NRM 5302
Research Methods

Instructor: Justin French

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RAS 124
4:00 PM - 5:15 PM, Wednesdays
Email (preferred): justin.french@sulross.edu
Phone: (432) 837-8505
Office Hours: Fridays, 1:00 PM to 4:00 PM, or by appointment.

1 Course Overview

This class is intended to start you out on the right foot with your graduate research, and provide a sound basis for your development as a critical thinker and scientist. It is divided into 3 modules, beginning with the nature of science itself, progressing to the nature of wildlife science specifically, then discussing the approach and tools to take in conducting good scientific research.

The class is based on discussion of important foundational concepts within science, as well as the progression of our field, and readings pertaining to those subjects. There will be 1 examination at the end of the semester, conducted similarly to a written preliminary exam, that makes up half of your grade. The other half comes from your notes on the readings and videos, and participating in class discussions. You are required to read/watch the assigned materials and write down your questions/thoughts that occur while doing so. You must submit them to me via email the day prior to class. They must contain your own, unique thoughts. I will use your notes to guide our discussion in class the following day. This process also allows those who cannot be present in class, for research obligations, to contribute to the discussion.

2 Required Materials

I will provide pdf's of all readings and links to the assigned videos in the course schedule below. Videos are from the *Crash Course: Philosophy* series produced by PBS.

3 Course Philosophy

As you will learn, our field has struggled with rigor, ergo research quality for over 80 years. We are not alone; other fields have the same issues we do. What does set us apart from other fields is that we have largely gotten away with it, whereas other fields have imploded. Psychology and sociology are currently embroiled in a credibility crisis because so few of their studies can be reproduced, much less replicated. This crisis has called the body of research and peer review process in these fields into question, and even upended people's careers. It is only a matter of time before we face similar scrutiny.

The failures of our field are largely avoidable, if we adhere to basic scientific principles. These principles are the culmination of over 2.5 millennia of critical thought. It is important, and hopefully interesting, to think about the basis of human understanding when you begin a career as a scientist in order to prevent the proliferation of bullshit (misinformation with a veneer of plausibility).

We will also confront the uncomfortable reality that scientific bullshit (Moberger 2020) is common. Bullshit in an applied science is incredibly dangerous but, unfortunately, it is all too common in many fields, including ours. Basing your work on undetected bullshit will undermine your ability to draw conclusions, or worse, lead you to draw false ones. This is a real problem in wildlife management because we are in the business of making decisions in the face of both great uncertainty and risk. Basing such decisions on bullshit leads to undesirable outcomes with real-world consequences. The success or failure of wildlife management decisions depends on the reliability of the information guiding them.

My intent is to give you the tools to spot bullshit, and leave you with no excuses for failing to critically evaluate the basis, design, and quality of your own research. We will build a foundation in the philosophy of knowledge (epistemology), develop reasoning skills with explicit frameworks, extend them to wildlife science itself, and discuss their practical application to wildlife research.

Moberger, V. 2020. Bullshit, peudoscience, and pseudophilosophy. Theoria. 86:595-611.

4 Grading Policy

Your grade will be based on participation in discussions (notes and in class), as well as a final exam. Each contributes 50% of your final grade.

Letter grades follow: $100 > A \geq 90 > B \geq 80 > C \geq 70 > D \geq 60 > F$. There is no curve.

5 Attendance

Showing up is the only way to get the material you need. If you don't come to class, your grade will reflect it with no penalty needed from me. In the event of an excused absence, make arrangements with me to go over material ahead of time.

6 Academic Dishonesty

Academic dishonesty includes copying, sharing, or obtaining information from an unauthorized source, attempting to take credit for the intellectual work of another person, falsifying information, and giving or receiving information about a test, quiz, or assignment to other students. Any student involved in academic dishonesty will receive no credit (0) for work done and/or may be penalized in accordance with published University Rules.

AI Statement

The use of artificial intelligence of any kind is strictly prohibited in this class. This includes both generative AI, as well as AI summaries of readings. Your notes should reflect your real-time thoughts on the articles, hence no AI summaries that would skew or confuse that process. Of course, using generative AI on any assigned work or exams is plaigiarism and subject to appropriate disciplinary measures.

