

Thinking About Research

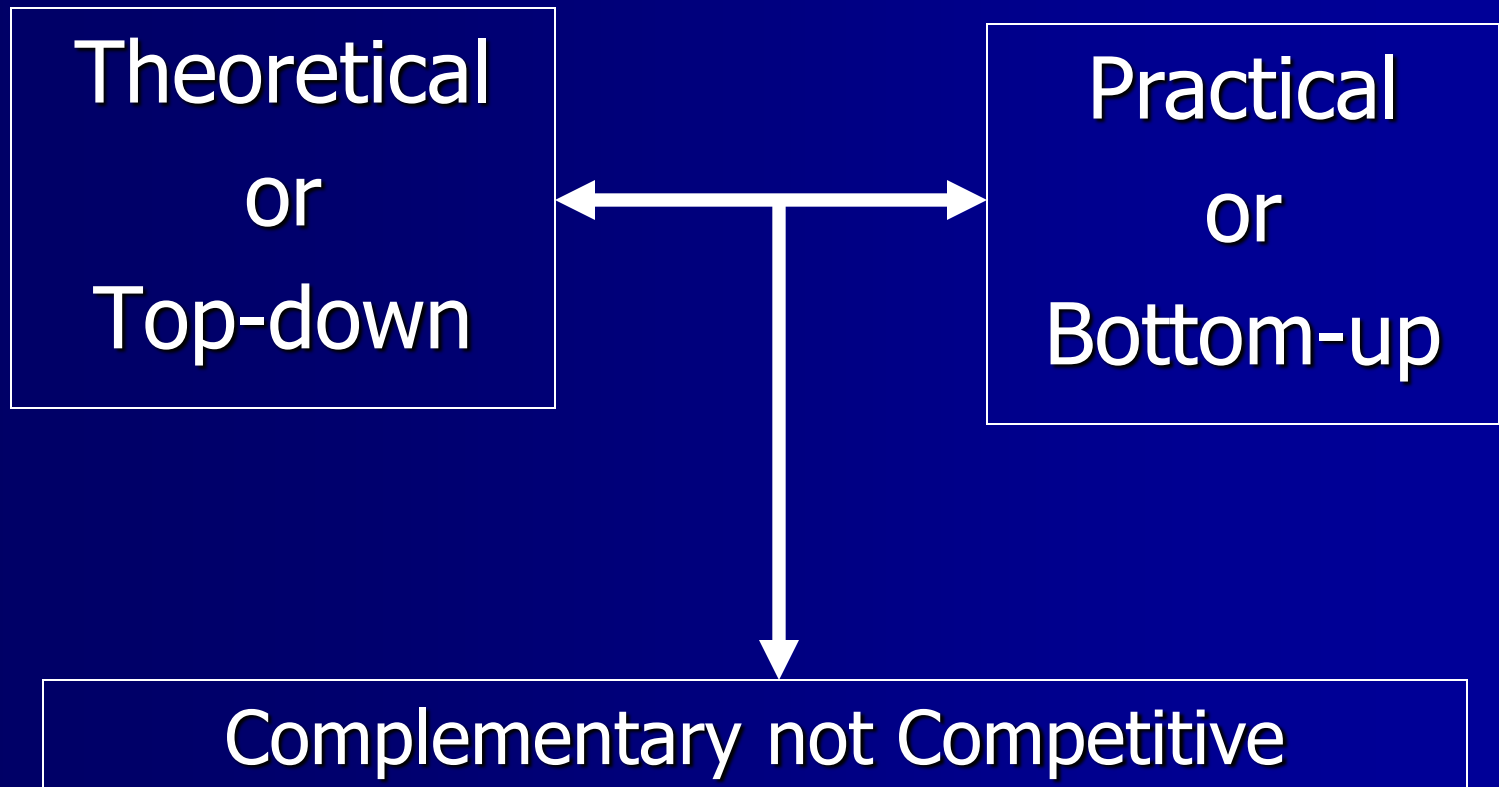
Adrienne Keller, Ph.D.

