

How to Write & Review Papers

PRESENTER: PAUL GÖLZ (CORNELL)

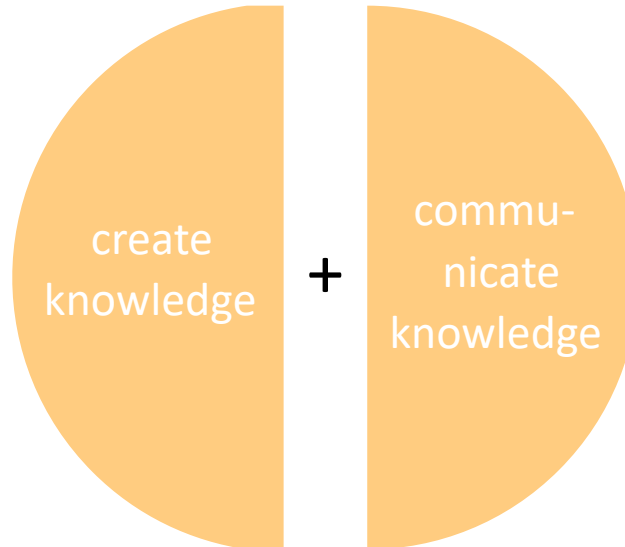
ORIGINAL SLIDES BY NICOLE IMMORLICA (MICROSOFT)
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Part 1: Writing Papers

You're a



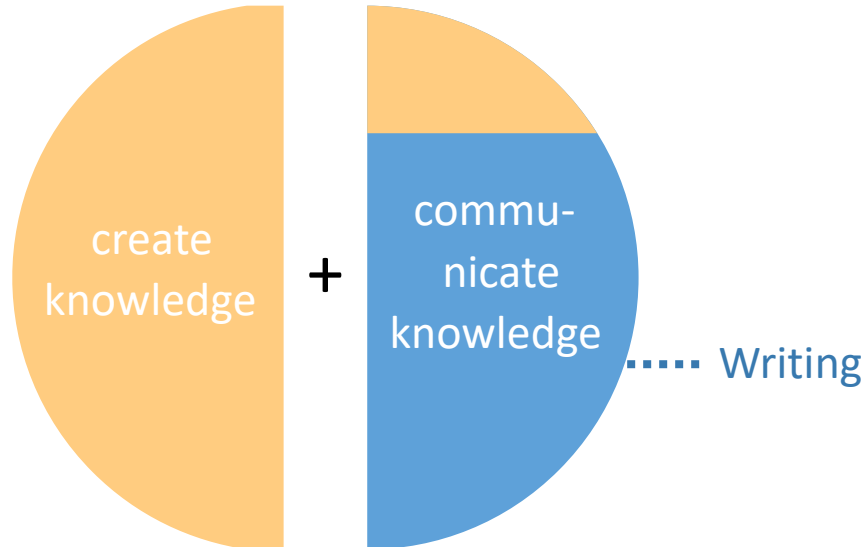
I.e., your job is to



You're a



I.e., your job is to



⇒ You are a professional writer!



Writing Objectives:

- allow the reader to reconstruct your ideas
- engage the reader
- convince them your work is awesome

Everything else is secondary!

outline.

1. **Title**: phrase indicating what you did
2. **Abstract**: concise description of what you did
3. **Introduction**: motivate and informally define problem, emphasize intuition and key contributions
4. **Related Work**: how your work fits with the literature
5. **Model**: the mathematical setting you consider
6. **Results**: statement, important/interesting proofs
7. **Conclusion**: summary, reflection on results

body

8. **Appendix**: remaining proofs, minor extensions

title.

Purpose: Briefly indicate why someone might be interested in reading your paper.

title.

Good

Bad

Descriptive (but brief)

Vague

title.

Bad:

Information Aggregation in Social Networks, Feldman, Immorlica, Lucier and Weinberg, 2014, working paper.

Good:

Reaching Consensus via non-Bayesian Asynchronous Learning in Social Networks, Feldman, Immorlica, Lucier and Weinberg, APPROX 2014.

title.

Purpose: Briefly indicate why someone might be interested in reading your paper.

Example: Why is vague bad?

- *Information Aggregation in Social Networks.*
- Is it a theory paper? Empirical study?
- No idea what makes it different from the 100,000 other papers on information aggregation in social networks.

abstract.

Purpose: Help someone understand what's in the paper (normally targeted at an expert), and whether they should read more.

Example: Should I sell the main results?

- You could state objectively **why the main result is interesting**, so an expert knows what's the point.
- You shouldn't go overboard, you have an entire introduction for that.
- E.g. "This is the first constant-factor approximation."

abstract.

Good	Bad
concise	wordy
fact-based	salesmanship
accurate	over-claiming
identifies keywords	inaccurate terminology

Pet Peeve: abstracts that are really introductions.

abstract (bad).

In a social learning setting, **members of a society share their experiences to help others make better choices.**

Following the established path can boost an individual's utility but it can hurt the society as a whole since other options of higher value may never be explored.

We show that when the population is diverse, this issue can be avoided as people may not be satisfied with the available choices and look for alternatives.

High diversity, though, comes at a cost as past experiences become less valuable.

abstract (bad).

We model these situations in a standard setting of consumer search introduced by Weitzman and study how different diversity levels compare with each other. We ... and **quantify how the socially optimal diversity level changes** Moreover, while high diversity can lead to **anarchy and confusion** in typical situations, we show that it can be **really beneficial** in settings where society may accidentally uncover a unanimously accepted **hidden gem**.

abstract (good).

