Writing good

Peter Attia

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Writing ~~good~~ well: Scientific papers

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Why should you write well?

- It's your job

- Clearly communicate results to community

- Understand your own work

- Expedite review process

- Your papers will outlive you

Why should you write well?

Good writing is clear thinking made visible.

– Bill Wheeler

This talk

- My processes, best practices, and tools for writing
    - Happy to hear input from others!

- Assume you are ready to "write it up"
    - Talk to Will or others about when the story is complete

My writing process

1. Draft figures

2. Draft paper

3. Edit paper and figures

Step 1: Drafting figures

- Do this when you have (almost) all the data

- "Tell the story" with just your figures

- Don't focus on perfecting them (yet)
  - Make a slidedeck with rough order and positioning

Step 2: Draft paper

- Focus on **organizing your thoughts**
  - Flow, storytelling, logic

- Rough outlining – fill in sentences/thoughts as you go

- Don't focus on word choice/grammar

Step 2: Draft paper

- Find a quiet spot with no distractions
  - Laundry room!

- I recommend **pen and paper**
  - Freeform, fast, distraction-free
  - I find laptops too distracting
  - Definitely don't use Word
    - Defenitely don't use Word

Step 2: Draft paper

Recommended order:

1. Results
2. Discussion
3. Conclusion
4. Introduction (without citations)
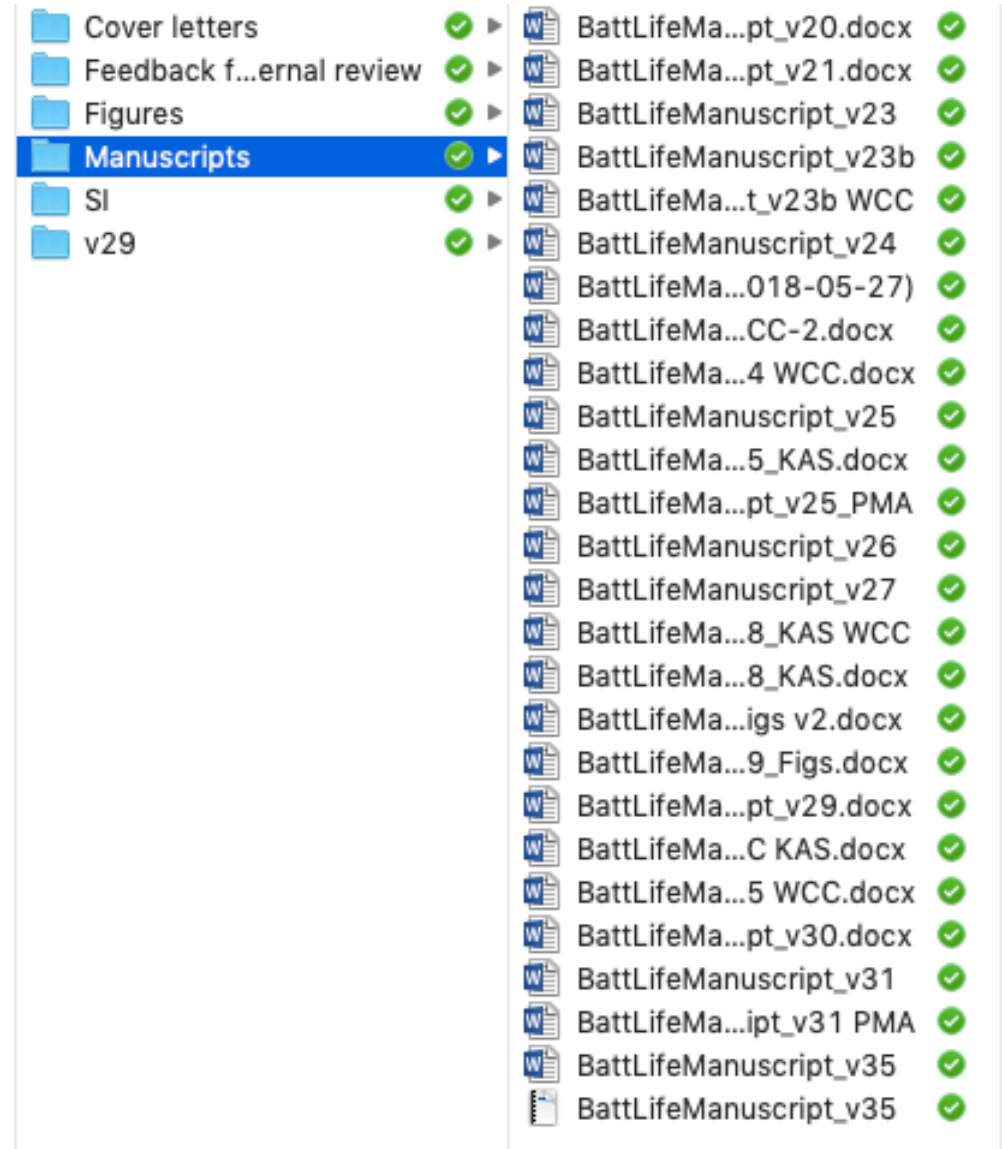
Write methods when you need a break

