Coming up:

- Competition Nov 20th arrive at 5:30 PM Big Shan (Shan 1430)
- Board available until Nov 19th at 6 PM
- No class Nov 22nd (Enjoy break)
- Presentations Dec 4th and 6th
- *Final Report Dec 7th*

Today's topic: Technical Writing

Technical writing features:

- Purpose -> convey results; not convince
- Quantitative
- Objective
- Concise

Technical vs. non-technical writing

Abstract

The Advanced LIGO gravitational wave detectors are next generation instruments which will replace the existing initial LIGO detectors. They are currently being constructed and installed. Advanced LIGO strain sensitivity is designed to be about a factor 10 better than initial LIGO over a broad band and usable to 10 Hz, in contrast to 40 Hz for initial LIGO. This is expected to allow for detections and significant astrophysics in most categories of gravitational waves. To achieve this sensitivity, all hardware subsystems are being replaced with improvements. Designs and expected performance are presented for the seismic isolation, suspensions, optics and laser subsystems. Possible enhancements to Advanced LIGO, either to resolve problems that may arise and/or to allow for improved performance, are now being researched. Some of these enhancements are discussed along with some potential technology being considered for detectors beyond Advanced LIGO.

Gregory M Harry, *Class. Quantum Grav*. 27 (2010) 084006

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This article analyzes the representational strategies Vergil uses in the description of the shield of Aeneas to shape the reception of his text. Three aspects of the ekphrasis highlight its ambiguous status as a literary representation figuring itself as a material presence that can become part of history as well as depicting it. First, descriptions of rivers frame narrative units within book 8 as though the text were a visual image, while failing to perform such a function in the case of the shield itself. Rivers also symbolize both the linear progression of the narrative and its static visual surface. Second, the presence of multiple levels of internal spectators simultaneously reminds Vergil's audience of the differences between poem and image and image and reality and provides focalizing perspectives from which each represented image can be perceived as real. Finally, intertextual references to defining features of historiography as a literary genre provide a model for how literary accounts of the past can influence events. But the comparison with historiography also draws attention to what Vergil does differently, particularly his direct representation of divine action and his refashioning of history's linear order into a circular, spatial image that can be viewed synchronically.

Andrew Feldherr, *Classical Antiquity* 33 (2014), p. 281

Technical vs. non-technical writing (Quantitative)

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Technical vs. non-technical writing (Objective)

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Technical vs. non-technical writing (Concise 7-141 vs 6-200)

Abstract

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20 words per thought vs 33 words per thought!

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Example forms of technical writing

- Scientific paper
- Report
- Datasheet
- Technical memo
- Manual
- Documentation

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- Scientific paper
- Report
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Parts of a paper or report

- Abstract
- Background
- Methods/Results
- Conclusion
- References
- Supplemental information

Abstract

- Tells what you will learn by reading the main document
- Reports quantitative main results of work
- Generally best to write this *last* even though it is the first thing people read
- Often limited to 150-250 words

Background/Introduction

- Provides the context for the work
- How does the current work fit into existing work?
- Is *not* a review of what others have done
- May explain why the current work is important in this context

Overview:

The Laser Interferometer Gravitational-wave Observatory (LIGO) project was envisioned from inception to follow up the initial detectors with improved instruments. The initial LIGO detectors reached their design sensitivity in 2006 [1] and have produced astrophysically interesting results [2]. Advanced LIGO is the name given to the next generation of detectors that will use the existing vacuum envelopes at the two LIGO sites in Louisiana and Washington state (see figure 1). These new detectors will include improved seismic isolation, suspensions, optics, lasers and all other hardware subsystems. US National Science Foundation funding for Advanced LIGO construction and installation began in April 2008. Installation of hardware is planned to be underway in early 2011 and first observations could begin as early as 2014.