Associate Professor, Public Health Sciences

Research Director, NSNI

ae3a@virginia.edu

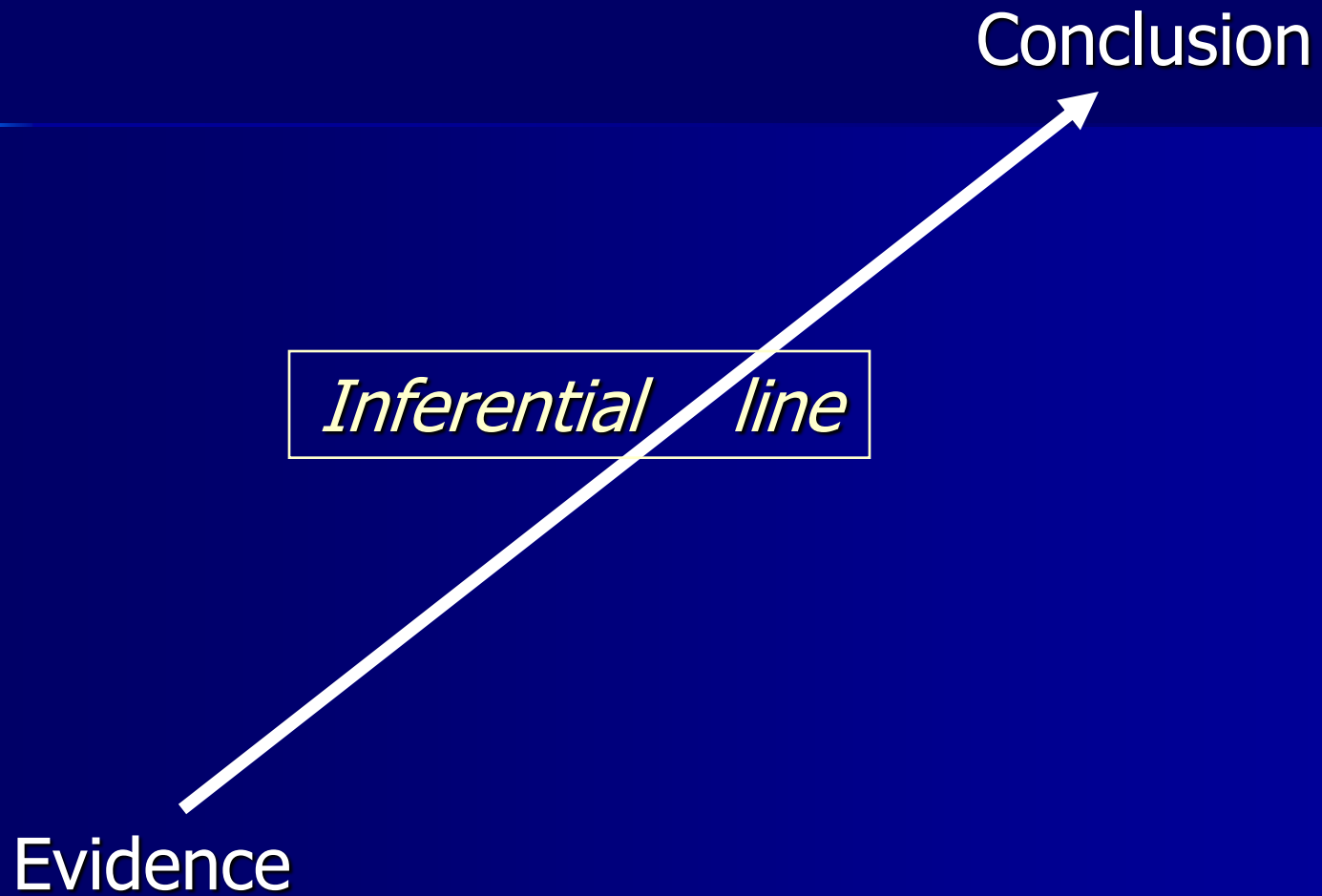
Two Approaches



Theoretical or Top-down

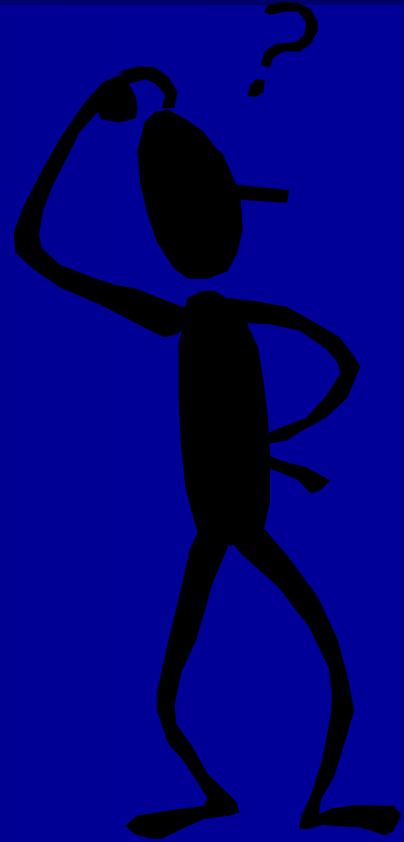
...starts with understanding the
inferential line connecting
evidence and ***conclusions***





What's so helpful about that?

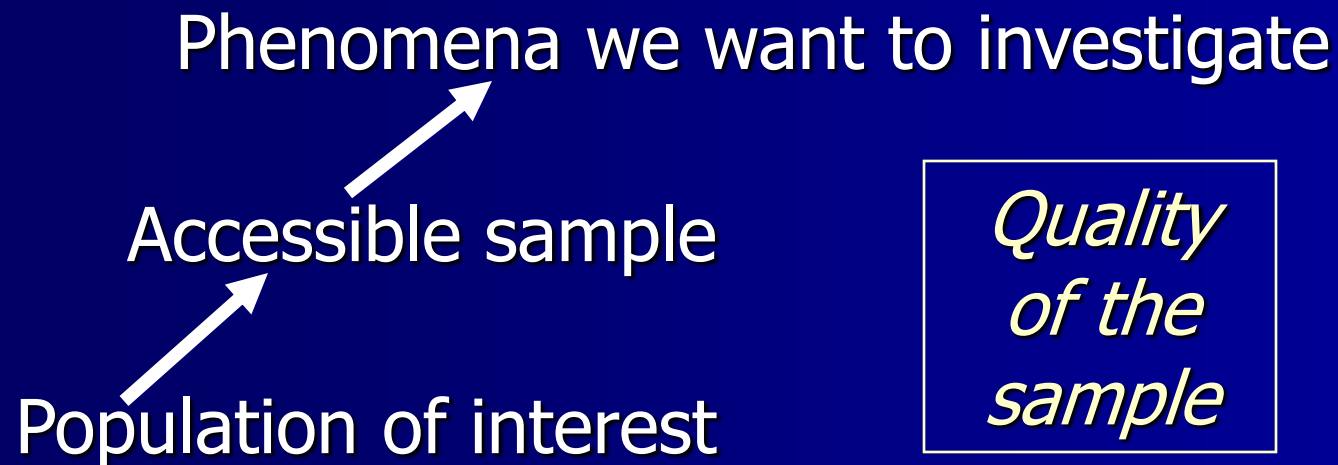
Let's take a more detailed look...