7 Counseling and Accessibility Services

Sul Ross State University is committed to equal access in compliance with the Americans with Disabilities Act of 1973. It is the student's responsibility to initiate a request for accessibility services. Students seeking accessibility services must contact Mary Schwartze, M. Ed., L.P.C., in Counseling and Accessibility Services, Ferguson Hall, Room 112. The mailing address is P.O. Box C-122, Sul Ross State University, Alpine, Texas 79832. Telephone: 432-837-8691. E-mail: mschwartze@sulross.edu.

8 Course Schedule (Tentative)

- **Module 1: Being a Scientist**
  - **Week 1 (1/13-1/17):** What is science anyway?
    - **Lecture:** Science as a subset of philosophy, the hierarchy of complexity in the sciences, logic and uncertainty.
    - **Reading:** Murphy and Noon. 1991. Coping with uncertainty in wildlife science. Journal of Wildlife Management. 55:773-782.
    - **Videos:**
      - **The basics:** `https://www.youtube.com/watch?v=1A_CAkYt3GY`
      - **How to argue 1:** `https://www.youtube.com/watch?v=1A_CAkYt3GY`
  - **Week 2 (1/20-1/24):** Logic and Reasoning
    - **Lecture:** Validity and truth.
    - **Reading:** Williams, B. K. 1997. Logic and science in wildlife biology. Journal of Wildlife Management. 61:1007-1015.
    - **Videos:**
      - **How to argue 2:** `https://www.youtube.com/watch?v=1A_CAkYt3GY`
      - **A dose of humility:** `https://www.youtube.com/watch?v=IV-8YsyghbU`
  - **Week 3 (1/27-1/31):** Skepticism, Rationalism, and Empiricism
    - **Lecture:** Descartes and Hume: Am I real?
    - **Reading:** Davison. 1946. False principles delay advancement in wildlife techniques. Journal of Wildlife Management. 10:296-299.
    - **Videos:**
      - **Skepticism:** `https://youtu.be/MLKrmw906TM`
      - **Empiricism:** `https://www.youtube.com/watch?v=5C-s4JrymKM`
  - **Week 4 (2/3-2/7):** Knowledge, Belief, and Bullshit
    - **Lecture:** The implosion of psychology and sociology, the Sokal Hoax, Sokal Hoax - Redux, and the Credibility Crisis
    - **Reading 1:** A selection from the Grievance Studies Affair (these papers have been retracted, I will provide a copy of the chosen reading).
    - **Reading 2:** Earp, B. D. 2016. The unbearable asymmetry of bullshit. HealthWatch Newsletter. 101:4-5.
    - **Videos:**
      - **What is knowledge?:** `https://www.youtube.com/watch?v=kXhJ3hHK9hQ&t=477s`

- **Week 5 (2/10/2/14):** Hypotheticals, Induction, and Falsification
  - **Lecture:** Refutation, not confirmation
  - **Reading:** Guthery. 2007. Deductive and inductive methods of accumulating reliable knowledge in wildlife science. Journal of Wildlife Management. 71:222–225.
  - **Videos:**
    - **Science vs. Pseudoscience:** `https://www.youtube.com/watch?v=-X8Xfl0JdTQ&list=PL8dPuuaLjXtNgK6MZucdYldNkMybYIHKR&index=9`

- **Week 6 (2/17-2/21):** Models, Abduction (again), and Human Understanding
  - **Lecture:** Plato, the Theory of Forms, and Likelihood: H-D is not the *only* way.
  - **Reading 1:** Sprenger. 2011. Hypethetico-deductive confirmation. Philosopy Compass. 6/7:497-508.
  - **Reading 2:** TBD, on abductive reasoning in science.