Methods/Results

- What you did
- How you did it
- What data you collected
- May contain sub-sections such as: Technical approach, methods, results

- First analyze your results, and draw your conclusions
- Make figures that show how you go from data to conclusions (ideally without having to read anything)
- Finally write the methods and prose to complement your data so that others can reproduce your work and understand how it was collected

Captions (are not a title)

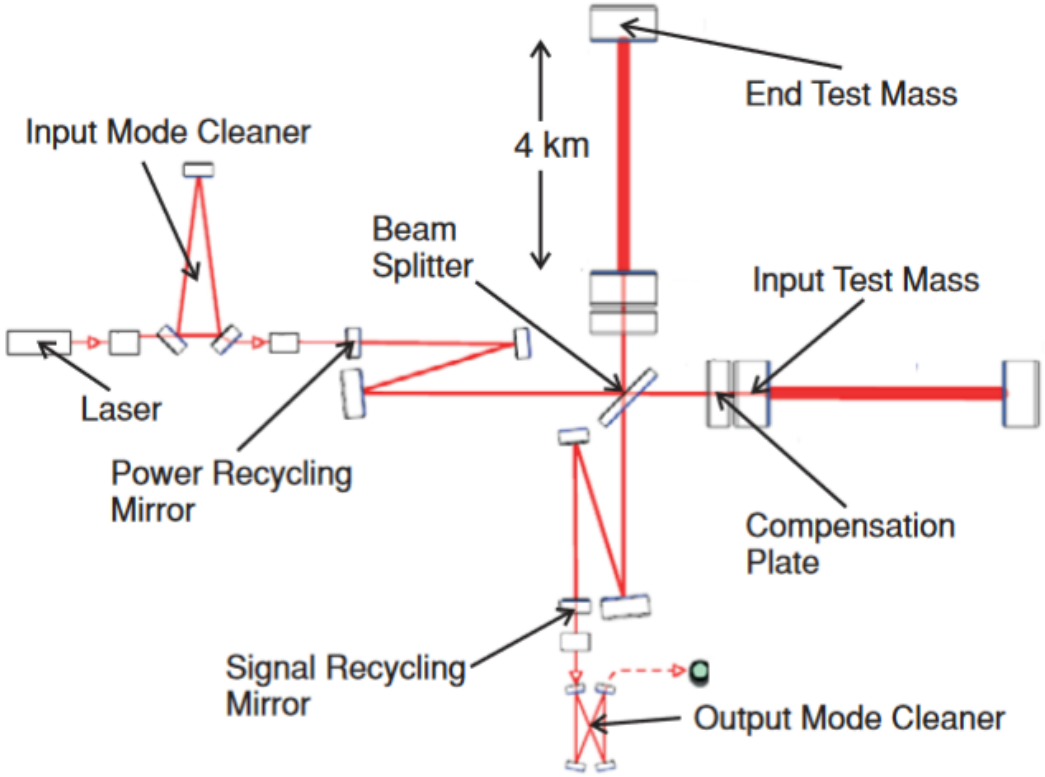

Figure 2. Advanced LIGO optical layout. Light travels from the laser through the input mode cleaner into the power recycling cavity. The light is split at the beamsplitter, then enters the two 4 km long arm cavities formed by the input and end test masses. Any signal exits through the signal recycling mirror and output mode cleaner. Also shown are the compensation plates used to control thermal lensing.

- Figures do not have titles
- The caption should explain everything in the figure fully without the reader needing the main text of the document.
- Caption text is smaller so pack it

