

## INQ 110: Intellectual Inquiry Science, Myths, Magic and Chaos

Dr. Roland Minton, Trexler 270-C, 375-2358

**Office hours** by appointment at [calendly.com/minton/15min](https://calendly.com/minton/15min)

[minton@roanoke.edu](mailto:minton@roanoke.edu)

**Course Description:** How do we know what we know? We hear that “seeing is believing” but the sights and sounds that reach our consciousness are heavily processed by our brains. Careful experimentation may establish isolated facts, but to utilize these facts we require stories that comfortably integrate them into our unique and flawed view of the world. Chaos theory shows us that complexity in nature can arise from simple processes. This confounds some of western philosophy and science. In this course, we examine the boundaries between fact and fiction, knowable and unknowable, and simple and complex.

**Intended Learning Outcomes:** At the end of the course, successful students will be able to

- describe ways in which scientific fields may differ from non-scientific fields, and discuss ways in which both types of fields may enhance our lives;
- describe ways in which our perception of the world is distorted by the brain, and how these distortions adversely affect our decision-making processes;
- describe different types of myths used to simplify life, and the importance of these myths in our view of the world;
- describe the ways in which different magic tricks work, and discuss what this tells us about the inner workings of the brain;
- describe the butterfly effect, both mathematically and non-mathematically, and its implications for knowledge and prediction;
- analyze current science reporting to identify potential biases and oversimplifications, and discuss how we can develop informed opinions.

In addition to the topic-specific outcomes, all sections of INQ 110 have the following learning outcomes.

- Students will be able to read, discuss, and write about college-level academic texts and ideas.
- Students will be able to use a process of drafting to write papers that have clear theses, cogent argumentation, proper use of evidence, effective organization, and a minimum of sentence-level errors.
- Students will be able to use library and other resources to find, evaluate and synthesize information from multiple sources and use this information in support of a research question.

### **Required Materials:**

- *Bully for Brontosaurus* by Stephen Jay Gould.
- *Sleights of Mind* by Stephen Macknik, Susana Martinez-Conde and Sandra Blakeslee
- *Chaos: The Making of a New Science* by James Gleick
- *Easy Writer (6<sup>th</sup> edition)* by Andrea Lunsford

Additional readings will be taken from other sources, such as Joseph Campbell, V.S. Ramachandran, George Lucas, Nate Silver, Richard Dawkins and Jared Diamond.

**Attendance Policy:** Regular attendance is expected. You must participate in class discussion! Most class periods will have some graded work, often in the form of writing activities. **If you have three unexcused absences, you will be dropped from the course. After the second absence, a warning letter will be sent to you, your advisor and the Registrar reminding you of this policy. If you miss a Peer Review/Workshop day, your grade on that paper will be reduced by one letter grade.**

**I expect you to spend at least 12 hours of work each week inside and outside of class.**

**Academic Integrity:** The college policy is fully supported. Doing your own work and properly acknowledging the work of others is of utmost importance in the academic setting. It is your responsibility to understand and abide by the policies outlined in the booklet “Academic Integrity at Roanoke College” that you received during orientation.

**Papers:** You will write three significant papers for this course. The assignments will be broken into stages that include initial planning, a first (well-thought-out) draft, a peer review process, consultation with me, substantive revisions and a final draft. All of these pieces will affect your grade on the paper. More details will be provided later, but the topics are as follows.

1. Science in the News. A compare-and-contrast assignment, to carefully analyze the quality and validity of science reporting in various media including magazines and tabloids. (4-6 pages)
2. Popular Myth. A research paper using multiple sources, to investigate the truths and history behind a popular story or belief. Here, “myth” means a story that is used over time to pass wisdom or cultural content to the next generation. (6-8 pages)
3. Chaos in the World. A paper covering the human side (a specific story) and the historical side (with some “what if” speculation) of the butterfly effect. (4-6 pages)

**Tests:** There will be two tests. The first test is an essay test primarily covering the readings, primarily from *Bully for Brontosaurus* (6-8 pages). The second test covers various aspects of chaos theory.

**Make-ups:** In case of sickness or scheduling conflicts, get in touch with me ASAP.

**Reading Responses and Short Papers:** For all of the readings, you should take careful notes. Study questions are given to help guide your reading. Most days, I will ask you to write responses to questions. Short papers will include an expansion of a response, a *Brain Games* paper, a personal butterfly effect, and a brief reflection essay at the end of the semester.

