Writing: Style, Visualization & Pitfalls

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Overview

1. Finding one’s own ‘style’

2. Good (and bad) graphical practice

3. Common pitfalls to avoid
What is style?

Style vs Substance

Examples:

Speech: accent, slang topic, language

Printed Text: typeface, words content, ideas

This Presentation: slides, my voice message

“Nothing we do can be done ‘simply’ and in no style, because style is something inherent in action, not something added to it.”

- Thomas and Turner
Cast a role both for yourself and the reader
Classic style

‘Mon style ne sera point fleuri, mes expressions seront simples comme la vérité.’

- Jean-Baptiste Le Brun (1700’s)

‘My style will not be at all florid, my expression will be as simple as the truth.’

‘as simple as the truth’
Classic style

Northern Shrike (*Lanius excubitor*)

“Unusual among songbirds, shrikes prey on small birds and rodents, catching them with the bill and sometimes impaling them on thorns or barbed wire for storage. Like other northern birds that depend upon rodent populations, the Northern Shrike movements are cyclical, becoming more abundant in the South when northern rodent populations are low. At times they hunt from an open perch, where they sit motionless until prey appears; at other times they hover in the air ready to pounce on anything that moves.”

- Audobon Society Field Guide
Classic style

“Physics has a history of synthesizing many phenomena into a few theories.”

- Richard Feynman
Non-Classic style

Fact: Science is full of blood, sweat, tears, details & dead-ends

Ask yourself: Do we do a reader/student a disservice by obscuring that?

⇒ Think about how you want to convey information
i.e. find your own style/voice
Case Study

1 - Style
Case Study
Case Study

Russell, Richardson and Cody (1986)
Case Study
1 - Style

**Task:** come up (with the person next to you) with a title to a report describing your results
Data Visualization

2 - Graphics

Palmer and Russell (1986)
Principles of ‘Graphical Excellence’

- show the data

- avoid distorting what the data have to say

- make large data sets coherent; present many #s in a small space

- serve a reasonably clear purpose

- reveal the data at several levels of detail

- tell the truth about the data
Principles of *Graphical Excellence*

**GOAL:** Give the viewer the greatest number of ideas in the shortest amount of time with the least ink in the smallest space
Carte Figurative des pertes successives en hommes de l'Armée Francaise dans la Campagne de Russie 1812-1813.


Les nombres d'hommes principaux ainsi que tous les graphiques qui suivent, ont été calculés et figurés de manière à s'aligner sur la carte, où se trouvent les endroits des événements. Tous les chiffres sont exacts et précise par des calculs mathématiques. La carte montre clairement les pertes en hommes et les trajets suivis par l'armée française pendant la Campagne de Russie de 1812 à 1813.

TABLEAU GRAPHIQUE de la température en degrés du thermomètre de Réaumur au-dessous de zéro.

Les pertes successives en hommes se manifestent clairement sur la carte. Les régions les plus pénibles, telles que la Sibérie et l'Asie centrale, ont subi les pertes les plus importantes. La carte démontre également que la marche en Russie fut d'autant plus difficile que les troupes françaises furent confrontées à des conditions climatiques extrêmes.

Minard (1880)
2 - Graphics

American Education (~1970)
“This may well be the worst graphic ever to find its way into print.”
- Edward Tufte
Further means to improve?
Curve Fitting

linear regression fit
Curve Fitting ⇒ Use Statistics

standard deviation
Curve Fitting ⇒ Use Statistics

better fit!
Curve Fitting ⇒ Use Statistics
(Some) Common Pitfalls

*Indefinite Antecedents*

“Historically, it has been difficult to make direct physiological measurements at the level of the inner ear. This is because of the size, complex structure and sensitive nature of the cochlea (which for mammals is encased in the hardest bone in the body).”
(Some) Common Pitfalls

Indefinite Antecedents

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Jargon & Abbreviations

- Learn to use ↔ **But do not abuse!**

- Think about possible etymological origins

  e.g. mRNA, mettaloenzymes, taxonomy, fitness, genetic *drift*, UBRP, et cetera
Who is the author?