Keep target journal's guidelines in mind, but don't focus on them

Step 2.5: Writing to editing

- Type up what you have

- Add citations
  - Find relevant citations by choosing key papers, and finding other papers that they cite and that cite them

- Not so bad so far, right??

Step 3: Editing

- Editing is **critical**, yet often not given the time it needs

- Even so, editing is the most time consuming part of writing
  - 80%?

📁 Cover letters ✓ ▶	📄 BattLifeMa...pt_v20.docx ✓
📁 Feedback f...ernal review ✓ ▶	📄 BattLifeMa...pt_v21.docx ✓
📁 Figures ✓ ▶	📄 BattLifeManuscript_v23 ✓
📁 **Manuscripts** ✓ ▶	📄 BattLifeManuscript_v23b ✓
📁 SI ✓ ▶	📄 BattLifeMa...t_v23b WCC ✓
📁 v29 ✓ ▶	📄 BattLifeManuscript_v24 ✓
	📄 BattLifeMa...018-05-27) ✓
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	📄 BattLifeMa...5 WCC.docx ✓
	📄 BattLifeMa...pt_v30.docx ✓
	📄 BattLifeManuscript_v31 ✓
	📄 BattLifeMa...ipt_v31 PMA ✓
	📄 BattLifeManuscript_v35 ✓
	📄 BattLifeManuscript_v35 ✓

Step 3: Editing

When I write, **I treat editing and writing as two separate tasks.** And I think this applies to any kind of creativity that idea generation and idea evaluation and refinement are completely different. And maybe even opposite mindsets, right?

– Adam Grant

HASSO PLATTNER
Institute of Design at Stanford

Step 3: Editing

- I'm writing a first draft and reminding myself that I'm simply shoveling sand into a box so that later I can build castles.
  – **Shannon Hale**

- While writing is like a joyful release, editing is a prison where the bars are my former intentions and the abusive warden my own neuroticism.
  – **Tiffany Madison**

Step 3: Editing

The most important rule to good writing:

Make every word count or, Make every word tell

Make every word count

I have made this [letter] longer than usual because I have not had time to make it shorter.
– Blaise Pascal

Make every word count

Anyone and everyone taking a writing class knows that the secret of good writing is to cut it back, pare it down, winnow, chop, hack, prune, and trim, remove every superfluous word, compress, compress, compress...
– Nick Hornby

Make every word count

So the writer who
breeds more words
than he needs,
is making a chore for
the reader who reads.
– Dr. Seuss

Make every word count

Kill your darlings, kill your darlings, even when it breaks your egocentric little scribbler's heart, kill your darlings.
– Stephen King

Step 3: Editing

The most important rule to good writing:

Make every word count

Maximize clarity:

- Word choice
- Logic
- Framing

Words/phrases to <u>never, ever</u> use

1. "It is"/"they are"

2. "There is"/"there are"

3. "This is"/"These are"

Thanks Mrs. Chandler!!

"It is"/"there are"

- ~~It is important to note that~~ decreasing the number of cats may increase the number of dogs

- As shown in Figure 3, ~~it is clear that~~ the mouse concentration decreases with cat concentration

- However, ~~it is possible that~~ this method could be extended to the analysis of solutions with lower CO_2 content

- Many unneeded words cut!

- Active voice → much stronger sentences

"It is"/"there are": Ambiguity

- The cat chased the mouse, since it is tasty.
- The cat chased the mouse, since it was hungry.
- The cat chased the mouse, since it was large.

- The overpotential increases with current density, since it is highly sensitive to temperature.

