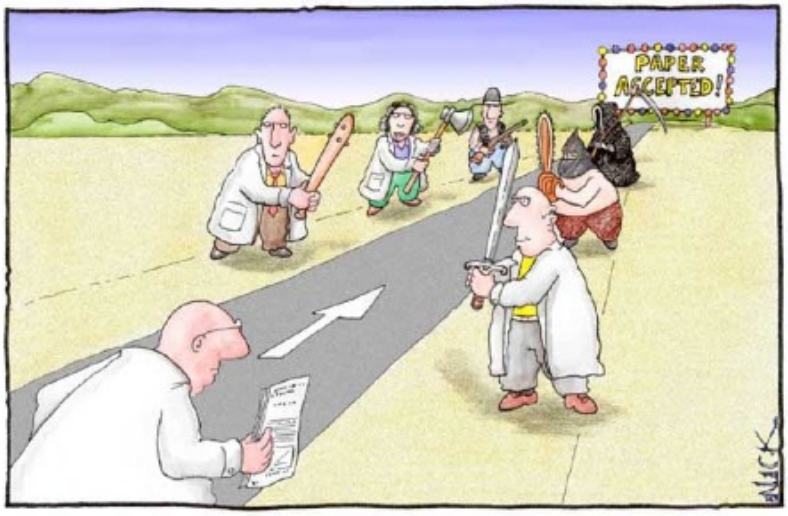
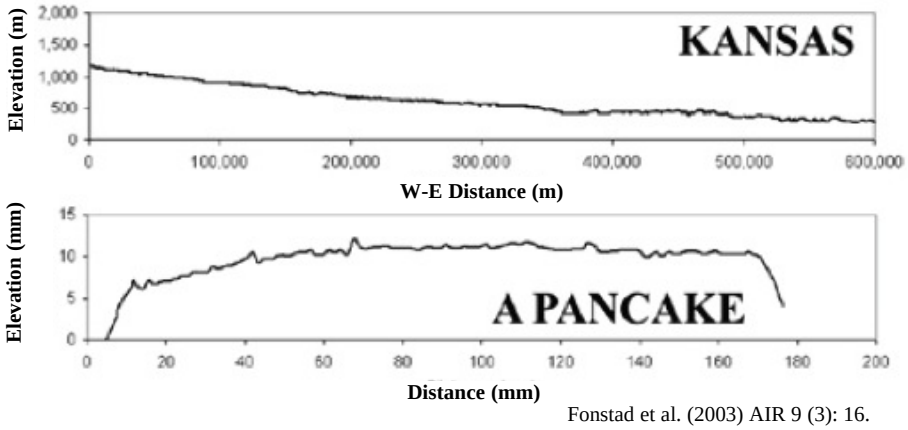
BE.109: Writing Results and Materials & Methods Sections



A Results Exercise: Kansas and Pancakes

Write a 5-sentence paragraph describing the results illustrated in this figure:

- Describe the figure: highlights? trends? conclusions?
- Be sure to include a topic and a concluding sentence; watch for structure and coherence.



Fonstad et al. (2003) AIR 9 (3): 16.

Kansas Is Flatter Than a Pancake

by Mark Fonstad [1], William Pugatch [1], and Brandon Vogt [2]

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In this report, we apply basic scientific techniques to answer the question "Is Kansas as flat as a pancake?"

While driving across the American Midwest, it is common to hear travelers remark, "This state is as flat as a pancake." To the authors, this adage seems to qualitatively capture some characteristic of a topographic geodetic survey [2]. This obvious question "how flat is a pancake" spurned our analytical interest, and we set out to find the 'flatness' of both a pancake and one particular state: Kansas.

