

Telling your data story

Readings for today

- Mensh, B., & Kording, K. (2017). Ten simple rules for structuring papers. PLoS Comput Biol, 13(9), e1005619.

Topics

1. Effective data communication
2. Principles
3. Structure
4. Process

Effective data communication

Principles of data investigations

1. Clearly identify what you are asking.
2. Determine the parameters & constraints of your query.
3. Know the context of your evidence.
4. Be systematic in your search.
5. Disturb the data as little as possible.
6. See the story from as many perspectives as possible.
7. Strive for simplicity over control.
8. Communicate your story effectively.



"The Adventure of the Abbey Grange"
- Sidney Paget

Rules for effective data communication

- | | | |
|------------|---|--|
| Principles | — | <ul style="list-style-type: none">1. Focus on <u>one</u> big idea.2. Present for naive, smart humans.3. Use Context-Content-Conclusion (CCC) structure.4. Optimize logical flow |
| Structure | — | <ul style="list-style-type: none">5. <u>Abstract</u>: compact summary.6. <u>Introduction</u>: why the study matters.7. <u>Results</u>: why the conclusion is justified.8. <u>Discussion</u>: Preempt criticism, be modest & thoughtful, give future impact. |
| Process | — | <ul style="list-style-type: none">9. Allocate time wisely.10. Iterate the story |

Principles

1. Focus on one big idea

Have a single sentence “take home” message that anyone outside your field would understand.

- Should have more complexity than the title, but the title should convey this.
- Specific & concise (not open ended)

Example: “The body’s inflammation response links increased poverty to reduced integrity of structural connections in the human brain.”

2. Present for naive, smart humans

Assume:

- Your audience does not have the same specialized background knowledge as you do. ← e.g., does not know field-specific jargon
- Your audience is rational and intelligent. ← e.g., audience is capable of learning.
- Your audience has typical human limitations. ← e.g., working memory limitations, distractible

3. Use Context-Content-Conclusion (CCC) structure

Context:

- Motivate
- Background
- “Why?”

Content:

- Describe
- Elaborate
- Details
- “How?”

Conclusion:

- Infer
- Insights
- Elaboration
- “So what?”

Multiple Scales

- Paragraph
- Sections
- Paper

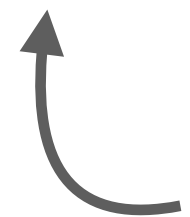
4. Optimize logical flow

Avoid zig-zagging:

- Only the central idea (Rule #1) should be touched on multiple times. Otherwise, present an idea and move on.
- String ideas together in a parsimonious and linear form.

Use parallelism:

- Parallel messages should be communicated in parallel form.

 e.g., if ideas are introduced in the order $A \rightarrow B \rightarrow C$, then they should be elaborated (or discussed) in the order $A \rightarrow B \rightarrow C$.

Structure

Structure of a paper

CCC structure of papers

Context — a. Introduction

Content — b. Methods
c. Results

Conclusion — d. Discussion

5. Abstract: compact summary of work

The most read part of papers and often the only published text for conference posters and talks.

↑ Important that the entire paper be encapsulated here.

CCC structure of abstract

Context — a. Motivation/context sentence
 b. Open question/hypothesis sentence

Content — c. Methods sentences (2-3)

Conclusion — d. Inference & interpretation sentence.

Take home message

6. Introduction: Why the study matters

Explain why the study is important and how you get to your hypothesis.

A. Big Picture:

- “Real life” context to anchor the problem for reader.
- Reframe problem in theory space (i.e., theoretical constructs)

B. Narrow focus:

- Operationalize concepts into testable measures.
- Limit the scope to space of variables in your hypothesis.

C. Hypothesis:

- Define hypothesis in the space of the data you will be working with
 - Specific variables
 - Rational
 - Falsifiable

7. Results: why the conclusion is justified

Reveal the story your data is telling you that point to the inferences you will make in your final conclusions.

Refocus statement:

- Remind reader of hypothesis
- Recap methods as necessary for evaluation of hypothesis.

Logic sequence:

Logic(i)

$$Q_i \rightarrow A_i \rightarrow I_i$$

Include figures for each relevant $A_i \rightarrow I_i$

Q_i : Question for point i
 A_i : Answer for point i
 I_i : Inference for point i

Example logic sequence:

Logic 1 (raw data) $Q_1 \rightarrow A_1 \rightarrow I_1$

↳ Logic 2 (data cleansing) $Q_2 \rightarrow A_2 \rightarrow I_2$

...

↳ Logic N (NHTSs) $Q_N \rightarrow A_N \rightarrow I_N$

8. Discussion: conclude & contextualize

Preempt criticism, be modest & thoughtful (ATOM approach), & look to the future.

A. Summary Statement:

- What was your hypothesis?
- What did data show you?
- What is your conclusion?

B. Limitations:

- Communicate your uncertainty.
- What could be done better?
- What are the gaps you cannot evaluate?

C. Relevance to field:

- How do your findings and conclusion relate to what others have shown?
- Show both alignment and disagreements (there will always be both).

D. Extensions:

- What new hypotheses do your data or inferences generate?
- What would be the next step in your series of inferences to a bigger picture?

