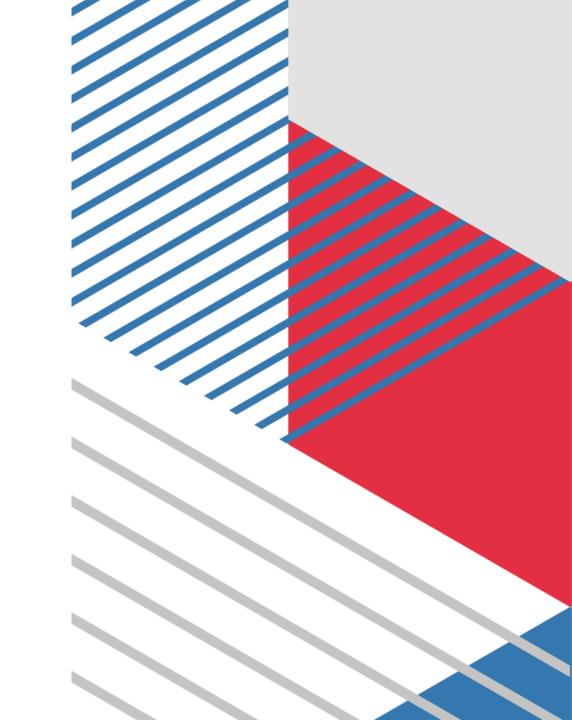


# Chapter 1: Introduction A Scientific Approach to Geography

### **Chapter Objectives**

- 1. What is a scientific approach to geography?
- 2. How is science both an individual and a social activity?
- 3. What are several metaphysical beliefs characteristically held by scientists?
- 4. What are four goals of scientific activity?
- 5. What are the relationships of natural science, social science, and the humanities to the study of geography?



### So, what even is science?

### The Logic and Philosophy of Science

Science is a personal and human endeavor in which ideas and empirical evidence are logically applied to create and evaluate knowledge about reality

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Science is a human activity where people use ideas and evidence to understand and learn about the world.

#### "Science is a personal and human endeavor"

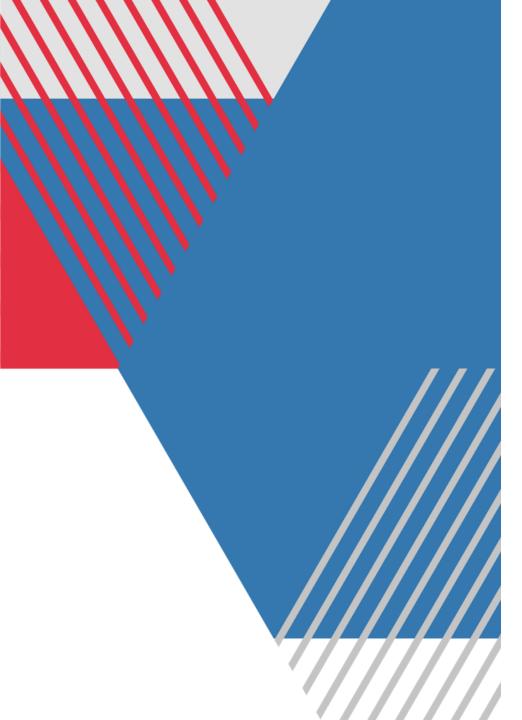
- First and foremost, science is done for humans, by humans
  - We learn science from other human scientists
  - We do science with other human scientists
  - We present our findings to other humans
  - We may improve human lives or expand human knowledge

#### "in which ideas and empirical evidence"

- Similar to how operations drive intelligence (in a recursive way), ideas drive science
  - Ideas lead to studies (units of focused observation or data collection)
  - Studies lead to empirical evidence
  - Empirical evidence leads to new knowledge
  - New knowledge leads to new ideas, ad infinitum
- About that word "empirical"
  - Derived from systematic observation of the world via the senses
    - Often aided by technology
  - Aims to be repeatable, accumulable, and publicly observable
  - Varies science from: intuition, authority, anecdote, etc.

