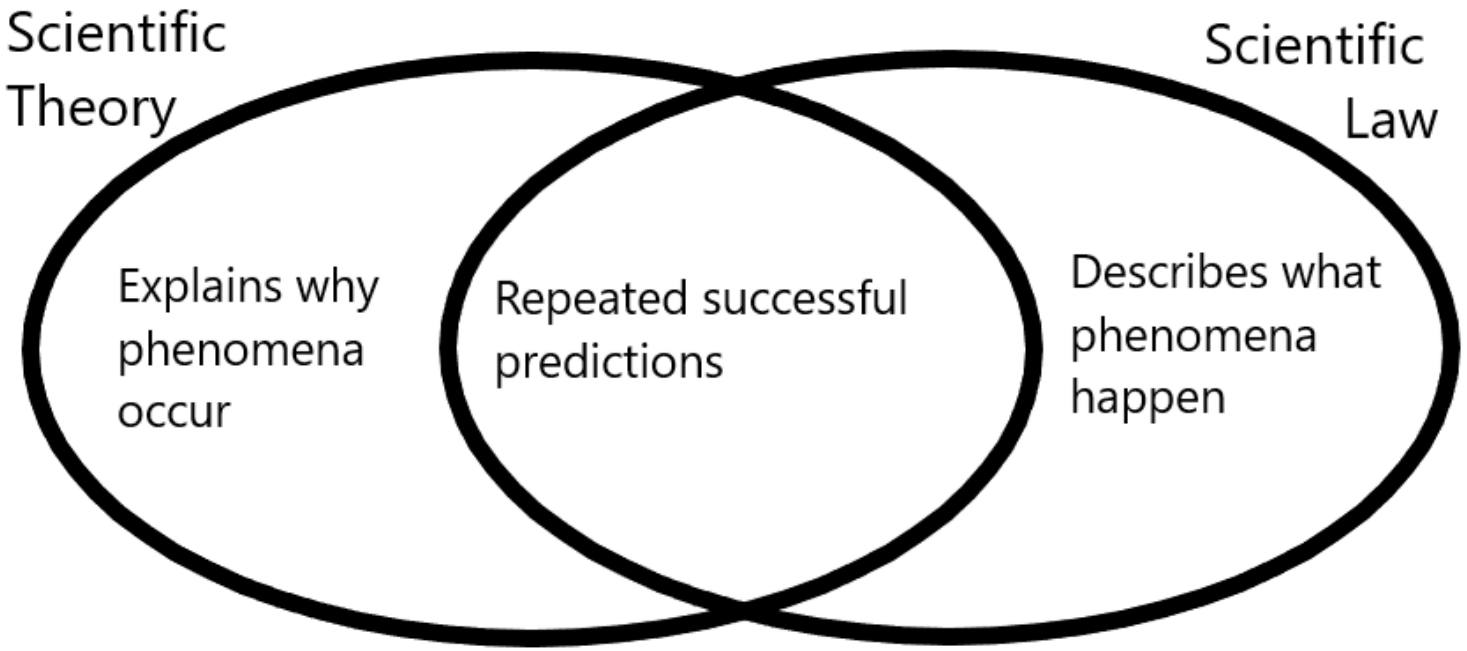
# Theory terminology

Theory: law, theorem, proof, hypothesis, prediction, model, framework, method, methodology, theories in maths, theories in words, construct, concept, variable, assumption, axiom, postulate

Drawn from various sources including Wikipedia – no guaranty of reliability, discipline dependent, not an exhaustive list

Some examples of how theory is described using the terminology

# Theory versus law



# Theories and models

- Models are (according to different authors)
  - a special type of theory
  - portions of theories
  - derived from theories
  - simplified versions of theories
  - models represent correspondence between two or more theories
  - theories represent specific interpretations of (i.e., are derived from) models
- Others consider the terms to be synonymous
- Theories always imply generalization; models may or may not do so

# Theorem

- In mathematics, a theorem is a statement that has been proven on the basis of previously established statements, such as other theorems, and generally accepted statements, such as axioms. A theorem is a logical consequence of the axioms.