**Presentation:** You and a partner will present the main ideas from an episode of *Brain Games*. There will be an associated short paper to be turned in.

**Co-Curricular:** Roanoke College offers an incredible number of student- and faculty-run events on campus. During the course of the semester, you must attend at least four approved co-curricular events offered by the college, with two due before fall break. For each, write a one-to-two-page reflection, including a description of the event, specific aspects of the event that were of special interest to you, and how the event relates to this course (if at all). Papers are due within a week of the event.

**Grading:** Your grade will be determined by the following.

- 48% Three major papers (including drafts and peer responses)
  - 24% Two tests
  - 18% Reading responses, short papers
  - 10% Presentations, co-curricular papers and class participation
- |     |        |     |       |     |              |
|-----|--------|-----|-------|-----|--------------|
| A:  | 93-100 | C+: | 77-79 | D+: | 67-69        |
| A-: | 90-92  | C:  | 73-76 | D:  | 63-66        |
| B+: | 87-89  | C-: | 70-72 | D-: | 60-62        |
| B:  | 83-86  |     |       | F:  | 59 and below |
| B-: | 80-82  |     |       |     |              |

**The Writing Center @ Roanoke College**, located on the Lower Level of Fintel Library, offers tutorials focused on writing projects and oral presentations for students working in any field. Writers and presenters at all levels of competence may visit the Writing Center at any point in their process—including brainstorming, drafting, organizing, editing, or polishing presentation skills—to talk with trained peer tutors in informal, one-on-one sessions. The Writing Center is open Sunday through Thursday from 4 to 9 pm. Simply stop in, or schedule an appointment by going to [www.roanoke.edu/writingcenter](http://www.roanoke.edu/writingcenter), where our staff members and workshops are also posted. Questions? Email [writingcenter@roanoke.edu](mailto:writingcenter@roanoke.edu) or call 375-4949. Like our Facebook page for hours and event updates!

**Accessible Education Services (AES)** is located in the Goode-Pasfield Center for Learning and Teaching in **Fintel Library**. AES provides reasonable accommodations to students with documented disabilities. To register for services, students must self-identify to AES, complete the registration process, and provide current documentation of a disability along with recommendations from the qualified specialist. Please contact Laura Leonard, Assistant Director of Academic Services for Accessible Education, at 540-375-2247 or by e-mail at [aes@roanoke.edu](mailto:aes@roanoke.edu) to schedule an appointment. If you have registered with AES in the past and would like to receive academic accommodations for this semester, please contact Laura Leonard at your earliest convenience to schedule an appointment.

### **The Philosophy of the Course:**

“Richard Feynman believed in the primacy of doubt, not as a blemish upon our ability to know but as the essence of knowing. The alternative to uncertainty is authority, against which science has fought for centuries. He believed that it was not certainty but freedom from certainty that empowered people to make judgments about right and wrong: knowing that they could never be more than provisionally right, but able to act nonetheless. Only by understanding uncertainty could people learn how to evaluate the many kinds of false knowledge that bombard them: claims of mind reading and spoon bending, belief in flying saucers bearing alien visitors. Science can never disprove such claims.” **James Gleick, *Genius***

“People say that what we're seeking is the meaning of life, but I don't think that's what we're really seeking. What we're seeking is the experience of *being alive*, so that the life experiences that we have on the purely physical plane will have resonance within those of our innermost being, so that we actually feel the rapture of being alive.” **Joseph Campbell, *The Power of Myth***

“Some stories are literally true; some of them are figuratively true; some of them are wrong. That’s the nature of stories, isn’t it? They show us all the highlights of the world, but they never leave us certain we can trust the things we know. We listen because they delight us, and mind them as much as they illuminate our hearts; but no one with a lick of sense ever trusts a tale he can’t verify himself.” **Alan Rodgers, *Bone Music***

“I try to not let the facts get in the way of the truth.” **Randall Wallace, writer for *Braveheart***

”Why do we read fiction, anyway? ... I think that most of us read these stories that we know are not ‘true’ because we’re hungry for another kind of truth: the mythic truth about human nature in general, the particular truth about those life-communities that define our own identity, and the most specific truth of all, our own self-story. Fiction, because it is not about somebody who actually lived in the real world, always has the possibility of being about ourselves.” **Orson Scott Card, introduction to *Ender’s Game***

Below, you'll see a star on the left and a large dot on the right. Cover your left eye, and look at the star using your right eye. With your left eye closed, slowly move closer to your monitor. At some point, the dot on the right will vanish (if you move even closer, the dot will re-appear).