Did all these people really write this paper?
letters to nature

N₂ and CO both occur in the same velocity component, that the velocity separation in OI and H₂, and that the CO component is aligned in velocity with the highest-velocity OI component strongly supports the claim of the first detection of interstellar N₂. Our N₂ detection is further supported by the fact that the excitation temperatures of H₂ (~9–10) and of N₂ agree for the long-wavelength component. Although the N₂ value is not definitely determined, we use the 519 value to improve our estimate and find N(N₂) = (1.8 ± 0.3) × 10¹⁴ cm⁻³. We note that 31 N₂ may be more extended than CO or H₂ in interstellar space. Because nitrogen has a lower cosmic abundance compared to either carbon or oxygen, we believe that the N₂ is not bound at N(OI) and should the true N₂ value be much smaller than that for Si (although this is unlikely). Significant amounts of N₂ (that is, N(N₂) > 10¹⁴ cm⁻³) would be possible. Our lowest limit to N(N₂) is insensitive to the 519 value or the choice of stellar model used to represent the stellar continuum. Taken together, these data strongly indicate that N₂ has been detected for the first time in the interstellar medium and with a column density of N(N₂) > 2.5 × 10¹⁴ cm⁻³.

From our analysis of the OI line at 1.26 cm, we find N(O) = (3.7 ± 0.6) × 10¹⁴ cm⁻³ for the component near 3.1 cm. Using the observed N(O) /[O I] ratio (3.7 ± 0.6) × 10¹⁴ cm⁻³ (ref. 11), this component contains N(O) = 1.5 × 10¹⁴ cm⁻³, where N(O) = (3.7 ± 0.6) × 10¹⁴ cm⁻³. The amount of OII further reddening for this component can be determined from the dust-to-gas ratio, which yields E(B-V) = 0.20 mag. Assuming that the ratio of the total to selective extinction is 3:1 (ref. 12), we find that the total visual extinction is 0.65 mag. When we compare our results to models of interstellar gas and dust chemistry, some of the standard cloud models explain our observations. The observed N₂ fractional abundance is more than two orders of magnitude less for dense cloud models and approximately two orders of magnitude larger than expected from models of diffuse clouds. The fact that N₂ shows a deficiency in relative abundance for lines of sight with N(O) > 3 × 10¹⁴ cm⁻³ would argue that dense cloud chemistry should be important for interstellar nitrogen. However, the measured N₂ abundance and upper limits for other nitrogen species do not account for the observed variations. Additionally, we find that the fractional abundance of N₂ towards HD 20384 is N(N₂)/N(O) = 1.5 × 10⁻³, similar to those estimated from CH₃OH observations of dense molecular clouds. Therefore, the far-ultraviolet lines of N₂ provide a unique probe of interstellar nitrogen chemistry in the transition region from diffuse to dense molecular gas.

A precision measurement of the mass of the top quark

09 Collaboration*

A list of authors and their affiliations appear at the end of the page.

The standard model of particle physics contains parameters such as particle masses whose origins are still unknown and which cannot be predicted, but whose values are constrained through their interactions. In particular, the masses of the top quark (m_t) and W boson (m_W) contain the mass of the long-hypothesized, but thus far not observed, Higgs boson. A precise measurement of m_t can therefore include where to look for the Higgs, and indeed whether the hypothesis of a standard model Higgs is consistent with experimental data. As two quarks are produced in pairs and decay in only about 10⁻⁸ s into various final states, reconstructing their masses from their decay products is very challenging. Here we report a technique that extracts more information from each top-quark event and yields a greatly improved precision of m_t = 173.1 ± 0.43 GeV (2σ) when compared to previous measurements. When our new result is combined with our published measurement in a complementary decay mode and with the only other measurements available, the new average for m_t becomes 173.1 ± 0.43 GeV (2σ).
Use of Mathematical Equations

(don't be afraid!)

Frishkopf & DeRosier (1983)

\[ m \ddot{x} + b \dot{x} + kx = A \sin \omega t \]

stiffness changes with bundle height

Corey and Hudspeth (1977)
Summary

Style - find and develop your own

Graphics - use principles of *graphical excellence*

Pitfalls - learn to avoid common mistakes
References

**Style:**  
- *Clear and Simple as the Truth* (Thomas and Turner)
  - *The Craft of Research* (Booth, Colomb & Williams)

**Graphics:**  
- *The Visual Display of Quantitative Information*  
  (Edward R. Tufte)

**Pitfalls:**  
- *The Art of Scientific Writing* (Ebel, Bliefert & Russey)

slides of this talk will be posted at www.math.arizona.edu/~cbergevin/
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