"There is"/"there are"

- There are many reasons why cats chase mice

- There is a high probability that a cat will eat a mouse today

- There are two types of people: those who like cats and those who like dogs

- There is a growing body of literature supporting this claim

- However, there exist very few sensing techniques that can yield meaningful information with sub-nm resolution

"This is"/"these are"

- Electric vehicles rely on lithium-ion batteries; these are critical to combating climate change

- This is an important result for the community

Ambiguity problem: add appropriate noun to increase clarity

Words/phrases to generally avoid

- Passive voice

- Redundant adverbs

- Overly complex words

- Old English

Passive voice

- The validation results are presented in Figure 4.
  Figure 4 presents the validation results.

- This relationship was investigated by Chueh et al.
  Chueh et al. investigated this relationship.

Sometimes OK

- Electrode disks were punched for coin cell assembly
  We punched electrode disks for coin cell assembly

Redundant adverbs

- This result is ~~quite~~ surprising

- This method could ~~possibly~~ extend to other fields

- This interpretation is ~~highly~~ prevalent in the literature

I ~~often~~ use generally and relatively

Unnecessary phrase: "In order to"

You can <u>always</u> replace "in order to" with "to"
You can often swap the clauses for a more effective sentence

- In order to do my taxes, I need my tax forms
- I need my tax forms to do my taxes

- In order to minimize air exposure, we prepared the samples in the glovebox
- We prepared the samples in the glovebox to minimize air exposure

Overly complex words

If you care about being thought credible and intelligent, do not use complex language where simpler language will do. My Princeton colleague Danny Oppenheimer refuted a myth prevalent among undergraduates about the vocabulary that professors find most impressive. In an article titled "Consequences of Erudite Vernacular Utilized Irrespective of Necessity: Problems with Using Long Words Needlessly," he showed that couching familiar ideas in pretentious language is taken as a sign of poor intelligence and low credibility.