# "are logically applied to create and evaluate knowledge about reality"

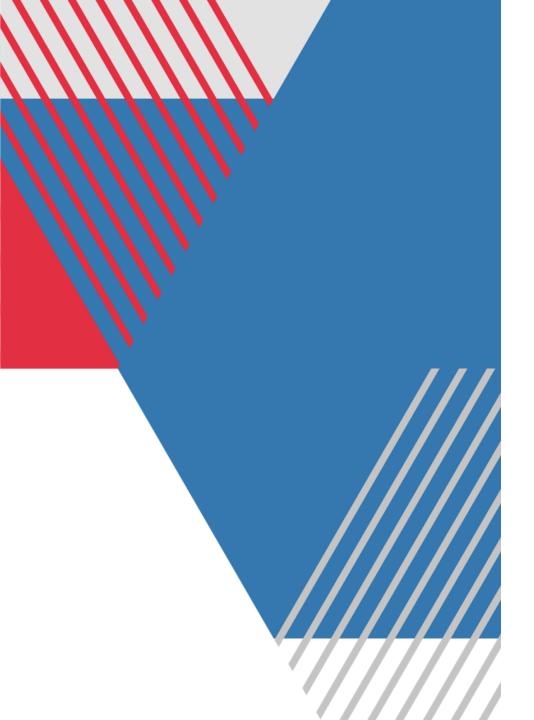
- Ideas and evidence should be applied to certain principles. A few are:
  - 1. One must avoid contradictions
    - If contradictions are present, problems are present
      - If Person 1 says A + B = C, and Person 2 says A + B = D, there is a contradiction
  - 2. Confidence in phenomenon increases with increased observation
    - If Person 1 gets A + B = C many times, confidence increases
  - 3. Past regularities will likely occur in the future
    - If Person 1 gets A + B = C in a year, and Person 2 gets A + B = C another year, the experiment is shown to be repeatable



#### A Note on Logic

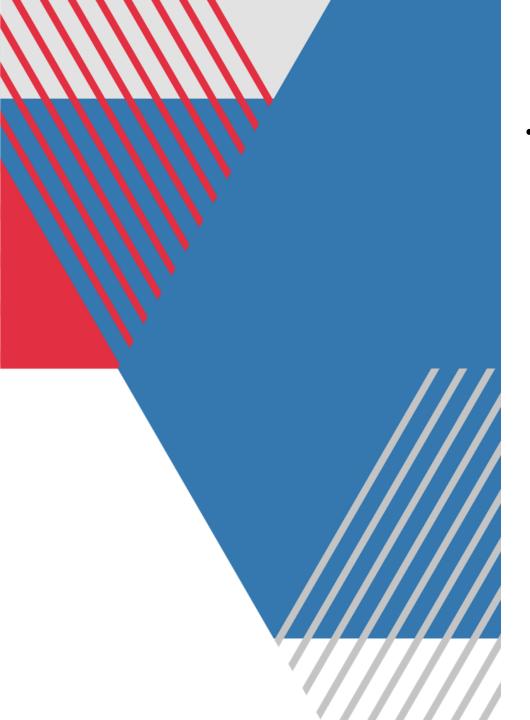
- There is not just 1 certified way of thinking doing science
  - Deductive Reasoning: If the premises are true, the conclusion must also be true.
    - Start with theory then test it. General -> Specific
  - Inductive Reasoning: Conclusions are probable and based on patterns in observations, but new evidence could change them.
    - Start with an observation, build a theory. Specific -> General
  - **Abductive Reasoning**: Finding the best possible explanation for the data at hand.
    - Start with observations, infer the best explanation

- There are also times logical thinking cant win the day
  - Creative thinking on ideas
  - Areas of science that are "theoretical"



#### A Note on Logic

- Deductive Reasoning: General -> Specific
  - All men are mortal
  - Socrates is a man
  - Socrates is mortal
- Inductive Reasoning: Specific -> General
  - Socrates is a man and he is mortal
  - Other men are also mortal
  - All men are mortal
- **Abductive Reasoning**: Best Possible Explanation
  - Socrates is mortal
  - All men are mortal
  - Socrates must be a man



# A Note on Nonscientific Ways of Knowing

- The humanities are similar to science in logical application of ideas to understand the world, but often do not use systemic empirical observation.
  - Scientists may want simple truth, while the humanities searches for specific truths about peoples/societies or for human values/morality. As a rule: <u>Numbers are clean, people are</u> <u>messy.</u>
  - Artists search for general knowledge about a given craft, but usually do not employ systemic empirical methodologies.
     Usually are concerned with production of items, rather than simply knowing.
  - Spiritual approaches to knowing usually do not employ empiricism, do not accept Realist philosophy, or employ skepticism as a matter of doctrine (depending)
  - Paranormal approaches to knowing tend to not employ systemic empiricism, but may be uncritical if empirical evidence is presented. Additionally, certain paranormal activity may violate forward causality

#### **Goals of Science**

Since the definition of science is to understand and learn about the world, there are four goals set to accomplish that:

- 1. Description: to distinguish and describe phenomena
- 2. Prediction: to understand the patterns in phenomena and predict when phenomena occurs
- 3. Explanation: to explain why phenomena happens
- 4. Control: to be able to bring desired change to phenomena

At that note, there are 2 different types of scientific research: <u>Basic</u> and <u>Applied</u> science

- Basic science sets to accomplish understanding the world for its own sake
  - Focus on description, prediction, and explanation
- Applied science sets to solve problems or meet needs
  - Focus on control, but requires a basis of the other 3 goals

### What makes a scientist?

### **Characteristic Metaphysical Beliefs of Scientists**

- What is metaphysics?
  - An idea, doctrine, or posited reality outside of human perception
- What is a "metaphysical belief"?
  - Intellectual preferences
  - Unproven
  - For scientists, not necessarily all required, but usually common traits