Accessible sample
↗
Population of interest

*Quality
of the
sample*

Evidence



Evidence How we assess the phenomena

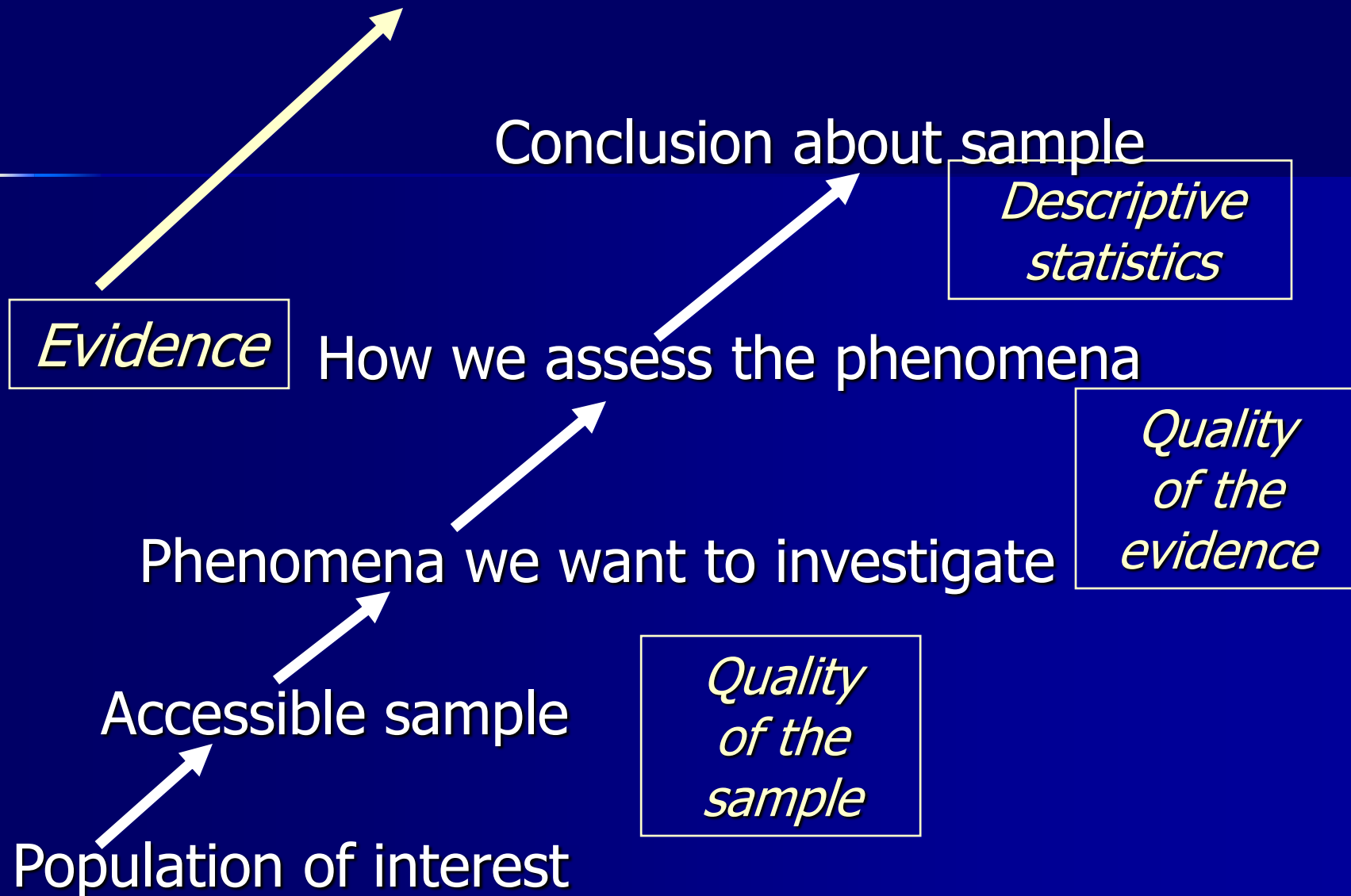
Phenomena we want to investigate

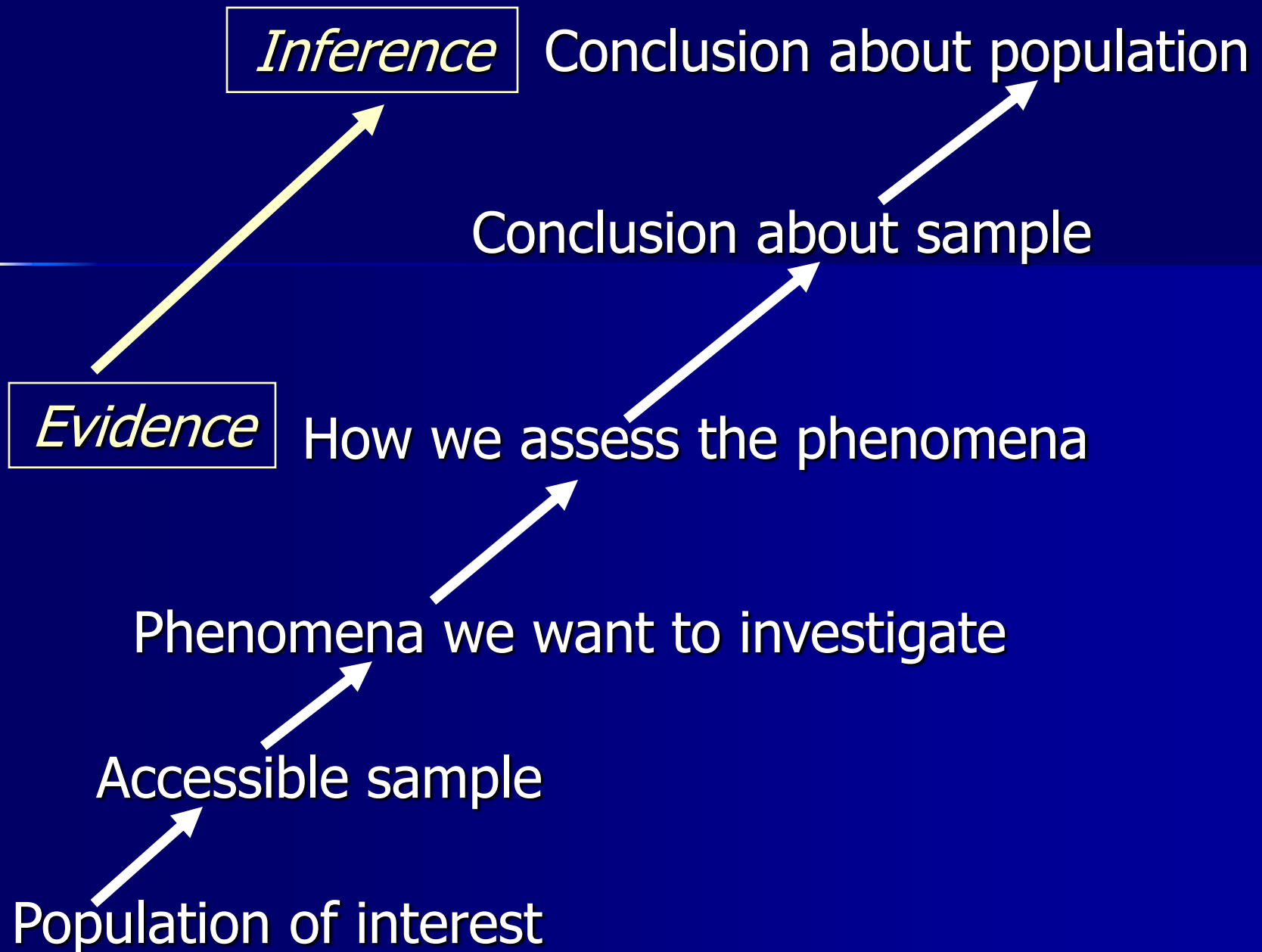
*Quality
of the
evidence*

Accessible sample

*Quality
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Population of interest

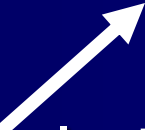




Foundational Questions

- Can we legitimately make inferences from our sample to our population: How well does our sample *represent* our population?
- Can we legitimately make inferences from our evidence to the phenomena of interest: What is the *quality* of our evidence?
- How well have we defended against other explanations: How *strong* is our study design?

Can we legitimately make inferences
from our sample to our population:
How well does our sample *represent*
our population?

Accessible sample

Population of interest

Foundational Question 1

- How well does our sample represent our population?
 - Is the sample *unbiased* with respect to the population?
 - If we are comparing different conditions, are the samples in each condition unbiased? Importance of *randomization* techniques