– Daniel Kahneman,
Thinking, Fast and Slow

Old English

- Herein → Here
- Amongst → Among
- Thereby → Therefore
- Whereby → Where

(I like thus)
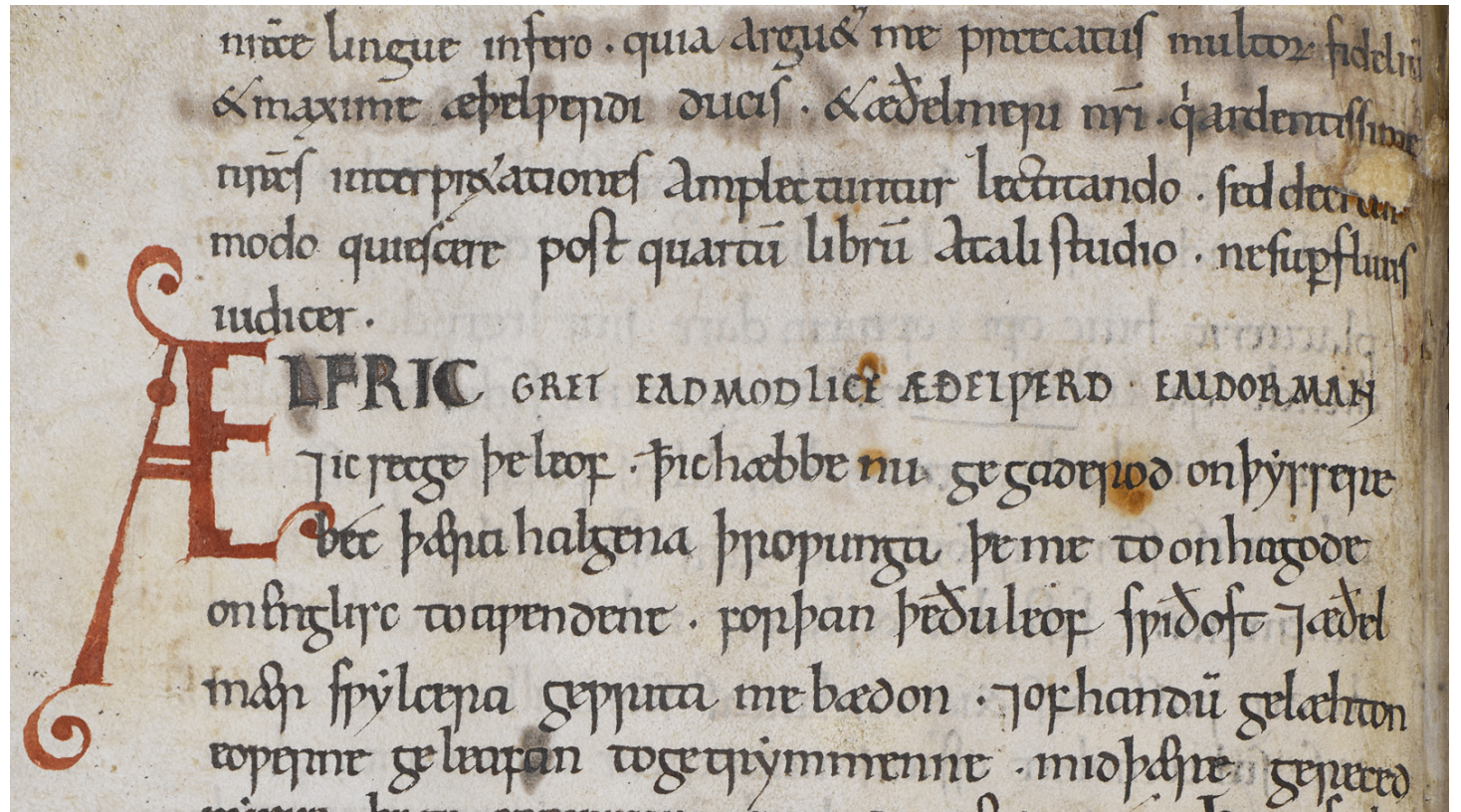
Making every word count

- Be careful with subjective wording
  - Unprecedented, paradigm shift, amazing, dramatic, interesting, remarkable
- Be careful with directionless words such as "influence"
  - Precipitation influences net primary production
  - Precipitation increases net primary production
  - A doubling of annual precipitation in arid ecosystems increases net primary production by 20%
- Be careful with "significant"

33

Making every word count

However, it is important to note that there is still some variation in measured reaction orders on LFP systems with some studies shown a non-zero reaction order when the pH is varied