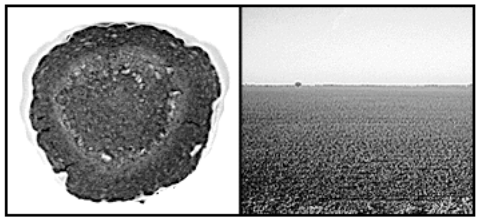


Figure 1. *(a) A well-cooked pancake; and (b) Kansas.* [1]

from http://www.improbable.com/

Results

The topographic transects of both Kansas and a pancake at millimeter scale are both quite flat, but this first analysis showed that Kansas is clearly flatter (see Figure 4).

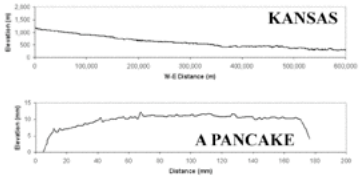


Figure 4. *Surface topography of Kansas and of a pancake.*

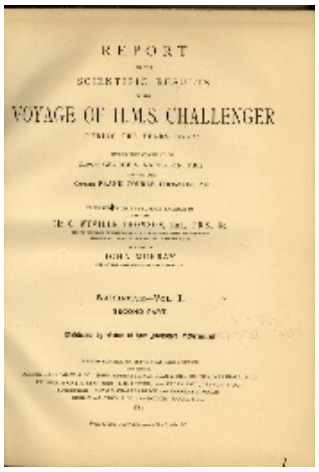
Mathematically, a value of 1.000 would indicate perfect, platonic flatness. The calculated flatness of the pancake transect from the digital image is approximately 0.957, which is pretty flat, but far from perfectly flat. The confocal laser scan showed the pancake surface to be slightly rougher, still.

Measuring the flatness of Kansas presented us with a greater challenge than measuring the flatness of the pancake. The state is so flat that the off-the-shelf software produced a flatness value for it of 1. This value was, as they say, too good to be true, so we did a more complex analysis, and after many hours of programming work, we were able to estimate that Kansas's flatness is approximately 0.9997. That degree of flatness might be described, mathematically, as "damn flat."

from http://www.improbable.com/

What is the Purpose of the Results Section?

- **Objectivity**: Make the data, just the data, easy to find.
  - *Some readers want to interpret your data themselves rather than accepting the interpretation presented in the discussion.*
- **Description**: Describe the data presented in figures and tables.


REPORT
SCIENTIFIC RESULTS
VOYAGE OF H.M.S. CHALLENGER

What Differentiates Results from the Methods?

Methods = *How* the data were accumulated.

Results = *What* data were accumulated.

Readers expect to find the "answers" to your research questions in your Results section.

What Differentiates Results from Discussion?

Results = *Data Presentation*

("Experiments showed that . . . .")

Discussion = *Data Interpretation*

("Experiments suggest that . . . .")

However, you still need to choose which data to present in your Results Section (an act of interpretation!).

What are the Contents of a Results Section?

- A brief description of the experiment or rationale at the beginning of each subsection ("In order to . . . . As a result, we found that . . . .).
- The data (in past tense).
- Descriptive text for FEW determinations.
- Tables or graphs for REPETITIVE determinations.
- The data that your methods indicated you would produce (and answering the questions you established in your introduction).

What are some qualities of a well-written Results section?

- Methods and Results **Correspond**.
  - *i.e., no experimental results for which there are no methods, and vice versa.*
- Results are presented in a **logical order**.
  - *e.g., most important first, most fundamental first, etc.*
- Results **focus on the question(s) or hypothesis** introduced earlier in the paper.

What are some pitfalls of a Results section?

- **Overstating** the results
  - (e.g., "Figure 1 clearly shows…")
- Reporting **irrelevant** results
  - Although it is sometimes useful to report experiments that didn't work.
- **Omitting** visual organizers
  - Such as subheads.
- Including **inappropriate** illustrations.
- Including methods and/or discussion.
  - Overlap is acceptable in some circumstances.