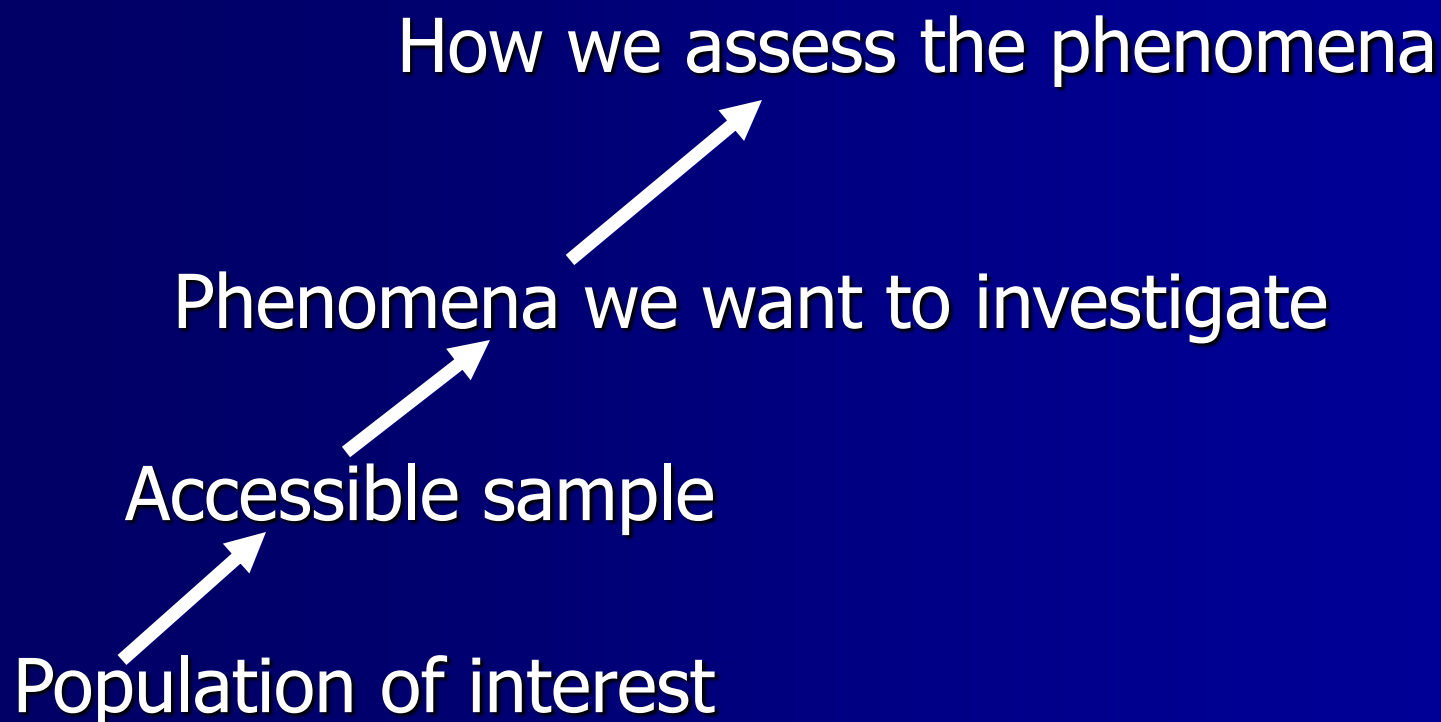
Example

- We want to study risk factors for depression in the general population.
- Our accessible sample is patients who have been hospitalized for depression.
- *Why is this a biased sample?*

Example

- We want to study how a new chemical compound affects the growth of cell cultures.
- We introduce the compound to one petri dish of cells that Susie prepared and compare it to another dish of cells that Jason prepared.
- ***What is wrong with this procedure?***

Can we legitimately make inferences from our evidence to the phenomena of interest:
What is the *quality* of our evidence?



Foundational Question 2

- How good is our evidence?
 - What is the *quality* of our measurement?
 - *Valid* for this population
 - *Reliable* for this population
 - What is the *metric* of our measurement?
 - *Nominal*: binominal or categorical
 - *Ordinal*
 - *Interval*: normal distribution? Continuous?

Example

- We want to know if a group intervention is effective in changing how families interact.
- In the last session of the intervention, the group leaders have parents complete a questionnaire that asks questions about how the family interacted before the intervention and how they interact now.

What do you think about the *validity* of this approach?

- In the last session of the intervention, the group leaders have parents complete a questionnaire that asks questions about how the family interacted before the intervention and how they interact now.

What do you think about the *reliability* of this approach?

- In one group, the families are Hispanic, so the questionnaire is translated into Spanish for that group.
- In the last session of the intervention, the group leaders help parents complete the questionnaire about how the family interacted before the intervention and how they interact now.

Example

- A survey asks students how much they agree with a statement about school alcohol policies.
- Answers are on a scale from 0 to 10
 - 0 = not at all
 - 10 = completely