Process

9. Allocate time wisely

Your time:

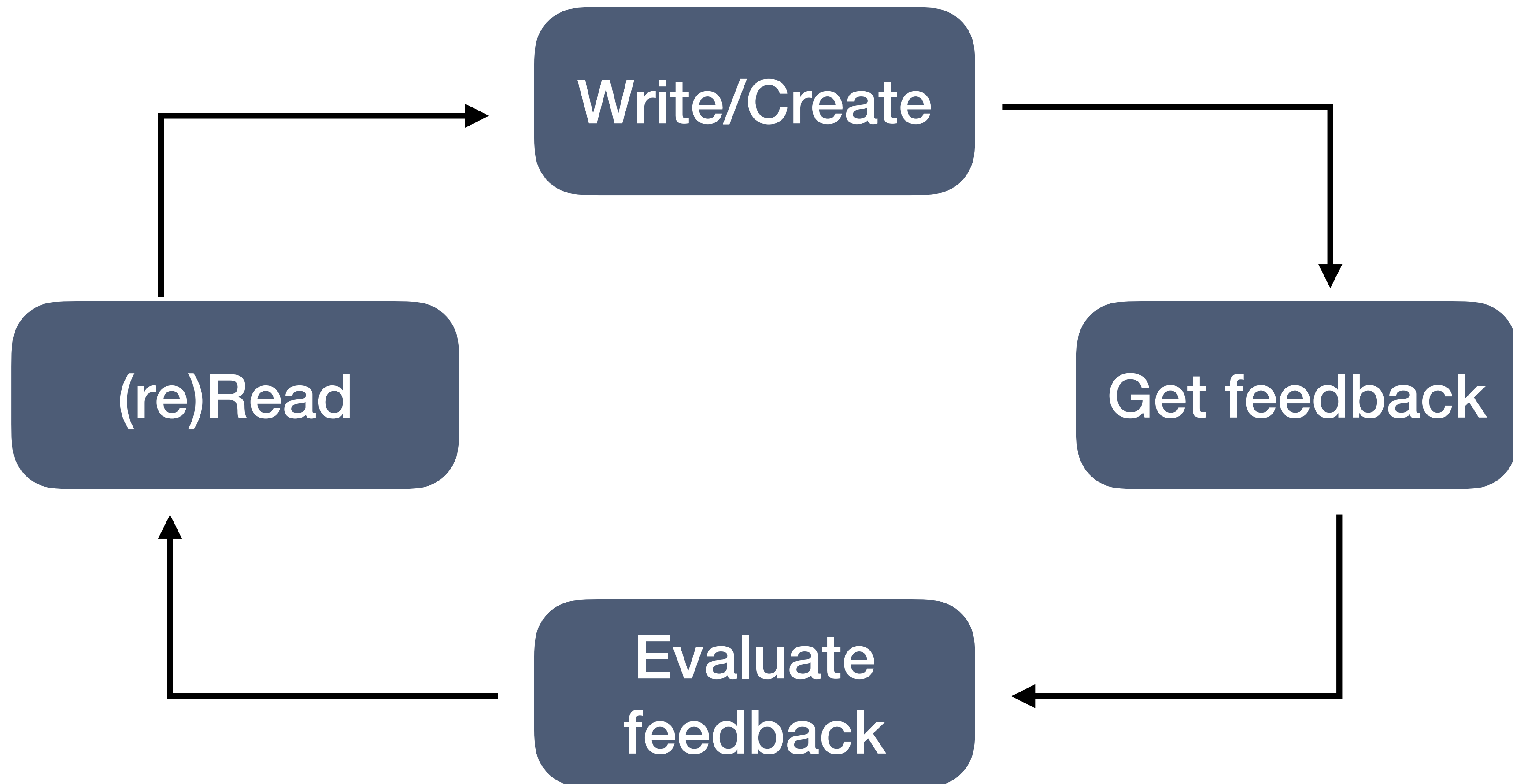
- Title, abstract, & figures are read the most.
 - Methods read the least.
 - Iteratively outline/structure your narrative until it has a coherent form before moving to formal prose.
- Budget your effort accordingly

Audience's time:

- Create a narrative arc that carries the readers attention.
- Think of as a story instead of a reporting of facts.
- Minimize the need to “go back” to previously read sections.

10. Iterate through the story

Scientific communication is an optimization problem!



Rules for effective data communication

- | | | |
|------------|---|--|
| Principles | — | <ul style="list-style-type: none">1. Focus on <u>one</u> big idea.2. Present for naive, smart humans.3. Use Context-Content-Conclusion (CCC) structure.4. Optimize logical flow |
| Structure | — | <ul style="list-style-type: none">5. <u>Abstract</u>: compact summary.6. <u>Introduction</u>: why the study matters.7. <u>Results</u>: why the conclusion is justified.8. <u>Discussion</u>: Preempt criticism, be modest & thoughtful, give future impact. |
| Process | — | <ul style="list-style-type: none">9. Allocate time wisely.10. Iterate the story |

Take home message

- Thinking carefully of the structure of your narrative provides an effective rationality and logic for communicating your findings.