Results Example: Creating a context for the results

Results

I hypothesize that CG7593 acetylates certain lysine residues of the histone protein, therefore neutralizing them, disrupting histone-DNA interaction, and allowing HeT-A to bind to telomeric DNA. CG7593 may or may not be involved in directing HeT-A to the telomeres. According to the hypothesis, I expect that CG7593 localizes in the nucleus and that in its absence, the entry of HeT-A into the nucleus would not be affected. The first steps in performing the experiments to test the hypothesis were verifications of HeT-A-GFP construct to be transfected into Schneider 2 cells, SD10812 EST from which *CG7593* was amplified, and the created *CG7593* dsRNA.

HeT-A-GFP construct verification SD10812 EST verification

***CG7593* dsRNA verification**

HeT-A protein localization in *CG7593* knock down Schneider 2 cell cultures

Viability Analysis

A Methods Section Exercise

1. Draw a relatively simple picture.
2. Write an account of how you drew that picture.
3. Give your written account to a partner, who will then draw based on your methods.
4. Compare your picture and your partner's rendering.

What are Some Goals of a Methods Section?

- Present the **experimental design.**
- Provide enough detail to allow readers to **interpret your results**.
- Give enough detail for readers to **replicate** your work.

"The key to a successful Methods section is to include the right amount of detail--too much, and it begins to sound like a laboratory manual; too little, and no one can repeat what was done."

Successful Scientific Writing, 2nd ed.

According to Paradis and Zimmerman,

"The experimental [or methods] section of an article **describes the tools and processes that enabled you to meet the stated objectives of the introduction**. . . . This section will be read for at least two major reasons. First, readers will judge how skillfully you have designed the empirical process of problem solving. Second, readers may test your methodology against your results in their own laboratories. In experimental sections, clarity and accuracy are priorities."

What are some pitfalls of a Methods section?

- Providing **too little or too much** information.
- **Reiterating** published methods rather than citing them.
- Writing strictly in **chronological order** (alternatives: most important first, most fundamental first, etc.).
- Methods and results don't **correspond** (you have to provide methods for all the experiments you report).
- **Forgetting to use visual organizers** that direct readers to specific aspects of the methods section, e.g., subheads.

Pitfalls of a Methods Section, cont.

- Using a "dangling modifier" because of an over-reliance on passive voice:

  Watch out for the dangler!

  "After scraping the desired plate in four swipes, the bacteria were placed in 8ml of media with no antibodies."

- Failing to provide a context and reasons for the methods themselves:

  "In order to . . . , we . . . " ⇐ context for the particular method is provided.

- Writing a Protocol rather than a Methods section.

Protocol vs. Methods Section

A Protocol is . . .

- A series of steps to be carried out.
- Written in sequential or temporal order.
- Intended for the reader to achieve a final result.

A Methods Section is . .

- A series of steps already completed and is written in past tense.
- Written in logical order.
- Intended for the reader to replicate the experiment.

Section headings: descriptive and parallel

Non-Parallel
Non-Descriptive

Introduction
Background
Marx Generators
Line Pulse
Beam Generation
Transporting Beam
Pellets
Results
Conclusions

Parallel
Descriptive

Introduction

Past Designs for Particle Beam Fusion

New Design for Particle Beam Fusion
- **Charging Marx Generators**
- **Forming Line Pulse**
- **Generating Particle Beam**
- **Transporting Particle Beam**
- **Irradiating Deuterium-Tritium Pellets**

Results of New Design

Conclusions and Recommendations

Use Section Hierarchies to Clarify Structure

Performance of the Solar One Receiver

Introduction
Steady State Efficiency
Average Efficiency
Start-Up Time
Operation Time
Operation During Cloud Transients
Panel Mechanical Supports
Tube Leaks
Conclusion

Performance of the Solar One Receiver

Introduction
Receiver's Efficiency
- **Steady State Efficiency**
- **Average Efficiency**

Receiver's Operation Cycle
- **Start-Up Time**
- **Operation Time**
- **Operation During Cloud Transients**

Receiver's Mechanical Wear
- **Panel Mechanical Supports**
- **Tube Leaks**

Conclusion