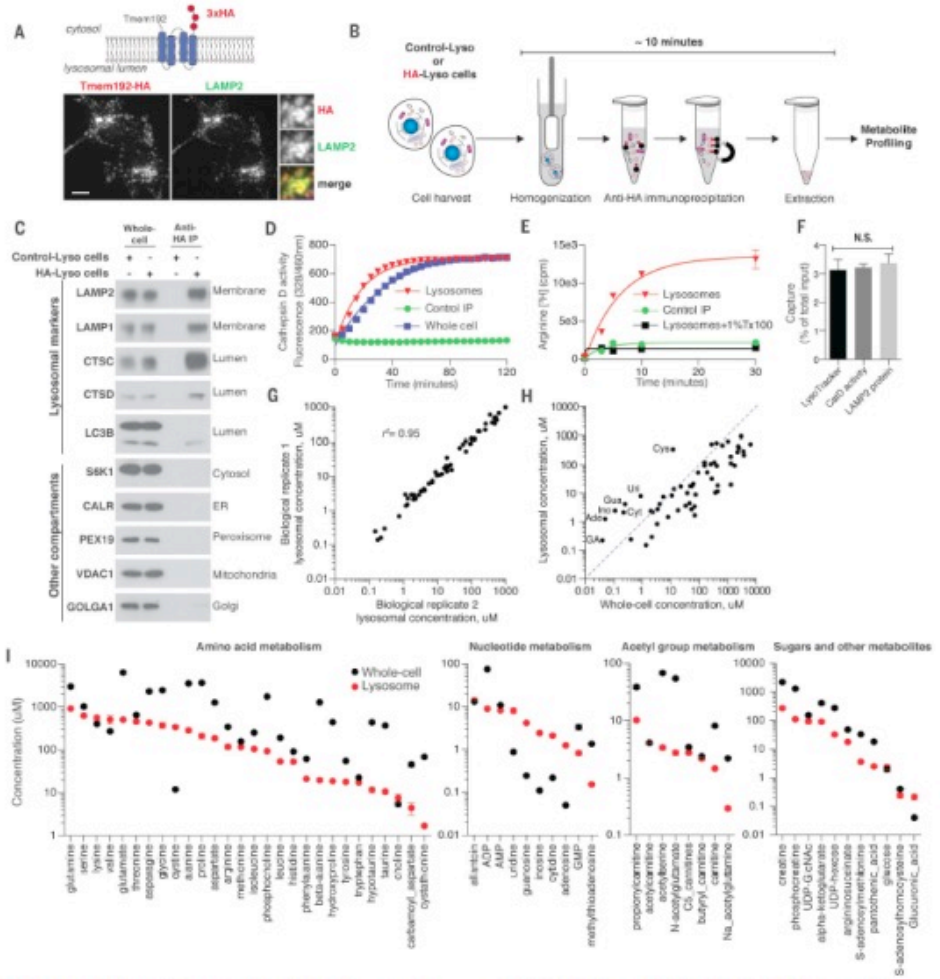

Fig. 1. LysoIP method for rapid immunoisolation of intact lysosomes for absolute quantification of their metabolite content. (**A**) Localization of Tmem192-3xHA fusion protein to lysosomes. Tmem192-3xHA and lysosomes were detected by immunofluorescence with antibodies to the HA epitope tag and the lysosomal marker LAMP2, respectively. Scale bars, 10 μm. Insets represent selected fields that were magnified 3.24X. (**B**) Schematic of the workflow for the LysoIP method. Control-Lyso and HA-Lyso cells refer to cells stably expressing 2xFlag-tagged TMEM192 or 3xHA-tagged Tmem192, respectively. (**C**) The LysoIP method isolates pure lysosomes. Immunoblotting for protein markers of various subcellular compartments in whole-cell lysates, purified lysosomes, or control immunoprecipitates. Lysates were prepared from cells expressing the 2xFlag-tagged TMEM192 (Control-Lyso cells) or 3xHA-tagged Tmem192 (HA-Lyso cells). ER, endoplasmic reticulum. (**D** to **F**) Purified lysosomes are intact and retain their contents. (D) Cathepsin D activity was measured in whole-cell lysates and lysosomes, and immunoprecipitates from Control-Lyso cells served as a negative control (Control IP) (mean ± SEM; $n = 3$). (E) Purified lysosomes take up radiolabeled arginine (Arginine [^{3}H]). Lysosomes treated with a detergent were used as a control (mean ± SEM; $n = 3$). (F) Calculations of the amounts of captured lysosomes (mean ± SEM; $n = 6$, $P > 0.05$; N.S., not significant; analysis of variance) were similar whether determined by tracking a membrane protein (LAMP2), the activity of the lysosomal protease cathepsin D (CatD), or a lysosome-specific small molecule (LysoTracker). Data are presented as the fraction of the material in the initial cell lysate. (**G**) Absolute quantification of lysosomal metabolites. Comparison of concentrations of lysosomal metabolites across two biological replicates, with r^2 value shown. (**H**) Metabolite concentrations in lysosomes and whole cells. Metabolites above the dotted blue line are enriched in lysosomes. Cys, cystine; Uri, uridine; Gua, guanosine; Ade, adenosine; Cyt, cytidine; Ino, inosine; GA, glucuronic acid. (**I**) Whole-cell and lysosomal concentrations of 57 metabolites in HEK-293T cells (mean ± SEM; $n = 5$). n indicates the number of independent biological replicates.

The entire page is just 1 figure and the caption!

The figure has 12 sub-figures!

This is common in space limited scientific publications

Conclusions/Future work

- What did you learn?
- Quantify how well you know it
- What does your work suggest should be done next?