from neutral to alkaline[1] and others showing the same zeroth order with respect to pH, even on nominally identical materials.[2]

However, we note that previous studies on LFP systems report both zero[1] and non-zero[2] reaction orders when the pH ranges from neutral to alkaline, even on nominally identical materials.

Framing your paper

- I find that the introduction is often the hardest section to write
- High-impact journals care about **novelty** and **broader impact**
  - How is it different from previous work?
  - Why should people care?
- Comprehensive literature review required
- Will is excellent at framing
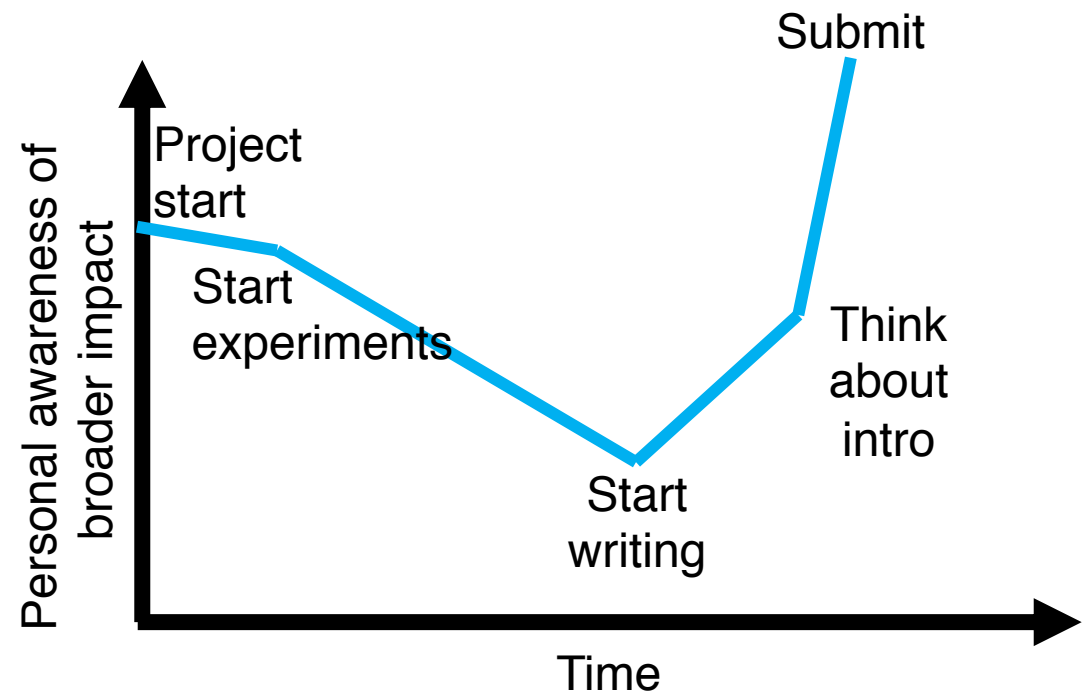
Logic flow

- Check every sentence precisely, in context

- Consider alternate meanings
  - "Potential dependence" → "Voltage dependence" or "possible dependence"?