- **Module 2: So, you want to be a *wildlife* scientist...**
  - **Week 7 (2/24-2/28)**: The Basic-Applied Continuum and the Con-Bio Schism
    - **Lecture:** Are we really arguing about this? The importance of theory in application
    - **Reading 1:** Edwards. 1989. The Wildlife Society and the Society for Conservation Biology: strange but unwilling bedfellows. Wildlife Society Bulletin. 17:340-343.
    - **Reading 2:** Anonymous. 1989. Wildlife management cannot afford strange but unwilling bedfellows. Wildlife Society Bulletin. 17:343-344.
    - **Reading 3:** Hunter. 1989. Aardvarks and Arcadia: two principles in wildlife research. Wildlife Society Bulletin. 17:350-351.
    - **Reading 4 (Pick one):**
      - Gavin. 1989. What's wrong with the questions we ask in wildlife research? Wildlife Society Bulletin. 17:345-350.
      - Bolen. 1989. Conservation biology, wildlife management and spaceship Earth. Wildlife Society Bulletin. 17:351-354.

  - **Week 8 (3/3-3/7):** A Bibliography of our Failings: 40+ years of deaf ears
    - **Lecture:** "Reliable" inference.
    - **Reading 1:** Romesburg, H. C. 1981. Wildlife science: gaining reliable knowledge. Journal of Wildlife Management. 45:293-313.
    - **Reading 2:** Sells, S. et al. 2018. Increased scientific rigor will improve reliability of research and effectiveness of management. Journal of Wildlife Management. 82: 485-494
    - **Reading 3:** Gula and Theuerkauf. 2018. Do *a priori* hypotheses improve the reliability of wildlife research?

- **Week 9 (3/10-3/14):** Bullshit in Wildlife and Natural Resource Science
  - **Lecture:** Why quality counts in research.
  - **Reading 1:** Sommers et al. 2010. Quantifying economic impacts of large-carnivore depredation on bovine calves. Journal of Wildlife Management. 74:1425–1434.
  - **Reading 2:** Hebblewhite. 2011. Unreliable knowledge about economic impacts of large carnivores on bovine calves. Journal of Wildlife Management. 75:1724–1730.
  - **Videos:**
    - **Epistemic responsibility:** `https://www.youtube.com/watch?v=AYkhlXronNk`

- **Week 10 (3/17-3/21):** Spring Break
  - Lecture 1: None
  - Lecture 2: None
  - Exercise: None

- **Module 3: Tools of the Trade**
  - **Week 11 (3/24-3/28):** Models (again) and Statistics
    - **Lecture:** Math and statistics in wildlife science: what *is* statistics?
    - **Reading 1:** White, G. C. 2001 Why take calculus? Rigor in wildlife management. Wildlife Society Bulletin. 29:380-386.
    - **Reading 2:** Hurlburt S., R. A. Levine, and J. Utts. 2019. Coup de grace to a tough old bull: 'statistically significant' expires. American Statistician, 73:352-357.

  - **Week 12 (3/31-4/4):** Tooling up for Study Design
    - **Lecture:** There is no simple recipe for study design: philosophy as a method
    - **Reading:** Johnson, D. H. 2002. The importance of replication in wildlife research. Journal of Wildlife Management. 64:912-932.

  - **Week 13 (4/7-4/11):** Study Design 1
    - **Lecture:** Don't cut yourself with Occam's Razor: The role of simplifying assumptions and design vs. model-based inference
    - **Reading:** Herlihy, J. and S. Turner. 2015. Untested assumptions: psychological research and credibility assessment in legal decision-making. European Journal of Psychotraumatology. 6: 27380.

  - **Week 14 (4/14-4/18):** Study Design 2
    - **Lecture:** Representative of what?: Achieving unbiased estimates
    - **Reading 1:** Hurlbert. 1984. Pseudoreplication and the design of ecological field experiments. Ecological Monographs. 54:187-211.
    - **Reading 2:** Hawkins. 1986. Pseudo-understanding of pseudoreplication: a cautionary note. Bulletin of the Ecological Society of America. 67:184-185.

- **Week 15 (4/21-4/25):** Reporting and Reproducibility
  - **Lecture:** The importance of writing and transparency in the scientific process
  - **Reading:** Krausman, P. R. 2024. The basics of scientific writing one more time. Journal of Wildlife Management. 88:1-3.

- **Week 16 (4/28-5/2):** Wrapping up
  - Final Exam.