References

- Anything you read that influenced your generally is referenced
- Need to do this in a uniform style, but the style varies with discipline

References

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E11 Report

- < 5 pages
- An overview of your autonomous vehicle and your strategy
- A description of your modification(s):
  - A dimensioned drawing of your chassis if you designed a new one
  - A description and bill of materials for any hardware you added
  - Schematics of any electronics beyond the stock hardware
- An explanation of your game-playing algorithms
- A summary of the robot performance, including how it did during your tests, the scrimmage, and the final game, discrepancies with the intended algorithm, limitations you have observed, and concrete recommendations for improvements.
- A summary of the main lessons you have learned from the project.
- An appendix listing your Arduino code

E11 Report -> Template

- Abstract -> Abstract
- Background -> Introduction
- Methods/Results -> Physical modification, Algorithm, Results
- Conclusion -> Lessons Learned
- References -> References (add as needed)
- Supplemental information -> Code Appendix

Writing within a Team

Group Writing Method	Pros	Cons
1. One person from the group writes the entire report with little help from anyone else. *(Bad Method)*	• You won't have to worry about agreeing on a single voice. • If this person is a good writer with a good understanding of the project, the report will be pretty decent.	• This person will hate everyone else on the team. • This person will not get a lot of sleep before the report is due (especially if it's a long report). • Nobody else has a say in what goes in the report. • Everybody's specialized technical knowledge will get lost forever
2. The group leader splits the report into sections and divies it out to the group members. Each person writes their own section, then the sections are cut-and-pasted together. *(Bad Method)*	• Each person contributes more or less equally. • Nobody ever has to read the entire report.	• The person receiving the report will hate all of you. • Whoever has to edit the report before it's completed (your advisor, liaison, professor, etc.) will get little sleep. • Your report will likely lack quality, integrity, and coherence.
3. Same as 2, except then also have the best writer in the group read and edit the entire report before turning it in. *(Slightly better Method)*	• The report will have a single voice • Everyone's specialized technical knowledge and/or unique perspectives will be included.	• A tremendous amount of time will be needed to edit everything. • Your chosen editor may be a poor editor.
4. The group writes an extensive outline together and decides up front: audience, tone, information to include, organization. Everyone writes his/her section. Finally, everyone takes a turn reading/ commenting on the entire report and a final editor cements suggested changes. *(Good Method)*	• Relatively little time is necessary in the editing stage. • The workload is pretty equal and nobody gets stuck doing the lion's share. • Everybody has a say in what information goes in the final report and how it's presented. • Having everyone edit virtually guarantees a correctly spelled title.	• This method takes a lot of time on the front end. Granted, it's well worth it, but if you're late getting started this may be a difficult method to implement at the last minute. • You will spend lots of time in a room together with your team. Order pizza.
5. The group writes the intro, conclusion, and all transitions together. The rest is the same as 4. *(Better Method)*	• See Method 4.	• See Method 4. But order Chinese food instead.
6. The group locks themselves in a room and writes the entire report together. *(Ok method, slightly insane)*	• The report has a single voice. • Everyone has a say in what the final report looks and sounds like. • Everyone suffers equally.	• Order pizza and Chinese food. This is a huge time commitment. • It's difficult to remain sensitive to others' feelings when stuck in a small room for long periods of time. You may all hate each other before you are done. • This may not be fun, and the resulting report may show it

Present vs. Past Tense

For most of the document, the present tense is preferred:
The robot's locomotion is actuated by two DC motors.

The past tense is used when describing experiments that took place:
The AUV was deployed at 7:30am in Carnegie Lake, NJ on March 21, 2011.

Active Voice vs. Passive Voice

A passive construction occurs when you make the object of an action into the subject of a sentence:
Why was the road crossed by the chicken?

Passive can be unclear.
Active voice is (often) preferred.

Passive Example:
A new process for eliminating nitrogen oxides from diesel exhaust engines is presented.
Active Example:
This paper presents a new process for eliminating nitrogen oxides from diesel engine exhaust.

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Ambiguity

In technical documents, ambiguity can lead to poor decision making, dangerous situations, and lawsuits:

We examined neat methanol and ethanol and methanol and ethanol with 10% water.

Is the water just with the ethanol?

More clear:

We examined four fuels: neat methanol, neat ethanol, methanol with 10% water, and ethanol with 10% water.