## Day-by-Day Course Schedule

W 8/29: Introduction; Science, myths and magic; What distinguishes science from non-science?

### Part 1: Basic Mythmaking

F 8/31: read BB - *Streak of Streaks, The Median Isn't the Message*

**Questions:** Is there such a thing as “hot hands”?

What are psychological factors that cause streaks? Stop streaks?

What are some ways that humans find meaning in random events?

How does only knowing an average value change our perception of a situation?

How did knowing the distribution of lifetimes help Gould deal with cancer?

M 9/3: read BB - *Creation Myths of Cooperstown and Literary Bias*

**Questions:** Should the truth get in the way of a good story?

How much evidence is there for Doubleday as the inventor of baseball?

In what ways are creation myths useful?

In what ways did the Burgess Shale story change over time? Is this bad?

Under what circumstances is it ethical to change aspects of a story?

W 9/5: read I - “Star Wars Myth” and “Star Wars Mythology”

**Questions:** What are some characteristics of a classic myth?

To what extent did George Lucas use his knowledge of mythology in writing *Star Wars*?

In what ways has *Star Wars* philosophy changed our culture?

What are some elements of the Hero Quest that can be seen in other stories?

Do you agree that the “artist is the one who communicates myth today”?

Th 9/6 **Research notes for Paper #1 due**

F 9/7: read I - “The Golden Age”

**Questions:** Is modern life too complicated to find a balance with nature?

Why is a golden past an attractive idea?

What are some examples of disasters detailed in the essay?

Are humans naturally good or bad?

In what ways can history be relevant to modern life? What are some limitations?

### Part 2: Spiritual Mythmaking

M 9/10: read BB - *Knight Takes Bishop* and *William Jennings Bryan*

**Questions:** Does “survival of the fittest” degrade humanity?

Was the great debate about science versus religion? Who won the debate?

Who won the debate and why was the story changed?

What was Bryan’s real objection to evolution? Do you sympathize?

Should science proceed regardless of social implications?

W 9/12: read SM - *Introduction* and Chapter 7: *The Indian Rope Trick*

**Questions:** Is eyewitness testimony the best evidence in a trial?

What are the lessons to be learned from the Indian Rope Trick story?

In what ways are memories fallible? How easy is it to correct mistakes?

What are some implications of faulty memory in our lives?

**First draft of Paper #1 due**

F 9/14: peer review sessions on first paper

**M 9/17:** read BB - *Godfather of Disaster* and *Genesis*

**Questions:** In what ways can science and religion be reconciled?  
In what ways was Whiston crazy? Newton? Why are they portrayed differently now?  
Does *Genesis* coincide with modern science? Should it?  
Are religious texts more poetry than prose? Are scientific texts?

**W 9/19:** read SM - Chapter 2: Spoon Bending

**Questions:** How does the Ambitious Card Trick work?  
What was Uri Geller's claim to fame? Why was it hard to debunk?  
How does spoon bending work?  
In what ways does sawing a person in half depend on continuation?

**Th 9/20: Paper 1 due**

**F 9/21:** read BB - *Kropotkin Was no Crackpot*

**Questions:** Is the main criterion for success competition or cooperation?  
Describe important differences in background between Darwin and Kropotkin.  
Is Darwin's theory really that the strong destroy the weak?  
Why do humans show altruistic behavior?

**M 9/24:** read BB - *Chain of Reason* and I - "Charlatan"

**Questions:** Is it more attractive to follow celebrities than to follow scientists?  
How was Mesmer revealed as a fake or charlatan?  
Do you consider the scientists in this story the good guys or the bad guys?  
Did Mesmer do more harm than good?  
What distinguishes science from pseudoscience?

**W 9/26:** read BB - *The Dinosaur Rip-Off*

**Questions:** Does popular science (like dinosaurs) subvert science education?  
Do you agree that we live in a "profoundly nonintellectual culture"?  
What changes would improve science education?