Evidence

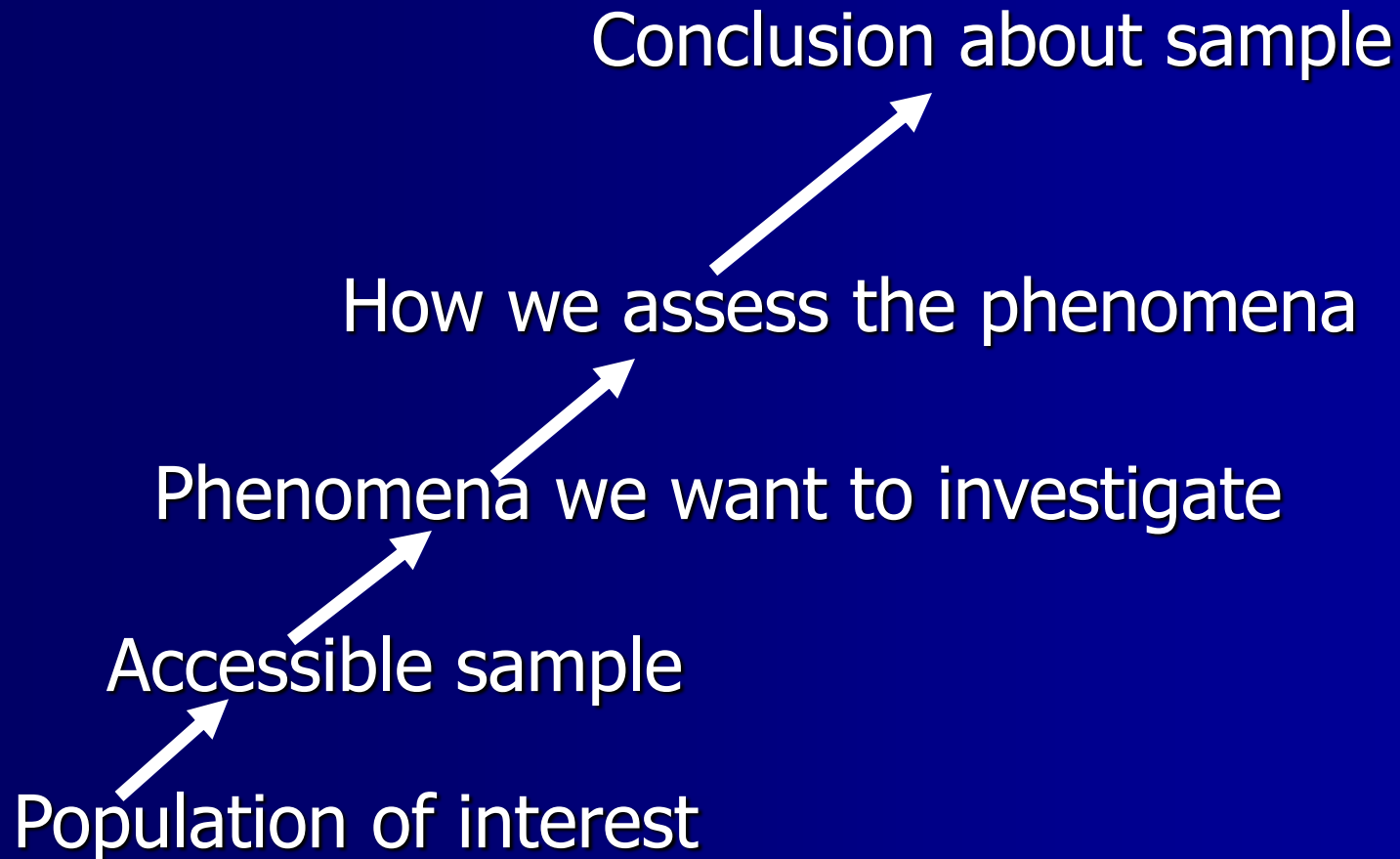
- The mean for freshmen is 5
- The mean for sophomores is 6.7
- The mean for juniors is 8
- The mean for seniors is 9.3

Conclusion

- Agreement with the schools alcohol policy increases with years in school.
- ***What is wrong with this conclusion?***
 - Hint: The problem is the ***metric*** of measurement.



How well have we defended against
other explanations:
How *strong* is our study design?



Foundational Questions 3

- How strong is our study *design*?
 - What type of study is it?
 - *Historical*
 - *Observational*
 - *Quasi-experimental*
 - *Experimental*
 - *RCT*
 - Does the study have adequate *power* (i.e., sample size) for the measures?

Example

- **Research Question:** Is the rate of severe asthma among children higher in some Virginia counties than others?
- **Method:** Examine hospitalization records for the previous 10 years

Conclusions

- The rate of hospitalization of children ages 0-18 years for severe asthma is significantly higher in some counties.
- Therefore, the rate of severe asthma in children is significantly higher in some counties.

Questions for You

- What is the *evidence*?
- What is the *inference*?
- Is the evidence *strong enough* to support the inference?
 - “Be prepared to defend your conclusion.”

Example

- Hypothesis: Students who receive information on how to avoid risky drinking at Halloween will drink less at Halloween.
- Method: Student survey:
 - Did you receive information?
 - How much did you drink?

Results

- Students who did NOT receive information reported drinking, on average, 9 drinks on Halloween
- Students who DID receive information reported drinking, on average, 5 drinks on Halloween.

Conclusion

- The information was effective in reducing drinking.
- ***What do you think?***

Example

- A well-designed randomized controlled trial compared a new anti-psychotic medicine to a standard anti-psychotic.
 - Patients who agreed to participate received free medical care and money for their transportation and time.
 - Patients in the trial were contacted once a week by a nurse to ensure compliance.

Evidence

- Patients on the new anti-psychotic did much better (greater symptom remission) than patients on the old anti-psychotic.
- Patients on the new anti-psychotic did not experience a greater number of “medically serious” side effects.
- Patients on the new anti-psychotic did gain, on average, 10 pounds more than patients on the old anti-psychotic.

