UNIT IV: Non-Deductive Arguments

Section 1: Critique of Inductive Arguments

Inductive arguments are those in which a conclusion is drawn about a class of objects, based upon the characteristics observed in a sample of that class. Such arguments are persuasive to the extent that the sample was connected causally to the larger class in such a way that the characteristics of the larger class will be reflected in the sample. For example, "Most of the jellybeans in my hand are red. They were taken from this jar, and I mixed them up well before I took them out. So, most of the jellybeans in this jar are red." Because inductive arguments turn upon the causal connection between a sample and a larger class, they allow us to draw conclusions that extend beyond what is said in the premises. Induction indicates facts about the world beyond what we actually observe; but this also makes induction open to the possibility of error. Given the truth of the premises, we can often estimate a numerical probability that the conclusion is true, but true premises do not *guarantee* a true conclusion.

Inductive arguments can be divided into four kinds, depending on two factors.

(1)   the sample - which can be either...
      (a)   simple (uncontrolled); or
      (b)   bifurcated (controlled)

(2)   the nature of the conclusion - which can be either
      (a)   general (to the population as a whole); or
      (b)   oblique (to other unobserved cases within the population).

These two factors create a grid with four quadrants.

	Simple (uncontrolled) sample	Bifurcated (controlled) sample
General conclusion	Uncontrolled studies that generalize to an entire population. EXAMPLES: Opinion polls, jelly beans in an urn	Controlled studies that generalize to an entire population. EXAMPLES: Comparison studies (e.g. comparing women to men)
Oblique conclusion	Arguments from observed cases to unobserved cases. EXAMPLES: Analogical arguments; trend projections	Controlled studies applied to new individual cases. EXAMPLES: Medical studies as used to provide a prognosis for a patient.

The criteria by which Inductive arguments should be evaluated fall into two types, corresponding to the two premisses of an Inductive argument: the facts observed and the characteristics of the sample subject to observation. There are, in total, nine criteria to consider.

I. Critique of the Method of Observation

There are two criteria by which the observation should be critiqued.

A. Objectivity – Is the observation performed in a way that filters out the expectations and prejudices of the people participating in the observation, specifically the experimental subjects (assuming that they are persons) and the experimenter who makes and records the observations?

(1)   An increase in the objectivity of the subjects will strengthen the argument.

Example:

> A group of people were asked to respond to photographs of human faces, saying whether they thought the person in the photo was trustworthy, friendly, etc. Prior to responding to the photos, the subjects took an elevator ride during which they were asked to hold either a cup of warm coffee or a glass of cold coffee. People who held the warm coffee were more likely to respond favorably to the faces in the photographs. The subjects were not told that the coffee had anything to do with the study.
>
> a. Suppose the subjects had known that the coffee was an essential part of the study.
>
> *This would, of course, weaken the argument, since it decreases the objectivity of the subjects. Subjects should not know what their answers mean, or how they will be used.*

(2)   An increase in the objectivity of the experimenter will strengthen the argument.

Example:

> Samuel Morton, a 19th Century scientist, measured the cranial capacity of numerous human skulls to determine whether white races had larger head size (on average) than dark races. He assumed that they would, since he assumed that larger cranial capacity would indicate greater intelligence. He did, indeed, find that white races had about 15% larger heads that African negroes.
>
> a.   Suppose Morton had asked lab assistants to measure the skulls, without telling them what racial groups the skulls belonged to.
>
> *This would strengthen the argument, since it increases the objectivity of the experimenter. Morton did, in fact, re-do the study using lab assistants. His 15% difference entirely vanished. (By the way, cranial capacity does not correlate with intelligence in any case.)*

B. Decisiveness – Is the property observed a clear and reliable example of the property being looked for, or is it a weak, borderline example? Is the conclusion drawn from the observation commensurate with the decisiveness of the property actually observed?

(3)   An increase in the decisiveness of the observation (i.e. in the premisses) will strengthen the argument.

