Astronomy 2202: “A Spacecraft Tour of the Solar System”

Lecture 2: “How to Write About Science”

Fall 2020
MW 9:55 – 11:10 am, RF203

Instructor: Prof. Alexander Hayes
TA: Carly Snell

http://www.astro.cornell.edu/academics/courses/astro2202/
Constraints

• Audience
  • Who will read the document?
  • What do they know about the subject?
  • Why will they read the document?
  • How will they read the document?

• Format
  • Length / Reference Style / Typeface / etc.
  • Worry about Style, not Format.

• Mechanics
  • Rules of grammar and punctuation
  • Class reading: Strunk & White

• Politics
  • Remain honest.
  • Recognize relevant political pressures
Morton-Thiokol’s presentation to NASA suffered because of all capital letters on the slides

Morton-Thiokol Presentation to NASA
January 27, 1986

PRIMARY CONCERNS -

FIELD JOINT - HIGHEST CONCERN

• EROSION PENETRATION OF PRIMARY SEAL REQUIRES RELIABLE SECONDARY SEAL FOR PRESSURE INTEGRITY
  • IGNITION TRANSIENT - (0-600 MS)
  • (0-170 MS) HIGH PROBABILITY OF RELIABLE SECONDARY SEAL
  • (170-330 MS) REDUCED PROBABILITY OF RELIABLE SECONDARY SEAL
  • (330-600 MS) HIGH PROBABILITY OF NO SECONDARY SEAL CAPABILITY

• STEADY STATE - (600 MS - 2 MINUTES)
  • IF EROSION PENETRATES PRIMARY O-RING SEAL - HIGH PROBABILITY OF NO SECONDARY SEAL CAPABILITY
  • BENCH TESTING SHOWED O-RING NOT CAPABLE OF MAINTAINING CONTACT WITH METAL PARTS GAP OPERATING TO MEOP
  • BENCH TESTING SHOWED CAPABILITY TO MAINTAIN O-RING CONTACT DURING INITIAL PHASE (0 - 170 MS) OF TRANSIENT
Structure of Typical Scientific Article:

- **Title**
  - Claim-Staking Titles
  - Problem-Posing Titles
  - Thematic Styles
  - Undiscovered Relationships

- **Abstract**
  - What was done?
  - How was it done?
  - What was discovered?

- **Introduction**
  - Define a research territory.
  - Establish a limited problem in that territory.
  - Suggest or summarize solution to stated problem.

- **Results and Discussion**
  - Clearly present results (Tables, Figures, etc.).
  - Discuss qualifications.
  - Results: Present Data
  - Discussion: Put results in context of posed problem.

- **Conclusion**
  - Restate original claims as supported by evidence in the text
  - Establish wider significance of findings.
  - Suggest possible future work

From “The Craft of Scientific Communication” by Joseph E. Harmon and Alan G. Gross
Six Suggestions For Popular Science Articles:

1. Develop a story (use a simple overall plan)
   - Context
   - Problem
   - Solution

2. Give your article an attractive title and headline that convey the main message in plain language
   - Science Title: “Low Energy Transit Orbits in the Restricted Three-Body Problem”
   - American Scientist Article: “The Interplanetary Transport Network”
   - Headline: “Some mathematical sophistication that allows spacecraft to be maneuvered over large distances using little or no fuel”

3. Begin your article with a fact, situation, or anecdote designed to build a bond between you and your potential readers, then introduce the problem or discovery.
   - Hook
   - Background
   - New Research

4. In your conclusions, do not merely sum up; also talk about your science’s future and wider implications (i.e., Finish with a Flourish)
   - Reiteration
   - Wider Significance
   - Future Work
   - Moral (practical uses, lessons learned, ethical implications, social policies)

From “The Craft of Scientific Communication” by Joseph E. Harmon and Alan G. Gross
Six Suggestions For Popular Science Articles:

5. Adjust your writing style by defining central technical terms, incorporating informal language into formal prose, and employing figures of speech like metaphor not only to enliven and explain but also as organizing principals.
   - Depart from the impersonal trend of specialized journal publications
   - Problem
   - Solution

6. Adapt your tales and illustrations to a general audience by means of strategic simplifications and amplifications
   - DO NOT Sensationalize
   - Readers move back and forth between text and illustrations / tables, which represent very different representations of scientific knowledge

From “The Craft of Scientific Communication” by Joseph E. Harmon and Alan G. Gross
Checklist for Translating Complex Science Into Understandable Prose for a General Audience:

- Create and attentional-getting title and informative headline
- Organize your thoughts around a context-problem-solution structure that tells a compelling story of discovery. If possible, support that organization with a central metaphor that will aid in the understanding of the lay audiences.
- Begin with a “hook” – a fact, situation, or anecdote designed to build a bond between you and your potential readers.
- End with talk about your science’s future, its wider significance, and policy of ethical implications.
- For applied research, address at some point how close it is to practical use by others. For controversial research, discuss any knowledge claims that others might question.
- Adapt a less formal and more personal writing style and avoid overly technical terms where possible.
- Finally, make your story by means of judicious selection of tables and illustrations adapted for a general audience (i.e., simplification and amplifications) that include clear legends / captions that describe the purpose of the graphic.