# Axiom, postulate

- An axiom or postulate is a statement that is taken to be true, to serve as a premise or starting point for further reasoning and arguments
  - Philosophy: a statement that is so evident or well-established, that it is accepted without controversy or question
  - Logic: premise or starting point for reasoning
  - Mathematics
    - Logical axioms - statements that are taken to be true within the system of logic they define
    - non-logical axioms (e.g., $a + b = b + a$); substantive assertions about the elements of the domain of a specific mathematical theory - "axiom", "postulate", and "assumption" may be used interchangeably - not a self-evident truth, but rather a formal logical expression used in deduction to build a mathematical theory

# Proof

A proof is sufficient evidence or a sufficient argument for the truth of a proposition

The concept applies in a variety of disciplines, with both the nature of the evidence or justification and the criteria for sufficiency being area-dependent.

In any area of mathematics defined by its assumptions or axioms, a proof is an argument establishing a theorem of that area via accepted rules of inference starting from those axioms and from other previously established theorems. The subject of logic, in particular proof theory, formalizes and studies the notion of formal proof.

# Concepts as the basis of understanding

- Concepts are:
  - generalized abstractions
  - encompass universes of possibilities
  - hypothetical - not reality, just ideas regarding reality
  - learned
  - socially shared
  - reality oriented (or functional)
  - selective constructions
- Conceptual systems – concepts and their relationships

# Construct, variable

- Construct: defined theoretical concept
- Variable: real world attribute that can be measured or described
- Modelling, statistics, experimentation: the values of dependent variables depend on the values of independent variables. The dependent variables represent the output or outcome whose variation is being studied. The independent variables (statistics : regressor) represent inputs or causes: potential reasons for variation. In an experiment, any variable that the experimenter manipulates can be called an independent variable

# Hypothesis

- a proposed explanation for a phenomenon - either:
  - empirically testable statements that are derived from theories and that form a basis for rejecting or not rejecting those theories, depending on the results of empirical testing, or
  - pre theory - a theoretical statement that has yet to be empirically validated

# Assumption

- Assumptions are statements accepted as given truths without proof. In order to use a theory, the assumptions must be accepted by the user. Assumptions set the foundation for the application of a particular theory
- An explicit assumption is a statement of truth that is fully and clearly expressed

# (Testable) prediction

- Rigorous, often quantitative, statement forecasting what would happen under specific conditions
- Notions that make no *testable* predictions are often considered not to be part of science

# Proposition

- Aristotle: sentence which affirms or denies: all men are mortal
- Formal logic: string of variables, operators, function symbols, predicate (or relation) symbols, quantifiers, and propositional constants
- Testable statements connecting constructs

# Theories defined using the terminology

- The process of the scientific method involves making conjectures (hypotheses), deriving predictions from them as logical consequences, and then carrying out experiments or empirical observations based on those predictions. A hypothesis is a conjecture, based on knowledge obtained while seeking answers to the question. The hypothesis might be very specific, or it might be broad. Scientists then test hypotheses by conducting experiments or studies. A scientific hypothesis must be falsifiable, implying that it is possible to identify a possible outcome of an experiment or observation that conflicts with predictions deduced from the hypothesis; otherwise, the hypothesis cannot be meaningfully tested.
- If the hypothesis is tested, confirmed by replication, and not falsified it is theory

Bacharach, B. (2011). Organizational Theories: Some Criteria for Evaluation. *Academy of Management Review, 14*, 496-515.