Example:

> In 1989 two electrochemists working on the development of cold fusion (energy production from fusion without inducing a nuclear explosion) created a table-top device that apparently caused hydrogen atoms to be pulled close together, possibly close enough to fuse. They measured slightly greater energy output from their devise than the energy needed to run it. Science reporters were enthusiastic in reporting that clean, plentiful energy would soon be available to everyone.
>
> a.   Suppose the energy output was so small as to be less than the margin of error predicted from their methods of measurement.
>
> *This would weaken the argument, since the decisiveness of the observation is decreased. In fact the actual observations were only barely above the margin of error in the first place, and have not been replicated. Apparently the one significant result was a statistical fluke.*

(4)   A decrease in the decisiveness of the expectation (i.e. in the conclusion) will strengthen the argument.

Example:

> A study found a significant correlation between drinking a glass of red wine with dinner and lower rates of heart disease. Apparently, alcohol is good for the heart.
>
> a. Suppose researchers (remembering that people who regularly have red wine with dinner are relatively wealthy, and so able to afford better health care) had concluded that better access to health care might help prevent serious heart disease.
>
> b. Suppose researchers (remembering that stress is strongly correlated with higher rates of heart disease) had concluded that there *may* be some relation between small amounts of alcohol and lower stress.
>
> *Either of these conclusions is better. Both recognize that more research is needed before we can claim to understand the reason for the observed correlation.*

II. Critique of the Sample

There are four criteria that can be used to judge the adequacy of a sample. However, only the first two criteria apply to every sort of Inductive argument. The third criterion applies only to oblique generalizations; the fourth applies only to arguments based on a bifurcated sample.

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A. Sample Size – Is the sample large enough to represent the population?

(5)   An increase in the size of the sample will strengthen the argument.

Example:

> I am performing a longitudinal study to determine how long American cars remain on the road. I tracked five cars from the time they were purchased until they were sold for scrap. Four cars were still on the road after twelve years. Only one was totaled in an accident after only five years. I conclude that American cars will last a long time.
>
> a. Suppose I had tracked ten cars instead of five.
>
> *Obviously, this would strengthen my conclusion by increasing sample size.*

B.   Sample Diversity – Is the sample broad enough to be considered an adequate representation of the population? Is the population uniform enough that the sample adequately represents it? There are two ways to achieve sample diversity:

> **randomize** - make sure that each member of the population has an *equal chance* to be selected for the sample.
>
> **stratify** - make sure that *relevant segments* of the population are represented in the sample (in proportion to their occurrence within the population).

Stratifying is the more powerful way to achieve diversity, but it requires that the experimenter know enough about the population to be able to identify "relevant segments," i.e. how sub-populations are different from each other. In the absence of such knowledge one should achieve diversity by randomizing.

(6)   An increase in the diversity of the sample will strengthen the argument.

Example:

> I am performing a longitudinal study to determine how long American cars remain on the road. I tracked a thousand cars from the time they were sold until they were sold for scrap. All of the cars were driven in San Diego County, California. 90% were still on the road after twelve years. I conclude that American cars will last a long time.
>
> a. Suppose I had tracked cars in cities all around the country instead of just cars in San Diego County.
>
> *Obviously, this would strengthen my conclusion by increasing sample diversity. Notice that sample diversity is far more important than sample size. A study done with only five cars, provided they were from all around the country, would be more convincing than this study.*

(7)   A decrease in the diversity of the population will strengthen the argument.

In practice, limiting the diversity of the population is done by limiting the scope of the conclusion. For example, a conclusion limited to college freshmen is less diverse than a conclusion about college students in general.

Example:

> Prior to Thanksgiving dinner, I wish to determine whether the grapes on the table are seeded or seedless grapes. How big a sample do I need?
>
> a. Suppose there is only one bowl of grapes on the table, and they are all on the same stalk.
>
> *Grapes from the same stalk are genetically identical to each other. A single grape is a sufficiently diverse sample to represent the entire population!*

C. Analogy (Oblique generalizations only) - Are there enough points of similarity between the observed cases (i.e. the sample) and the unobserved cases (i.e. the conclusion) to warrant drawing an inference from one to the other? Are there notable points of dissimilarity?

(8)   An increase in analogy (similarity of observed cases to unobserved cases) will strengthen the argument.