**F 9/28: TEST #1**

**M 10/1:** read "Good Design"

**Questions:** What special talents do animals have that humans do not?  
Why don't the sound pulses emitted by bats deafen them?  
Why is it difficult for humans to acknowledge talents in animals?  
Does the existence of sophisticated technology in bats prove or disprove the existence of God?

**W 10/3:** Library research session

**F 10/5:** read SM - Chapter 5: Gorillas

**Questions:** What is the significance of an arced movement for a magician?  
How good is your peripheral vision? Why do some people miss the gorilla?  
Do we see all and perceive all? Why is this good? Bad?  
How good are we at multitasking? What does this mean about our lives?

**M 10/8:** *Brain Games* presentations

**W 10/10:** *Brain Games* presentations

**F 10/12: Research for Paper #2 due**

## FALL BREAK

### Part 3: Random Mythmaking

**M 10/22:** chaos introduction

**Questions:** What is an iterate of a function? What possible patterns are there?  
What are some physical analogs of iterates?  
Can simple processes be unpredictable?  
What is meant by a bifurcation? Do dogs know bifurcations?

**W 10/24:** read C - *Prologue, The Butterfly Effect and Revolution*

**Questions:** What are some everyday events that chaos theory explains?  
How did Lorenz discover the butterfly effect? In weather terms, what is the butterfly effect?  
Do all systems exhibit the butterfly effect? Why is it important?  
Where do scientific revolutions come from?

**F 10/26:** read BB - *George Canning and Panda's Thumb*

**Questions:** What was the connection between Andrew Jackson and Charles Darwin?  
How important is the butterfly effect in history?  
How did the QWERTY keyboard take over the keyboard market?  
How do businesses come to dominate a market?

**M 10/29:** read C - *Life's Ups and Downs and Inner Rhythms*

**Questions:** How does chaos show up in nature and physiology?  
What is the importance of distinguishing chaos from randomness?

**W 10/31:** introduction to fractals

**First draft of Paper #2 due**

**F 11/2:** peer review sessions on second paper

Introduction to the Chaos Game

**M 11/5:** read C - *A Geometry of Nature*

**Questions:** What was Mandelbrot's background? Why did he struggle to get his ideas accepted?  
What are fractals and where are they found? How did IBM transmission errors relate to fractals?  
How long is a coastline? What is self-similarity?

### Part 4: Rational Mythmaking

**W 11/7:** read C - *Images of Chaos*

**Questions:** How is the Mandelbrot set formed? What is its significance?  
What do fractals tell us about the nature of life? Describe the Chaos Game and its outcomes.  
Why were computers needed to discover fractals?

**Thursday 11/8: Paper 2 due**

**F 11/9:** read I - "Signal Noise"

**Questions:** How accurate are television political predictions?  
What are the criteria for being a television commentator?  
What is a "probabilistic" prediction? What are a "fox" and a "hedgehog" in Nate Silver's analysis?

**M 11/12:** read I - "Math Instinct"

**Questions:** Are babies blank slates with no knowledge of the world? How can this be tested?  
What are examples of animals solving mathematical problems?  
What is mathematics? Is it fair to say that all animals can do mathematics?

**W 11/14:** chaos and fractals videos

**F 11/16: TEST #2**

**M 11/19:** Career Services day

**M 11/26:** read SM - Chapter 3: Visual Art and 9: Forcing

**Questions:** What is enigmatic about Mona Lisa's smile?  
What do facial expressions tell us about personality? Our own biases?  
How can cards and memories be forced?  
Why do we think that our thoughts can affect events?  
Is free will an illusion? What is meant by free will?  
**First draft of Paper #3 due**

**W 11/28:** peer review sessions on third paper

**F 11/30:** read SM - Chapter 10: Magic Wands

**Questions:** How does our cause-and-effect impulse work against us?  
What are examples of illusory correlation?  
How does hypnosis work? Are we all subject to its effects?

**M 12/3:** Illusions and mathemagic

**W 12/5:** read SM - Chapter 12: Will the Magic Go Away?

Do science and knowledge spoil the fun?

**F 12/7: Paper 3 due**

**W 12/12: Final reflections due**