#### **Characteristic Metaphysical Beliefs of Scientists**

- 1. Realist Philosophy
  - The universe is an objective entity that has matter and energy patterned in space and time.
    - Simply put, nature will do its own thing, regardless of how we feel
- 2. Only continuous and forward causality
  - Everything in space and time has a cause and effect
    - No gaps or reversals. Sorry time travelers
- 3. Simplicity
  - The simplest explanation is the most correct, given adequate evidence (aka parsimony)
    - Differs from picking the most simple answer just because its simple
- 4. Skepticism
  - Approach truth finding with the expectation of never finding the full truth
    - Preference for ideas that could be potentially proven false
- 5. Quantitative Thinking
  - Use mathematics and computation to increase precision of ideas and observations (often aided by tech)

So where does Geography fit in with Science?

### **Geography: The First of the Sciences**

- The study of Earth as the home of humanity
  - From Greek, literally "earth writing"
  - Broad range of topics, multi-discipline
  - If its on the surface of the Earth (or slightly below it), congrats, its (probably) geography
    - Or at least has a geographic component to it

#### Ancient Geography

- Historical geographers had three main goals:
  - 1. Economic
    - Natural resource extraction, trade routes
  - Political
    - Civilization building, power consolidation, taxation, diplomacy
  - 3. Military
    - Geographic advantage, logistics, information warfare
- Early geographers employed the use of linguistics (study of language), graphic (e.g. cartography), and mathematical (e.g. geodesy measuring the earth) approaches to accomplish these study goals

#### **Growing Pains**

- Sometime in the 19<sup>th</sup> Century, a new approach was developed: Regional Geography
  - The world was divided into regions, and all natural (geomorphological, climatological) and human (cultural, economic) phenomena were characterized and organized into regional features.
  - Sometimes called the "National Geographic" approach
  - May be described as more qualitative
- Later in the 19<sup>th</sup> century, a sibling approach flowered: <u>Systematic Geography</u>
  - Elected to view the world through systems, choosing not just to describe the where, but understand how they work across the planet
    - E.g. River systems, Urban structures
  - Championed as more scientific, with a penchant for applying math
  - Development lead to the "quantitative revolution" by the 20<sup>th</sup> century, with using certain methods the "right way" to do geography:
    - Statistics, geometry, calculus, computers, remote sensing, GIS
  - Positivism was the new philosophy for Geography
    - A theory that everything can be explained through observation and empirical evidence

#### **Growing Pains**

- From there, a counter-revolution emerged, pushing back against total positivism
  - Assertion was data and numbers oversimplified the human experience
    - Left out a key component: humans are messy
  - Opted for inclusion of subjective thinking and using social theory in analysis to explain phenomena:
    - Phenomenology: Focuses on people's subjective experiences of space and place
    - Marxism: Analyzes geography through the lens of economic and social inequality, focus on capitalism
    - Feminism: Examines how gender influences spatial dynamics
    - Social Theory: Investigates the social structures and power relationships that shape geographic spaces
    - Deconstructionism: Challenges idea that representations are neutral entities
    - Postmodernism: Understanding that there is no 1 objective reality

# Modern Geography: Reunification

- Like the Earth, the growth of geography has come full oblate spheroid
  - Geographers have managed to mitigate differences in approach by combining approaches, and separated 2 main sections in Geography:
    - Physical and Human
    - Both use blends of linguistic, cartographic, and mathematical methods
  - There is also the understanding that between both sections, geography is both:
    - 1. Multidisciplinary
      - Varied disciplines work side by side
    - 2. Interdisciplinary
      - Disciplines are combined
  - E.G. Physical geography intersects with:
    - geology, biology, climatology
  - Human Geography intersects with:
    - sociology, economics, anthropology, political science



Questions?
Comments?
Concerns?

#### **Review Questions**

- 1. What are the four scientific goals of description, prediction, explanation, and control, and how do they relate to each other?
  - Description is used to distinguish and describe phenomena.
     Description helps to categorize phenomena.
  - Prediction is used recognize patterns and predict phenomena based off those patterns.
  - Explanation is used to describe why phenomena happens.
     Explanations can assist in adding precision to prediction and/or description.
  - Control: Control is used to bring a desired change to phenomena. The three former goals assist in defining how to elicit change to phenomena.

#### **Review Questions**

- 2. What are the following "characteristic metaphysical beliefs" held by scientists: realism, continuously connected and forward causality, simplicity, skepticism, quantitative thinking?
- Realism posits the universe is an objective entity that does what it wants
- Forward Causality posits everything in space and time has cause and effect.
- Simplicity posits the simplest answer is usually the most correct (given proper evidence)
- Skepticism posits one should question true validity of all things
- Quantitative thinking posits math increases precision of ideas and observations