From “The Craft of Scientific Communication” by Joseph E. Harmon and Alan G. Gross
Casey Dreier

Director of Advocacy and Senior Space Policy Advisor for The Planetary Society

Here’s some of what Casey wrote so far in 2020:

- Magazine articles
- Investigative reporting
- Blogs
- Press releases
- Emails to Congress
- Direct mail
- White papers on space policy
- Policy guides for Congress
- TV & book reviews
- Talking Points
- Scripts for Bill Nye’s political videos
- Journalism pieces from major science conferences
- ~4 pages of emails/day
How to Write About Science

(It’s kind of a big topic)
remember: Science is a process; a set of conceptual tools for figuring things out.

You rarely write about the process of science,

you write about the consequences of science.

Consequences happen to people and societies,

but it’s not always immediately clear what those consequences are.
Science writing is just regular writing with *extra* emphasis on context.
Nonfiction writing is all about providing context for the reader.

For science stories it is particularly important to provide the human context.
Don’t be afraid to talk about spirituality or emotion, where appropriate.

You’re writing for people, not robots. Don’t deny the existence of the human condition.
How to Write About Science
Step (1)
Write a crappy first draft.

Step (2)
Revise.

Step (3)
Repeat step (2) until done (or due).
I should probably add at this point that you should also **read** as much science writing as possible—mainly the good stuff.

*Ask yourself: am I bored? If so, why? If not, what was so engaging?*

*Then copy (not in a plagiaristic way) what works until you’re good at it.*
THE SCIENCE NEWS CYCLE

Your Research
Conclusion: A is correlated with B (p=0.56), given C, assuming D and under E conditions.

...is translated by...

UNIVERSITY PR Office
(YES, YOU HAVE ONE)
For Immediate Release: Scientists find potential link between A and B (under certain conditions).

which is then picked up by...

Local Eyewitness News
WHAT YOU DON'T KNOW ABOUT "A"... CAN KILL YOU! MORE AT 11...

4 LOCAL EYEWITNESS NEWS
...and caught on...

Cable News
We saw it on a Blog!
A causes B all the time.
What will this mean for Obama?

News Wire Organizations
A causes B, say scientists.

The Internets
Scientists out to kill us again.
POSTED BY RANDOM DUDE
Comments (377)
OMG! i kneew itii!
WTH????????

...then noticed by...

WWW.PHDCOMICS.COM
Recurring Slope Lineae (RSL) in Equatorial Regions of Mars

A.S. McEwen et al., Nature Geoscience, web release 12/10/13

Right: Animation of 4 MRO/HiRISE images of RSL in crater on floor of central Valles Marineris; scene 193 m wide
Discussion Questions for the Assigned BBC and Scientific American Articles:

• What scientific discovery are the articles reporting?
• What would you say is the main focus of the BBC article is? How about the Scientific American Article?
• Discuss the main differences in the manner in which both articles report the science.
• Describe the geological features described in these articles.
• What is the mechanism of formation of these features according to each article? Do they mention other possibilities?
• Which article did you reference the most in answering the previous two questions? Why?
• What did you learn about these new features on Mars from reading these two articles?
Recurring Slope Lineae (RSL) in Equatorial Regions of Mars
A.S. McEwen et al., Nature Geoscience, web release 12/10/13

• RSL are dark flows up to a few meters wide on steep, rocky slopes.
• They behave like salty water flows in terms of temperature dependence, seasonality, and growth patterns, but origin of water is not known.
• Previously reported in southern middle latitudes.
• Now known to be abundant in equatorial regions, especially deep in Valles Marineris.
• They follow the sun: active on N-facing slopes when subsolar latitude is to the north; active on S-facing slopes when sun is to the south.
• Shallow water may be surprisingly abundant near the surface in equatorial regions of Mars.
• Key issue to understand present-day Mars for future human explorers.

Right: Animation of 4 MRO/HiRISE images of RSL in crater on floor of central Valles Marineris; scene 193 m wide
What is the main objective of the study and the paper?
What are Recurring Slope Lineae (RSL) and when/where do they occur?
List four hypotheses for the formation of RSL mentioned in the paper.
Which hypothesis is most likely according to the authors? Why?
What effect do salts have on the freezing point of water? What does this mean for the cause behind RSL?
List three instances in which the presence of liquid water has been suggested to explain features on Mars, and why it was not definitely accepted as an explanation in each case.
Why is liquid water on Mars of great interest for astrobiology? Which article did you reference to answer this question? Does the science paper actually mention why?
Would you say the focus of article 1 (BBC) is the same as that of the Science paper? How about article 2 (Scientific American)?
What additional information did you learn from reading the Science paper? (there should be a LOT of new information you learned)