Example:

> The Greek anatomist, Galen, wrote an atlas of the human body which was regarded as authoritative for the next thousand years. However, Galen never dissected human bodies, since this was considered sacrilegious. He based his knowledge of the human body on dissections of dogs.
>
> a. Suppose Galen had used monkeys rather than dogs.
>
> *This would have strengthened the reliability of Galen's atlas by increasing analogy. Monkeys are more similar to humans than dogs are.*

D. Comparability (Bifurcated samples only) - Are there enough points of similarity between the comparison groups, e.g. between the experimental group and the control group, to warrant comparing them? Are there any notable points of dissimilarity, other than the specific feature used to define the groups?

(9)   An increase in comparability (similarity of the segments of the sample) will strengthen the argument.

Example:

> We did a study to determine whether men or women are more conscientious about washing their hands after using a public restroom. We gathered data at a local sports arena during a game. I observed hand-washing behavior in the men's room on the 3rd floor; my wife made observations in the women's room on the 1st floor, which is next to the cotton candy vendor. We determined that women are far more conscientious about washing their hands than men.
>
> a. Suppose both restrooms were on the same floor, equally distant from the cotton candy vendor.
>
> *This would strengthen the argument by increasing comparability. Proximity to the cotton candy vendor should be "controlled," since this factor, rather than gender, might account for the difference in the results.*

The following table summarizes the nine criteria and their effect on an Inductive argument.

criteria	*Increase* to this criterion will:	*Decrease* to this criterion will:
(1) objectivity of subjects	strengthen	weaken
(2) objectivity of experimenter	strengthen	weaken
(3) decisiveness of observation	strengthen	weaken
(4) decisiveness of expectation	*weaken*	*strengthen*
(5) sample size	strengthen	weaken
(6) sample diversity	strengthen	weaken
(7) population diversity	*weaken*	*strengthen*
(8) analogy	strengthen	weaken
(9) comparability	strengthen	weaken

Exercises:
A. Consider the following inductive arguments. State whether each of the suggested changes would strengthen or weaken the argument. State the specific criterion that justifies your answer.

1.   The Pew Hispanic Center recently released a survey of nearly 5000 migrants from Mexico working in seven cities in the United States. To the surprise of researchers, only about 5% of the migrants surveyed reported being unemployed in Mexico prior to leaving for the United States to find work. Although the survey didn't ask for immigration status, it was believed that most of the respondents were undocumented. The Pew Center concluded that lack of work in Mexico is not an important cause of illegal immigration.

      *[This argument uses a simple sample and draws a general conclusion, so
      you do not need to consider Analogy or Comparability.]*

   a.   Suppose the migrants surveyed had come from various parts of Mexico, including Mexico City, the Oaxaca region and the northern Chihuahua region.

   b.   Suppose the migrants surveyed had all been employed as seasonal laborers in the California fruit industry.

   c.   Suppose the people questioned believed they were being considered for a job, and that they wanted to appear to have a good work record.

   d.   Suppose roughly 3000 migrants had been surveyed.

   e.   Suppose the people questioned were asked not to put their names, or any other identifying marks, on their questionnaires.

   f.   Suppose the jobs that the workers had previously held in Mexico had been good-paying jobs, offering significant benefits and a promise of future advancement.

2.   Ralph has been driving across the country on business, and it is time to stop for lunch. He sees a billboard for a restaurant advertising "home style cooking." On three previous occasions he has eaten at restaurants advertising home style cooking, and he found them to be clean, reasonably priced, and offering a menu of familiar American food. He decides to stop, expecting to find a clean, reasonably priced restaurant with familiar food.

      *[This argument draws an oblique conclusion but it uses a simple sample,
      so you do not need to consider Comparability.]*

   a.   Suppose he expects to find chicken fried steak on the menu.

   b.   Suppose that the three restaurants he had eaten at previously were in Pennsylvania, Arkansas, and Arizona.

   c.   Suppose that his three previous dining experiences were while on a trip with his parents twenty years ago.

d. Suppose he had eaten at five restaurants advertising home style cooking instead of three.

e. Suppose that the restaurants he had eaten at previously had been roadside establishments that used highway billboards to advertise to motorists.

f. Suppose that the restaurants he had eaten at previously had personal possessive names, e.g. "Martha's" and "Denny's." This one is named "Nancy's."

