conditionals* and *subjunctive conditionals*: If A, then B hypothetical Paraffin candle example
   c. Statement "all rocks in box contain iron" can't support statement "if this rock is put in the box, it must contain iron"
   d. Law can serve as basis for explanation whereas finite conjunctions can't extrapolate to infinite rocks
2. Aren't all scientific laws probabilistic?
   a. Supporting evidence is always finite and logically inconclusive.
   b. However, no matter how poorly they are supported, the two kinds of scientific laws have different logical forms.