10.1: Inductive Logic

Induction and Deduction

- Let's being by recalling some of our very first definitions:

> A **valid argument** is one in which it is *necessary* that, if the premises are true, then the conclusion is true.

- So, in a valid argument is one in which the premises, if true, *guarantee* the truth of the conclusion. If that guarantee is absent, the argument is invalid:

> An **invalid argument** is one in which it is *possible* for the premises to be true and the conclusion false.

- In general, then:

> A **deductive argument** is one that is intended to be valid; hence one in which the premises are intended to *guarantee* the truth of the conclusion.

- Hence:

> **Deductive logic** is the study of methods for evaluating whether or not an argument is valid, that is, whether or not the premises of the argument guarantee the truth of the conclusion.

- In this chapter we turn our attention to *inductive logic.*

> An **inductive argument** is one in which the premises are intended to make the conclusion *probable* (i.e., *more probable than not),* without guaranteeing it.

- Thus, in inductive logic, the notion of validity is replaced by the (somewhat vaguer) notion of *strength,* that is, with the extent to which the premises of an argument raise the probability of the conclusion. Accordingly:

> A **strong argument** is one in which it is probable (but not necessary) that if the premises are true, then the conclusion is true.

- For example

    1. Ninety percent of 40-year-old American women live to be at least 50. Helen is a 40-year-old American woman. So, Helen will live to be at least 50.

- Argument (1) is obviously not valid — the premises do not *guarantee* the truth of the conclusion.

- But the premises *do* make the conclusion more probable than not.

    - You'd bet on that conclusion on the basis of those premises, right?

    - That's a typical mark of a strong argument.

- As validity is to invalidity, so strength is to *weakness*:

> An **weak argument** is one in which it is *not* probable that if the premises are true, then the conclusion is true.

- For example

    2. Exactly 50% of 30-year-old American women live to be 80. Alice is a 30-year-old American woman. So, Alice will live to be 80.

- Since, according to the first premise, exactly 50% of 30-year-old live to be 80, 50% of them do *not* live to be 80.

- Hence, the premise gives us *no more* reason to believe our 30-year-old American Alice will live to be 80 than to believe she won't.

    - Other things being equal, you wouldn't bet a large sum on something with only a 50% probability.

- We can now define *inductive logic* generally:

> **Inductive logic** is the part of logic that is concerned with the study of methods of evaluating arguments for *strength* or *weakness*.

- As we also learned early in the semester, valid arguments can still be *bad* arguments if they have false premises:

> An **sound (deductive) argument** is one that is both valid and has true premises.

- Hence:

> An **unsound (deductive) argument** is one that is either invalid or has false premises.

- The notion corresponding to soundness in inductive logic is *cogency*:

> An **cogent (inductive) argument** is one that is both strong and has true premises.

- And corresponding to unsoundness:

> An **uncogent (inductive) argument** is either a weak argument or a strong argument with a false premise.

Further Points of Contrast b/t Deductive and Inductive Arguments

- A sound argument cannot have a false conclusion but a cogent argument can.

  Example

  3. Ninety percent of the cars in the parking lot were vandalized last night. Michael's car was in the parking lot. So, Michael's car was vandalized last night.

- Validity is all-or-nothing; it doesn't come in degrees. Strength comes in degrees.

  - The conclusion of one strong argument might be more probable than that of another.

- Every argument with a valid form is valid, but strength is not ensured by form.

- Consider the following *statistical syllogism*:

  4. Ninety-five percent of women over 30 years of age cannot run the mile in under 5 minutes. Rebekah is a woman over 30 years of age. Hence, Rebekah cannot run the mile in under 5 minutes.

- This argument has the following form:

  1. _____ percent of A are B.
  2. c is an A.

  So, 3. c is a B.

  - As we want the above form to be that of a *strong* argument, the blank must be filled with a number > 50 and < 100.

    - Why < 100?

- In argument (4) above,

  - A is the set of women over 30.

  - B is the set of things that can't run the mile in under 5 minutes.

  - c is Rebekah.

- Now consider another argument of the same form:

  5. Eighty percent of women over 30 who are world-class marathoners can run the mile in under 5 minutes. Rebekah is a woman over 30 who is a world-class marathoner. Therefore, Rebekah can run the mile in under 5 minutes.

- (4) and (5) are both strong arguments and could even both have true premises and hence be considered cogent. Yet their conclusions contradict each other.

  - In deductive logic, you can't possibly have two sound arguments for contradictory conclusions.

- What's going on?

- Perhaps best characterized as follows:

  If someone were to advance (4) *while aware of* the information in (5) (in particular that Rebekah is a world-class marathoner), they would be *leaving out relevant evidence*, evidence that bears on the truth of (4)'s conclusion.

- Such an omission is typically considered a "sin", i.e., something for which someone can be considered culpable.

  - Consider, e.g., recent cases where prosecutors withheld evidence to win a conviction.

- In general, when one seeks to construct a strong argument but *knowingly omits relevant evidence*, one commits a fallacy, specifically:

> The **fallacy of incomplete evidence** is the *culpable* omission of relevant evidence.

- Bottom line for now:

  In deductive logic, the mere *form* of an argument can guarantee validity. In inductive logic, form does not guarantee *strength*.