3. Hector is convinced he is saving money by buying a more expensive brand-name gasoline rather than using the cheap gas at the corner Pump-n-Go. He thinks he gets better gas mileage with the brand-name gas. His wife tells him he is a fool, so, to prove his point, he fills his '75 Dodge Ram with Pump-n-Go gas and his wife's '98 Ford Focus with brand-name gas. They then carefully monitor their gas mileage. To his satisfaction, Hector finds that during the test the vehicle with Pump-n-Go gas got 18 miles to the gallon, while the vehicle with brand-name gas got 31 miles to the gallon-more than enough to justify the extra cost. Having converted his wife, Hector decides to buy a new house with all the money he expects to save.

> [*This argument uses a bifurcated sample, but it draws a general conclusion, so you do not need to consider Analogy.*]

a. Suppose the test is conducted over a one-month period, using several tanks of gas in each vehicle, rather than only one tank each.

b. Suppose the Ford Focus had gotten 41 miles to the gallon instead of 31.

c. Suppose that Hector's wife does a lot of highway driving, but Hector does a lot of stop-and-go city driving.

d. Suppose that during the test, Hector drives both vehicles himself.

e. Suppose that Hector and his wife get two friends to drive their cars, but do not tell their friends about the experiment.

f. Suppose Hector decides to buy a new DVD player instead of a new house.

B. Consider the following inductive arguments. Decide whether the sample is simple or bifurcated and whether the argument draws s a general or an oblique generalization. Then state whether each of the suggested changes would strengthen or weaken the argument. State the specific criterion that justifies your answer.

1. The Microsoft Corporation is test-marketing the new X-Box 6000 to see if it is likely to be a popular purchase this coming Christmas season. They have assembled a focus group of twelve devoted gamers to try it out. The gamers are wildly enthusiastic about the new

members of the focus group declare that they can hardly wait to own their own console. Only one member of the focus group expresses dismay at the $200,000 price tag. The Microsoft executives conclude that soon nearly every household will have the new X-Box 6000, and that they will be wealthy beyond the dreams of avarice.

    i.   Is the sample simple or a bifurcated?

    ii.   Is the argument drawing a general or an oblique conclusion?

a.   Suppose all twelve members of the focus group owned stock in Microsoft.

b.   Suppose the focus group had included twenty members.

c.   Suppose the focus group had included only single men between the ages of 23 and 30 with high-paying jobs.

d.   Suppose the focus group had included people in college, people with advanced graduate degrees, and people who had never finished high school.

e.   Suppose the response, while generally positive had included numerous complaints about the fake-looking greenish tint in the holograms.

f.   Suppose the executives conclude that the X-Box 6000 will sell reasonably well.

2.   You are a ghost hunter. Seven people have reported strange occurrences at the house on the hill. One person heard footsteps in the attic. Several others reported mysterious moaning noises coming from inside the house. At least one person claimed to have felt a "presence." Based on these reports you conclude that the house is probably haunted, and go to investigate, fully expecting to have some strange experiences yourself.

    i.   Is the sample simple or a bifurcated?

    ii.   Is the argument drawing a general or an oblique conclusion?

a.   Suppose that two of the people who reported strange occurrences were children, while the rest were adults ranging in age from 22 to 64.

b.   Suppose you take a friend with you who believe you are only looking at the house as a possible real estate investment.

c.   Suppose that at least one person had reported seeing a human form materialize from nowhere, and then disappear again.

d.   Suppose that all seven of the people who have reported strange occurrences belong to the same family that last year tried to prevent the house from going on the market.

e. Suppose that you expect to actually see a ghost yourself.

f. Suppose you discover that ten people from a neighboring town have also had strange experiences at that house.

3. In their first eight games this season the Denver Broncos won 5 and lost 3. I therefore conclude that they will win most of their remaining games this season, and possibly even make the play-offs.

      i. Is the sample simple or a bifurcated?

      ii. Is the argument drawing a general or an oblique conclusion?

a. Suppose that in their eighth game their starting quarterback injured his shoulder and was benched for the rest of the season.

b. Suppose that the first eight games included games against teams with superior defensive lines as well as against teams with a good passing game, and teams with superior rushing plays.

c. Suppose that in many of the first eight games the Broncos won by a margin of less than three points, which were scored by field goals in the last few second of play.

d. Suppose I conclude that this will be one of the Broncos' best seasons ever, and that they may even win the Super Bowl.

e. Suppose that I am an avid Denver Broncos fan, and have even been known to paint myself orange on game days.

f. Suppose that it is only five games into the season instead of eight.