Inference

- The new anti-psychotic will work better than the old anti-psychotic.
- ***What are your thoughts about the evidence and the inference?***

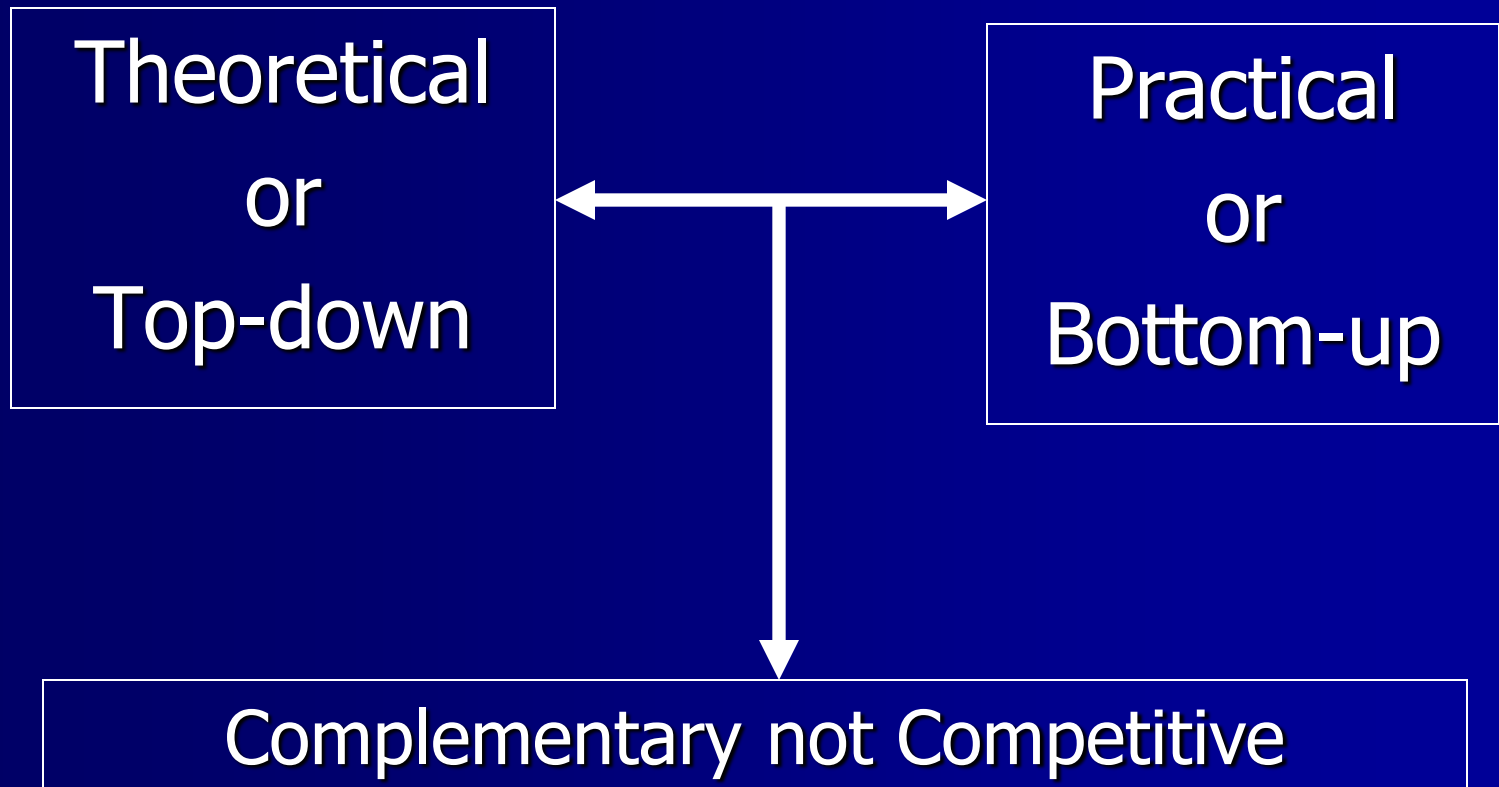
Summary of theoretical overview

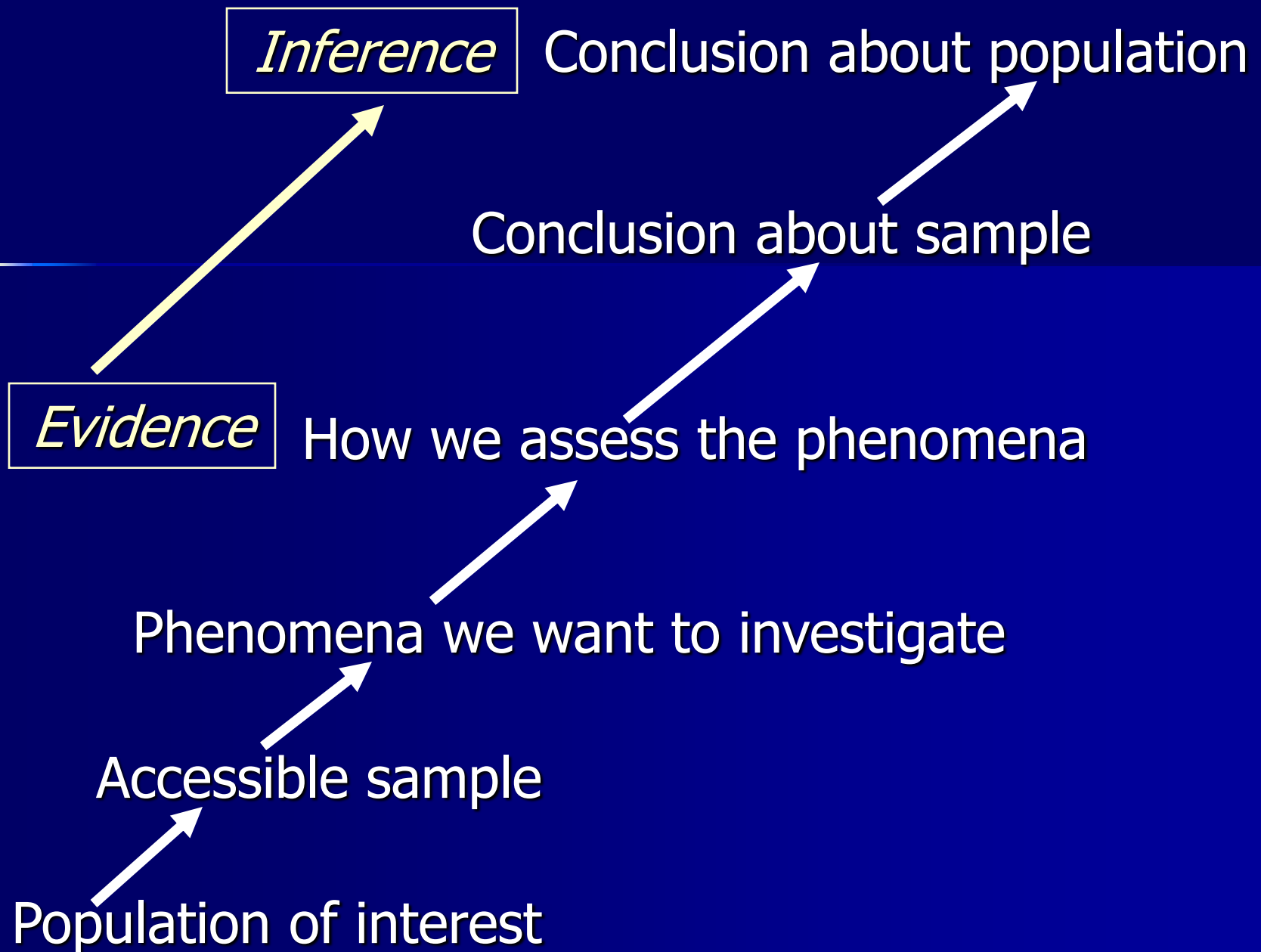
- The validity of our conclusions depends upon the strength of the ***inferential line***:
 - How well does our **sample** represent the population of interest?
 - How well do our **measures** represent the phenomena of interest?
 - How well does our **study design** defend against other possible explanations?

Helpful Websites: General Information

- <http://www.theresearchassistant.com/>
- <http://www.cche.net/usersguides/main.asp>
- <http://www.socialresearchmethods.net/>
- <http://www.stat.yale.edu/Courses/1997-98/101/expdes.htm>
- <http://www.iasri.res.in/design/>

Two Approaches





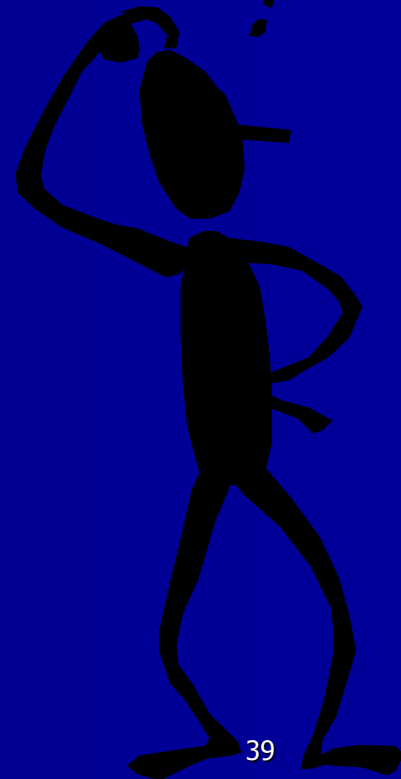
Practical or Bottom-up

...starts with understanding how to use ?

descriptive statistics and

statistical tests to draw

statistical inferences.



Typical research questions

- Do A, B, C, D correlate?
 - Sometimes? Under what conditions?
 - Sometimes? For whom or what?
- To what degree does A explain or cause B?
(how does A relate to the *risk* of B occurring?)
- How do A, B, C work together to cause or explain D
(the risk of D occurring)?
- Does A produce a better outcome (C) than B
(Is A more effective than B in causing C to occur?)

What you need to know

- How many variables in your study
- The metric of measurement for each variable
- The relationship among the variables:
 - Independent
 - Dependent
 - Modifying, mediating, co-variates

Example

- Hypothesis: There is a positive correlation between age and weight.
 - 2 variables
 - Both interval
 - Both independent: We are not hypothesizing that one causes the other.

Example

- Does weight depend upon age?
Does age predict weight?
Does age explain weight?
 - 2 variables
 - Both interval
 - Age is *independent*; weight is *dependent*

Example

- Is drug_a better than drug_b in treating disease_x?
 - **2** variables -- huh?
 - New_drug/old_drug variable is binominal
 - Disease_x is interval, discrete, non-normal
 - Disease_x is ***dependent***; new_drug and old_drug are ***independent***

Helpful Websites: choosing the right test

- <http://www.socialresearchmethods.net/selstat/ssstart.htm>
- <http://www.socr.ucla.edu/Applets.dir/ChoiceOfTest.html>
- <http://www.microsirris.com/Statistical%20Decision%20Tree/>
- <http://www.theresearchassistant.com/research/link.asp>

