

# A History of Science in Latin America (INTD262): Unit 0

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## Summary

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# Unit 0 Summary

## The Scientific Attitude, Nomenclature, Mesoamerican Science

1. The Demarcation Problem: the line between science and non-science
2. Nomenclature: philosophical, ecclesiastical, geographical, and political
3. *Reading and discussion*
  - The Introduction and Chapter 1 of *The Scientific Attitude*
    - 3.1 Examples of good science in 19th century medicine
    - 3.2 Examples of denialism, pseudo-science, and fraud
  - Introduction and Chapter 1 of *Science in Latin America*
    - 3.1 Examples of botany, zoology, and medicine of indigenous 18th-century Mexican people
    - 3.2 Comparisons to colonial knowledge and medieval medicine
    - 3.3 Examples of knowledge transmission: Europe to Latin America, and Latin America to Europe

# Unit 0 In-class activities

## In-class group activities

- The Mayan numeric system, comparitive mathematics
- Classification of studies: science or non-science?
- Classification of species: hummingbirds
- Medicine: malaria and its treatmeant with quinine



# Course Texts



**Figure 1:** (Left) *Science in Latin America: A History*, edited by Saldaña. (Right) *The Scientific Attitude*, by Lee McIntyre.

## The Demarcation Problem: the line between science and non-science

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# The Demarcation Problem: the line

*If we are asked to determine whether a human activity is scientific, what criteria should we use?*

Non-scientific activities:

- 1.
- 2.
- 3.
- 4.
- 5.

Scientific activities:

- 1.
- 2.
- 3.
- 4.
- 5.

Can we derive any **specific criteria** that distinguish the lists?

# The Demarcation Problem: the scientific method

*How do we define the scientific method? Let's re-create the scientific method for (left column) the physical sciences, (middle column) the life sciences, and (right column) the social sciences.*

Physical Sciences:

- 1.
- 2.
- 3.
- 4.
- 5.

Life Sciences:

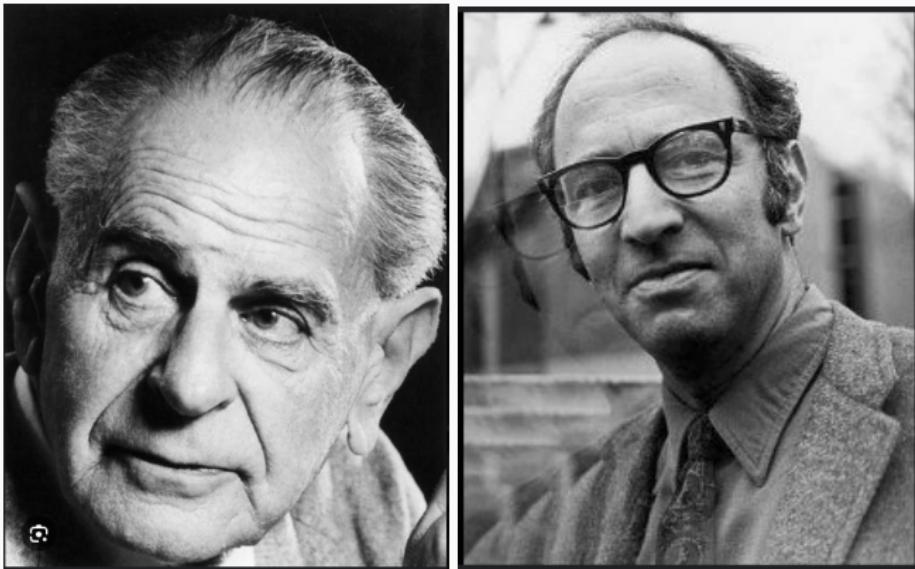
- 1.
- 2.
- 3.
- 4.
- 5.

Social Sciences:

- 1.
- 2.
- 3.
- 4.
- 5.

# The Demarcation Problem: the scientific method

*Philosophers of science* provide rational justification for scientific results, even while scientific progress continues.



**Figure 2:** (Left) Karl Popper, a philosopher of science (1902 - 1994). (Right) Thomas Kuhn, also a philosopher of science (1922 - 1996).

# The Demarcation Problem: induction and deduction

## Examples of induction:

1. "When I observe hummingbirds, I note they are all green. Therefore, all hummingbirds are green."

2.

3.

## Examples of deduction:

1. "Given that there are no camels in Germany, and that Hamburg is a city in Germany, I know that there are no camels in Hamburg."

2.

3.