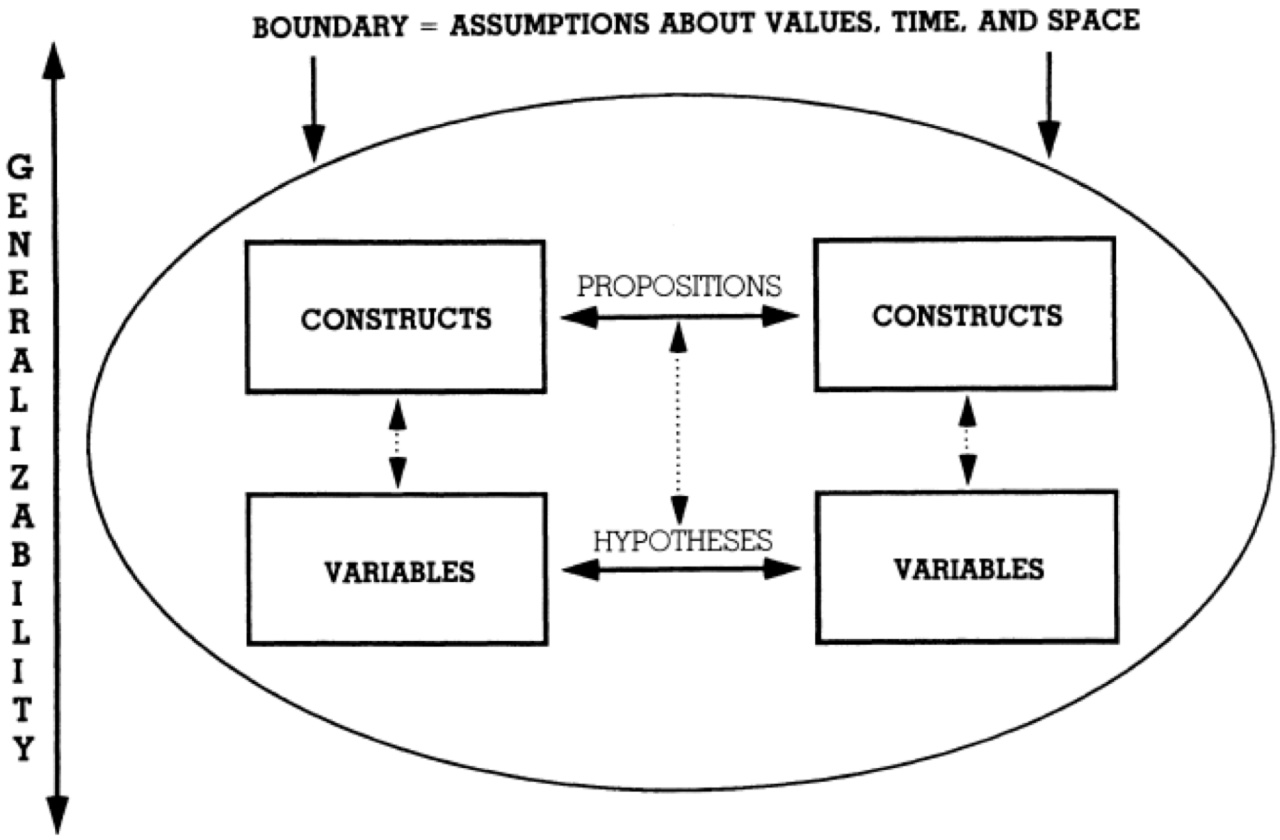



*Figure 1.* **Components of a theory.**

# Nomological net

Cronbach, X., Meel, P. (1962). Construct Validity in Psychologal Texts. *Psychological bulletin, 59*, 257-272.

- We shall refer to the interlocking system of laws which constitute a theory as a nomological network. The laws in a nomological network may relate (a) observable properties or quantities to each other; or (b) theoretical constructs to observables; or (c) different theoretical constructs to one another.
- These "laws" may be statistical or deterministic. A necessary condition for a construct to be scientifically admissible is that it occur in a nomological net, at least some of whose laws involve observables. The construct is not "reduced" to the observations, but only combined with other constructs in the net to make predictions about observables.
- An enrichment of the net such as adding a construct or a relation to theory is justified if it generates nomologicals that are confirmed by observation or if it reduces the number of nomologicals required to predict the same observations

# Choose your theoretical language and stick to it