4. A study was conducted on the effects of prayer on serious illness. Ninety patients in a Chicago cancer ward were divided into two groups. The names and photographs of patients in one group were given to a congregation of charismatic Christians, who assigned members of their congregation to pray for each of the patients. The people in the other group had their photographs taken, but did not receive extra prayers. The treatment and survival rate of the two groups was then compared, and it was found that the patients in the experimental group had used significantly fewer pain medications than patients in the control group. It was concluded that praying for patients does, to some degree, alleviate suffering.

      i. Is the sample simple or a bifurcated?

      ii.   Is the argument drawing a general or an oblique conclusion?

a.   Suppose that two people in the experimental group, and none in the control group, had experienced a complete remission.

b.   Suppose that the people in the two groups were unaware that an experiment was being conducted, or that they were being used in it. [Note: this might not be ethical.]

c.   Suppose that the two groups had been tended by different doctors who had different views on the advisability of using pain medications.

d.   Suppose that only 40 patients had been used in the study instead of 90.

e.   Suppose that AIDS patients had also been included in both groups as well as cancer patients.

f.   Suppose that the members of the congregation had been allowed to visit the subject of their prayers and pray directly at their bedside.

5.   The B.I.G. Corporation is one of the biggest corporations in the world, employing over two million people worldwide. We, in the Human Resources Department want to know how satisfied our employees are with their jobs, so we surveyed a cross-section of a hundred employees, asking them to rate their salaries, working conditions, and over-all job satisfaction. 67% of employees rated their job satisfaction at either good or excellent, while only 9% rated their satisfaction as poor or below. We concluded that the B.I.G Corporation is a great place to work!

      i.   Is the sample simple or a bifurcated?

      ii.   Is the argument drawing a general or an oblique conclusion?

a.   Suppose the cross-section had included employees in the company's Southeast Asian sweat shops, Mexican maquiladoras, and the corporate headquarters in Manhattan.

b.   Suppose the 67% of employees who gave high ratings to their jobs had included numerous comments praising the management style of the corporation.

c.   Suppose the cross-section had included only employees making more than $100,000 per year.

d.   Suppose the Human Resources Department were only asked to determine the job satisfaction of employees making less than $100,000 per year.

e.   Suppose the Human Resources report had concluded that most of the corporation's employees are reasonably well-satisfied with their jobs.

f.   Suppose, for lack of corporate backing, the Human Resources department had only been

able to contact a cross-section of 50 people.

6. You are a doctor considering prescribing a particular drug for one of your patients, a pregnant woman with morning sickness. You find a study by the FDA on the side effects of that drug. In the study the drug was given to 50 subjects while an additional 50 were given a harmless placebo. 46 of the subjects taking the drug reported no ill effects, while 3 reported feeling dizzy and one reported an upset stomach. In the group taking the placebo, 45 reported no ill effects while 2 reported getting a headache, 2 reported stomach cramps, and one broke out in a rash. Since there was no significant difference between those reporting ill effects in the experimental group and those reporting ill effects in the control group, you conclude that the drug has no side effects and may safely be prescribed to your patient.

  i. Is the sample simple or a bifurcated?

  ii. Is the argument drawing a general or an oblique conclusion?

 a. Suppose that all of the subjects in both groups were inmates at the state penitentiary.

 b. Suppose that another scientist does a similar study using a different group of subjects, and comes up with roughly the same results.

 c. Suppose that all of the subjects in both groups were pregnant women.

 d. Suppose that the drug and placebo were administered to some people during the day, while other people took it in the evening, and some people were forced to get up in the middle of the might to take the drug.

 e. Suppose that none of the subjects in either group were pregnant, but that the drug is intended for the use of pregnant women.