# The Demarcation Problem: falsification

## Falsifiable scientific hypotheses:

1. “Noble gases are made of molecules, and this leads to a predictable relationship between their temperature, pressure, and volume.”

2.

3.

## Un-falsifiable scientific hypotheses:

1. “Cutting taxes leads to an increase in economic opportunity for our citizens.”
- 2.
- 3.

# The Demarcation Problem: falsification

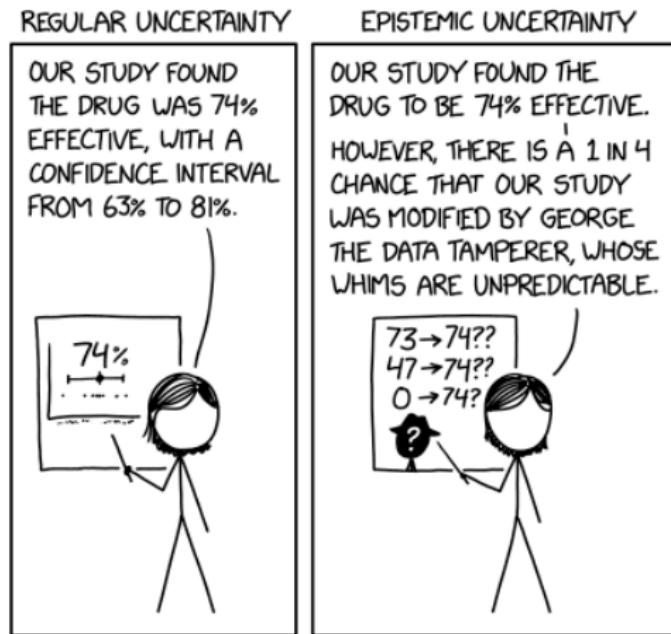


Figure 3: Credit: [xkcd.com](http://xkcd.com).

Nomenclature: philosophical,  
ecclesiastical, geographical, and  
political

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## Nomenclature: philosophical

- **Epistemology:** the philosophy of how we know something to be true
- **Metaphysics:** first principles, including abstract concepts such as being, knowing, substance, cause, identity, time, and space.
- **Cartesianism:** philosophy of René Descartes, *Discourse on the Method, Geometry*
  - “I think, therefore I am.” Start with doubt, then find concrete ideas in which to place belief
  - *Geometry* was an appendix to *Discourse*, unified algebra and geometry. Translating geometric areas and volumes into algebraic equations was unique and new at the time. From this moment we get the notion of a coordinate system
  - Offered three proofs of the existence of the Lord
  - Also worked on cosmology, optics, and the psychology of emotions

## Nomenclature: philosophical

- **Rationalism:** the theory that reason rather than experience is the foundation of certainty in knowledge
- **Empiricism:** the theory that all knowledge is derived from sensory experience, stimulated by the rise of experimental science
- **Theology:** the study of the nature of God and religious belief, systematically developed
  - Example of a theologian: Saint Thomas Aquinas (Dominican priest within the Catholic Church, from Sicily).
    - Scholasticism, *Summa Theologica*, reconciling faith and reason,
    - Influential philosopher from the Medieval period
    - Epistemology, ethics, economics, social justice

## Nomenclature: philosophical

**Empiricism:** epistemology based on sensory experience

1. Clearly has implications for experimental science
2. Modern sciences (especially the physical sciences) are divided into three branches:
  - theoretical
  - experimental
  - computational
3. Mathematics is also divided into various branches, including applied math, pure mathematics, which itself is divided into topology, algebra, real/complex analysis ...

## Nomenclature: ecclesiastical

**The Catholic Church:** the Christian Church founded by Jesus of Nazareth. Adopted the hierarchy of the classical Roman Empire:

1. Pope - the formal leader of the Church
2. Cardinal, archbishop, bishop, priest
3. Archdiocese, Diocese
4. Orders: Franciscan, Dominican, Society of Jesus (Jesuits)
5. Monks, nuns, priests from orders, and from dioceses

**Role in teaching:** often in the colonial period, modern universities grew from universities founded and run by the Catholic Church

## Nomenclature: geographic and political



**Figure 4:** The largest extent of the (northern) Spanish colonies in America, up to 1803.

# Nomenclature: geographic and political

The four major Spanish *virreinatos*: a local, political, social, and administrative institution, created by the Spanish monarchy in the sixteenth century, for ruling its overseas territories.