- **Internal peer review**
  - Coauthors, Chueh group, friends, etc

Editing your paper yourself?

- "Self editing is the path to the dark side. Self editing leads to self delusion, self delusion leads to missed mistakes, missed mistakes lead to bad reviews. Bad reviews are the tools of the dark side."
— Eric T. Benoit

Final stages

- Pre-empt weaknesses
  - Don't hide them from reviewers

- **Internal peer review**
  - Coauthors, Chueh group, friends, etc
  - I acknowledge all internal peer reviewers
  - Consider authorship (CRediT)

- Journal formatting requirements (length, style, etc)

- Keep at it! May take months/50 revisions

Workflow and tools

- Use tools for **rapid iteration**
  - Writing a paper will always take longer than you think
  - "Accelerated science"

- Growing trend towards sharing data and code
  - Required for many publications
  - Improves reproducibility
  - Use open source programming languages

Workflow: Figures (data)

+ Programmatic

+ Free/open source
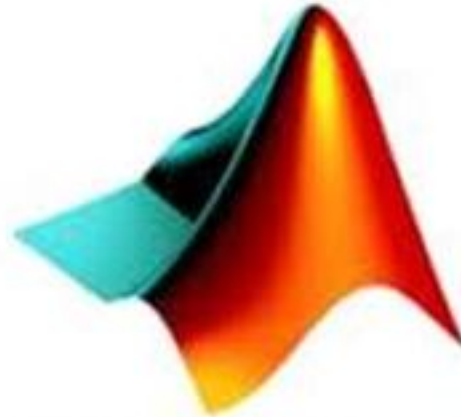
+ Programmatic
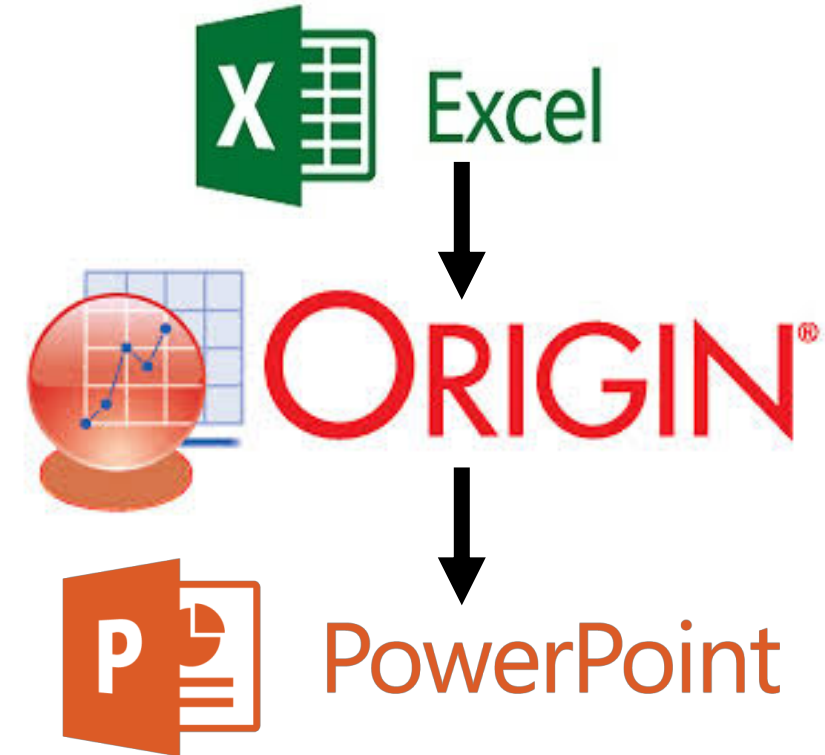
- Proprietary
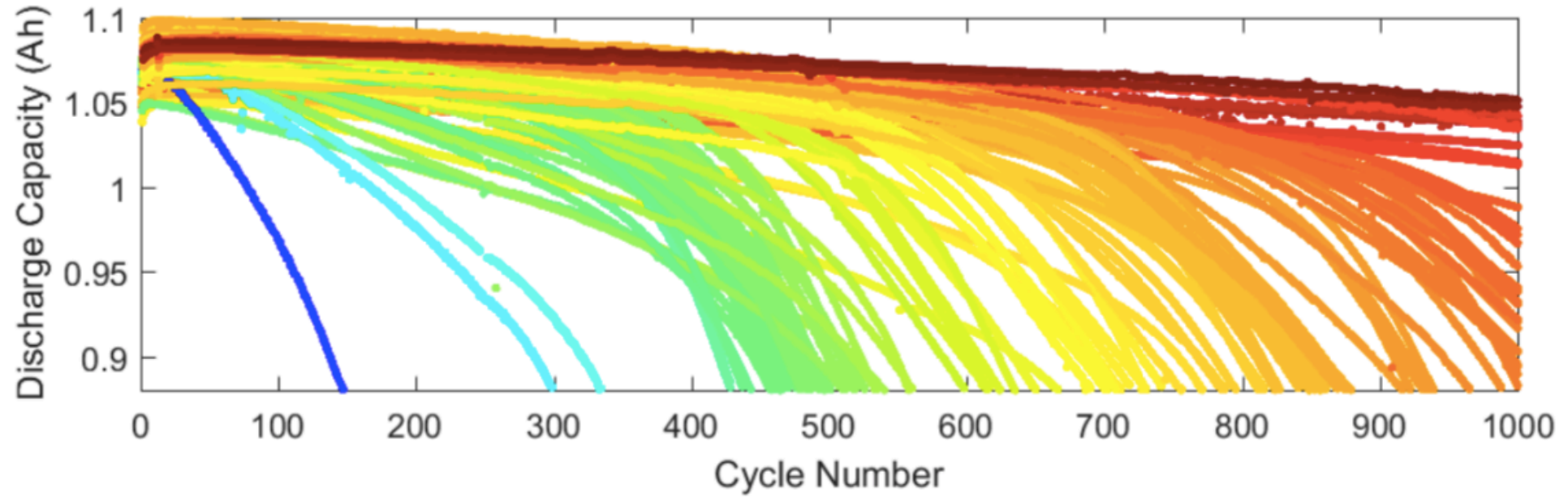
- Not programmatic