7. In the same type of study as above, but on a different drug, we get these results: In the group taking the drug, 28 of the 50 people report severe stomach cramps while the remaining 22 report no ill effects. In the group taking the placebo, 2 of the 50 people report a feeling of nervousness, while the rest report no ill effects. This time you conclude that the drug has definite side effects for many people and decide not to prescribe it for your patient, fearing she may suffer significant side effects.

  i. Is the sample simple or a bifurcated?

  ii. Is the argument drawing a general or an oblique conclusion?

 a. Suppose that all of the subjects in both groups were volunteer college students, and that they took the drug two days before finals.

 b. Suppose that among the 28 reporting stomach cramps some reported violent fits of

vomiting and one subject actually died.

c. Suppose you conclude that your patient may suffer severe, long-term side effects, and that the drug might even be fatal to her.

d. Suppose that many of the subjects had blood-type 0, while other subjects were type A, others were type B, and a few were type AB.

e. Suppose that the subjects in the group receiving the drug had the chicken salad sandwich for lunch at the university cafeteria. The subjects in the group receiving the placebo are all vegetarians.

8. During Covid-19 outbreak in New York State, Governor Andrew Cuomo had a study done to determine the local rate of infection, i.e. how many people in New York had been infected. Tests were done randomly on people at grocery stores and "box" stores. 3000 people were tested. 13.9% of this sample tested positive. New York has a population of roughly19.5 million people, so it was concluded that approximately 2.7 million people in New York had been infected.

   i.   Is the sample simple or a bifurcated?

   ii. Is the argument drawing a general or an oblique conclusion?

   a. Suppose the study had included people currently confined in their homes and in hospitals, as well as people who were out shopping.

   b. Suppose the study had tested only 300 subjects, because no more test kits were available.

   c. Suppose the study had concluded that *exactly* 2.7 million people in New York had been infected.

   d. Suppose it were discovered that the test kits had been supplied by the CDC (Centers for Disease Control) who failed to observe laboratory sterility protocols while manufacturing the kits.

   e. Suppose the study had been overseen by a medical examiner who owned stock in Plaquenil, the commercial brand name under which hydroxychloroquine (a drug being considered as a treatment for Covid-19) is sold.

   f. Suppose the study had been conducted only in up-state New York cities, including Buffalo, Albany, and Syracuse, but not in New York City itself.

Inductive Fallacies

Group 9a: Errors in Observation

Tainted Data - The argument draws a conclusion from a sample that was collected in a manner that would be likely to tilt or corrupt the results.

Experimenter Bias - The argument draws a conclusion from data that has been influenced by the expectations and hopes of the person collecting the data.

Ad Ignorantiam (Appeal to Ignorance) - The argument mistakes lack of evidence for evidence to the contrary. In effect the argument says, "No one *knows* it is true. Therefore it is false." Sometimes, in order to make the claim that "no one *knows*," the argument insists on an inappropriately strong standard of proof.

Inductive Hyperbole - The argument draws a conclusion that is stated more strongly than the evidence supports, i.e. overstating the significance of findings or overstating the degree of certainty we can claim for them.

Group 9b: Inductive Ambiguities

Inappropriate Operational Definition – The argument draws a conclusion about a property that cannot be observed directly based on a study in which an operational definition was used to replace the property of interest with a clearly observable and measurable property. However, the operational definition fails to adequately capture the common meaning of the property of interest.

Group 10: Errors in Sampling

Hasty Generalization - The argument draws a conclusion from a sample that is too small, i.e. is made up of too few cases.

Uncharacteristic Sample - The argument draws a conclusion from cases that are not sufficiently diverse to give a fair representation of the class about which a conclusion is being drawn.

False Analogy - The argument draws a conclusion from cases that are only superficially or apparently representative of the unobserved cases about which the conclusion is being drawn.

Uncontrolled Factors - The argument draws a conclusion based on a comparison between two (or more) groups, even though some important difference between the groups, other than the difference specified by the experiment, may be responsible for the results obtained.

Group 11: Inductive Circularities (Circular Evidence)

Speculative Evidence - The argument draws a conclusion from an assertion about what the evidence *would* show if one were actually to look at it; however, the argument appeals to evidence that has not actually been collected.

Anecdotal Evidence - The argument draws a conclusion from cases specifically chosen to support the conclusion (often while ignoring cases that might tend to undermine the conclusion).

Fishing for Data (Post-Designation) - The argument draws a conclusion from correlations observed in the sample, but only after the sample has already been drawn, and without declaring in advance what correlations the experimenter was expecting to find.

No True Scotsman – The argument defends an assertion by disallowing all counterexamples to it as a matter of definition.