- **Virreinato de Nueva España**, former Aztec empire
  1. Capital: Ciudad de México, Tenotchitlan, modern Mexico City
- **Virreinato del Perú**, former Incan empire
  1. Capital: Lima, Perú. The original capital of the Incans was Cusco.  
*Note: Incan empire was the largest in the world at the time.*
- **Virreinato de Nueva Granada**, modern day Venezuela, Columbia, Panama, Ecuador
  1. Capital: Santa Fe de Bogotá, modern Bogotá, Colombia
  2. Caracas and Quito are also within this province
- **Virreinato del Río De la Plata**
  1. Capital: Buenos Aires
  2. Modern Argentina, Chile, Bolivia, Paraguay and Uruguay

## Nomenclature: geographic and political



Figure 5: Virreinato de Nueva España

## Nomenclature: geographic and political



Figure 6: Virreinato del Perú

## Nomenclature: geographic and political



**Figure 7:** Virreinato de Nueva Granada

## Nomenclature: geographic and political



**Figure 8:** Virreinato del Río De la Plata

# Nomenclature: Nahuatl and Español

Consider these 8 words, from English:

1. Chocolate (cocoa)
2. Coyote
3. Avocado
4. Tomato
5. Chili
6. Ocelot
7. Axolotl (some say: Texas salamander,  
cave salamander)
8. Chipotle



# Nomenclature: Nahuatl and Español

Trace the words through history:

1. Chocolate ... chocolate (Esp.) ... chocolatl
2. Cocoa ... cacao (Esp.) ... cacahuatl ... peanut, or cocoa bean
3. Coyote ... coyote (Esp.) ... coyotl
4. Avocado ... aguacate (Esp.) ... ahuacatl<sup>1</sup>
5. Tomato ... tomate (Esp.) ... tomatl
6. Chili ... chile (Esp.) ... chilli
7. Ocelot ... ocelot (Fr.) ... ocelotl
8. Axolotl (a salamander) ... axolotl
9. Chipotle ... chipotle (Esp.) ... chilli + poctli = chilpoctli. Smoked jalapeño, chile from Xalapa.

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<sup>1</sup>This is also the word for testicle.

# Nomenclature: Nahuatl and Español

More Nahuatl vocabulary<sup>2</sup>:

1. **Nahua**: main ethnic group indigenous to Mexico. The Aztecs were of Nahua ethnicity. Around 500 BC, settled in the basin in central Mexico.
2. **Nahautl**: a language group of the Nahua
3. **altepetl**: a Nahua city-state within which most individuals were of the same tribe and ethnicity. Sub-unit: **calpolli**.
4. **amoxtli**: a codex or book written in Nahuatl
5. **tlacuilo**: a painting or stelae
6. **tlacuilo**: one who paints or records, a notary or scribe

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<sup>2</sup>The Spanish x makes a sound much like the English “h,” as in *México* or *Oaxaca*, but in Nahuatl it’s closer to the English “sh.” The “tl” in Nahuatl does not exist in English or the Romance languages, so it takes some practice.

# Nomenclature: Nahuatl and Español

1. Nahuatl list of animals:

[http://www.native-languages.org/nahuatl\\_animals.htm](http://www.native-languages.org/nahuatl_animals.htm).

2. Fun story: *la historia del tecolote y mi suegra. Búho o tecolote?*
3. **Quetzal**: a tropical bird that carries the same name today
4. **Coatl**: a snake
5. **Quetzalcoatl**: Aztec deity (feathered serpent), related to wind, Venus, the Sun, knowledge, and learning
6. **Quetzalcoatlus**: a dinosaur

<https://youtu.be/zWGn1AQsRaE?si=co-Uqi1ZBZzIt-xo>

# Nomenclature: Nahuatl and Español

Try: condor (from Quechua, originally), **cozcacuauhtli**, ... griffin?



**Figure 9:** (Left) A California condor to scale with a man. (Right) Colonials compared this creature to a classical griffin.

# Nomenclature: Nahuatl and Español

Some medical terminology (balm, balsam)

1. **Xilo, xiloxochitl:** balsam, balsam tree. A general term for residue extracted from tree matter that has medicinal properties. The word balsam comes from The Balm of Gilead, in the Hebrew Bible (Genesis) for a region currently in Jordan. Why did the Spanish colonials refer to *xilo* as balsam?
2. **tzipipatli:** an herb native to Nueva España used to treat diarrhea. Compare to how the Europeans treated diarrhea.
3. **atolli, atole** (Esp.) A thick, starchy drink made with water, maize (masa), milk/condensed milk, with chocolate and cinnamon: **champurrado**. Atole is sometimes used as a way to ease digestion, or clear the intestines

## Conclusion

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