- Proprietary

Use color effectively

Before: Defaults
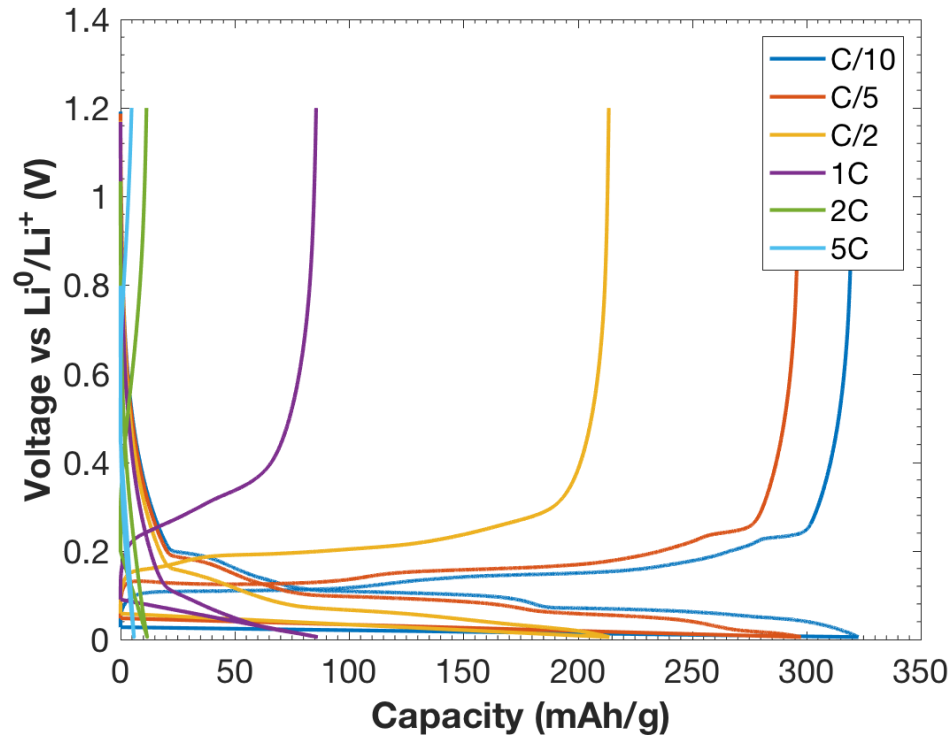
After: Color gradients

45
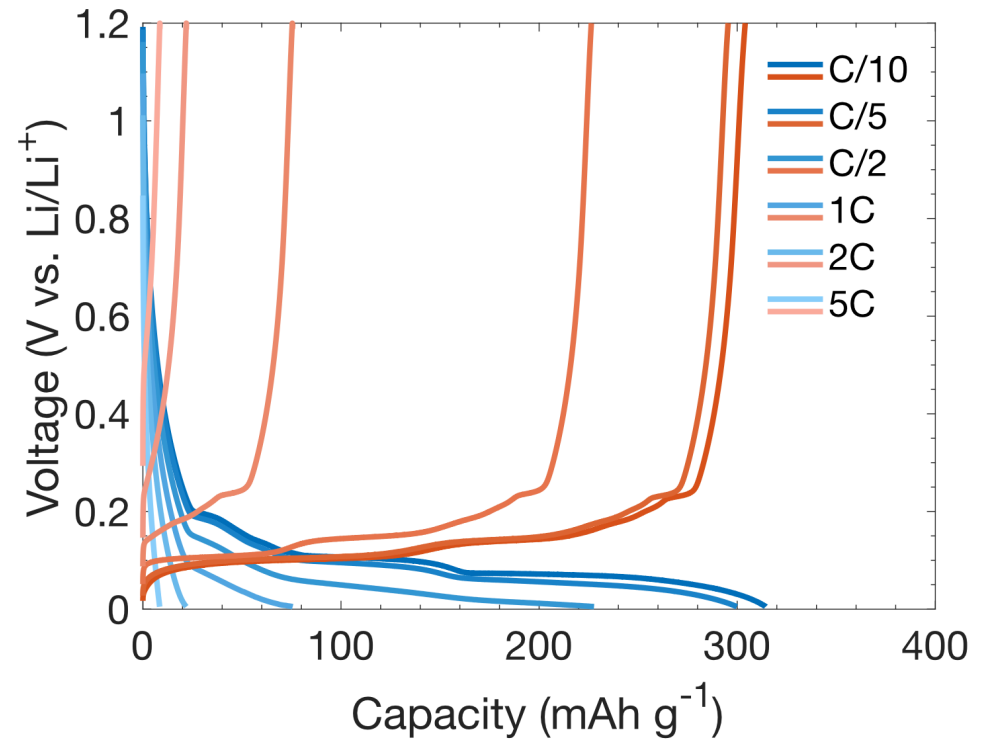
Avoid rainbow colormap

Figures
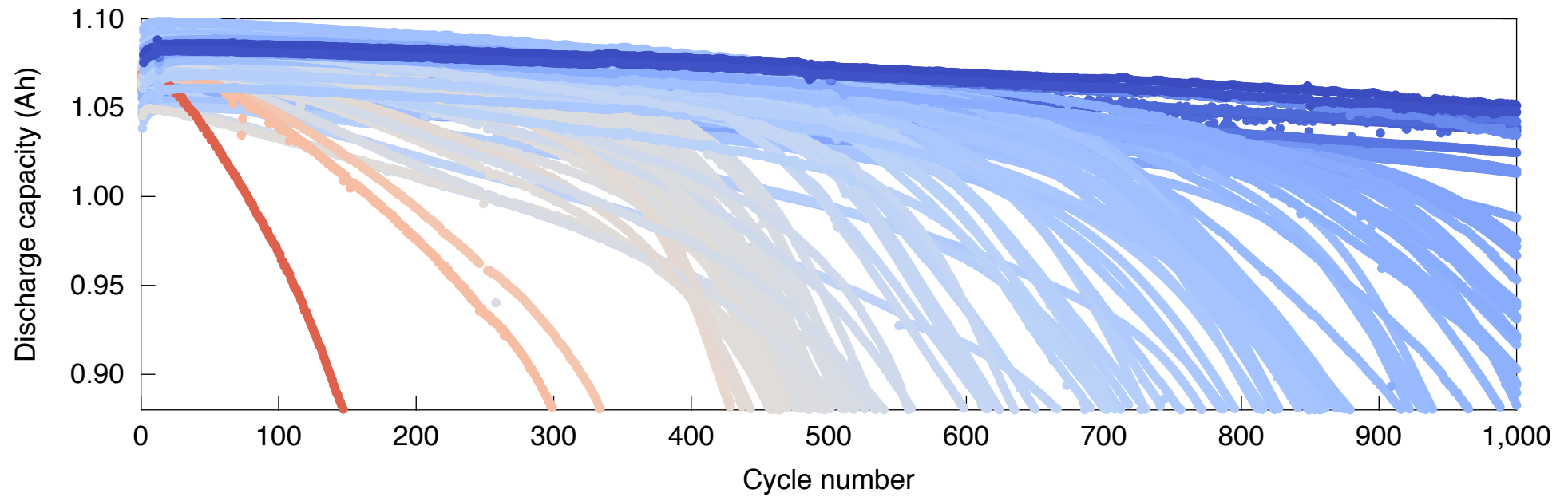
Use vector graphics

Use GitHub for version control

Example: https://github.com/petermattia/battery-parameter-spaces/tree/master/figures

7x Magnification

Vector

Bitmap
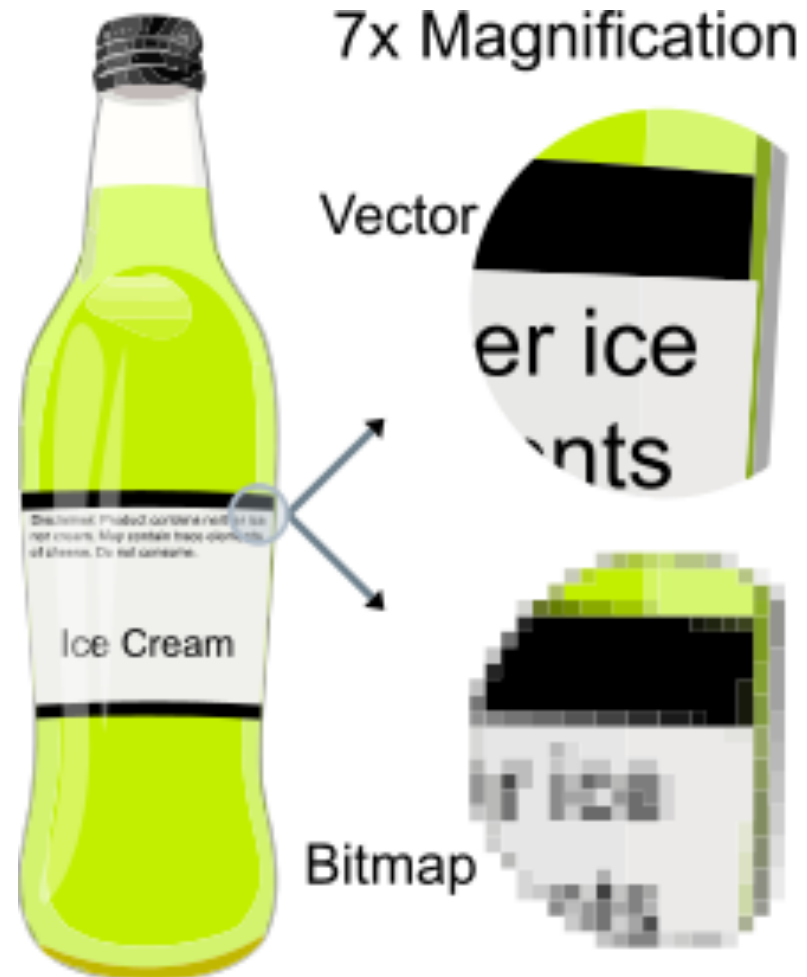
Workflow: Text

Google Docs

+ Real time editing
+ Version control
- Limited track changes

+ Track changes
- Real time editing
- Version control

DO NOT USE WORD + DROPBOX FOR CO-FIRST-AUTHOR PAPER

Name
Invitations (Frank Blome's conflicted copy 2016-11-28).xlsx
Invitations (Frank Blome's conflicted copy 2016-11-29).xlsx
Invitations (Frank Blome's conflicted copy 2016-11-30).xlsx
Invitations (Marvin Blome's conflicted copy 2016-11-29).xlsx
Invitations (Stefanie Blome's conflicted copy 2016-11-29).xlsx
Invitations (Stefanie Blome's conflicted copy 2016-11-30).xlsx
Invitations.xlsx

Citations: Zotero

+ Free/open source
+ Web importer