We introduce a general model of bandit problems in which the expected payout of an arm is an increasing concave function of the time since it was last played. We first develop a PTAS for the underlying optimization problem of determining a reward-maximizing sequence of arm pulls. We then show how to use this PTAS in a learning setting to obtain sublinear regret.

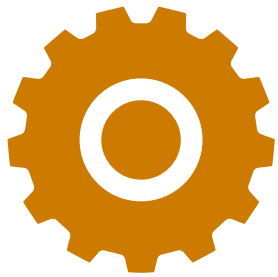
introduction.

Purpose: Serves a few purposes, tricky to balance.

- Get the reader excited to read the rest of the paper.
- Tell a skimmer what's cool about the paper.
- In both cases, focus on **why** it's cool.

Example: Should I sell the main results?

- Absolutely! Don't be afraid to tell the reader exactly why it's cool.
- (From a selfish perspective: don't be afraid to tell the *reviewer* exactly what they should state as the "main contributions" in their review).

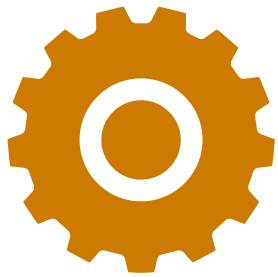


key tool: narrative

Stories are powerful way for motivating the reader.

Examples:

- X is an important setting in the real world. We model X to find out how to ...
- Theoretical results for X do not match real-world observation that ... We extend the model to incorporate important factor ...
- Overlooked possibility between known impossibilities.
- Recent breakthroughs X, Y, and Z are all proved separately. We give a unified framework.



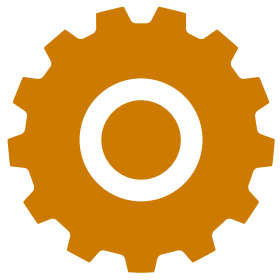
key tool: narrative

Good example (Kizilkaya & Kempe, IJCAI'22):

“... The distortion-3 conjecture was recently resolved in a breakthrough result by Gkatzelis et al. [19], using a novel voting rule called *PluralityMatching*.

One of the main drawbacks of *PluralityMatching* is that **it is unusually complex** for a voting rule ... it is not even obvious that there always exists a winner in *PluralityMatching* ... The rule is also almost certainly too technical to be understood by the general public.

Our main contribution is an extremely simple voting rule, called *PluralityVeto*, which achieves the same optimal metric distortion of 3.”



key tool: narrative

Settling on a clear narrative helps to write a convincing introduction.

What main challenge do you overcome and how?
(Important, for the entire paper!)

introduction.

Good	Bad
motivation from practice or existing literature	flimsy stories or cartoon realities
place results in context	abstracts of related work
identify take-aways and key intuition	overly-precise statement of results and techniques

Pet Peeve: Laundry lists of results with no motivation.

introduction.

Purpose: Serves a few purposes, tricky to balance.

- Get the reader excited to read the rest of the paper.
- Tell a skimmer what's cool about the paper.
- In both cases, focus on **why** it's cool.

Example: Should I overview techniques?

- **Only do so to emphasize a why.**
- Ex: “We first use a reduction of XYZ, then Chernoff bounds, then some calculus” contributes nothing.
- “The key to our approach is the recent reduction of XYZ, developed for an unrelated problem.”

introduction.

Purpose: Serves a few purposes, tricky to balance.

- Get the reader excited to read the rest of the paper.
- Tell a skimmer what's cool about the paper.
- In both cases, focus on **why** it's cool.

Example: Should I overview techniques?

- Most theory papers choose to do this. Not required.
- Helpful if there is something exciting/digestible/etc.
- Really not helpful if the reviewer can't understand it.
 - Always ask: what would a reader get from this?

Related work.

Purpose: Provide context for your work.

- Most related stuff (ideally) already covered in intro.
- Also to assign scientific credit for prior work.

related work.

Good	Bad
comprehensive	skimpy
describes connections	reads like a list
cites work from multiple fields	unaware of related literature

Pet Peeve: sections that read like a list of abstracts!

Related work.

Purpose: Provide context for your work.

- Most related stuff (ideally) already covered in intro.
- Also to assign scientific credit for prior work.

Example: How much detail should I give?

- Enough to make your point!
- Ex: “Cai and Daskalakis give a PTAS for a single unit-demand buyer with independent MHR item values, to the optimal deterministic item pricing.”
- Useful if you give a PTAS for a related problem.
- **Not** useful just because you study pricing.

Related work.

Purpose: Provide context for your work.

- Most related stuff (ideally) already covered in intro.
- Also to assign scientific credit for prior work.

Example: How much detail should I give?

- Enough to make your point!
- Ex: “Works such as [CaiD11, ...] also provide approximations in different models to ours.”
- Useful if you study unrelated pricing problem.
- **Not** enough if reviewer might reasonably wonder what your work contributes over CaiD11.

Model.

Purpose: Start being formal.

- Most intuition (ideally) already given in intro.
- Need to be precise, but also clear.

model.

Good

notation consistent
with existing norms

covers limited prelim
results/background

rigorous, yet clear

Bad

overloaded or
excessive notation

contains major theorem
statements and proofs

overly formal, or imprecise

Model.

Purpose: Start being formal.

- Most intuition (ideally) already given in intro.
- Need to be precise, but also clear.

Example: Should I give an example?

- Sure! If it serves a purpose.
- If complicated definitions, to illustrate definitions.
 - If simple, no point.
- To illustrate subtle counter-intuitive properties.
- To illustrate special case of main proof ideas.

Model.

Purpose: Start being formal.

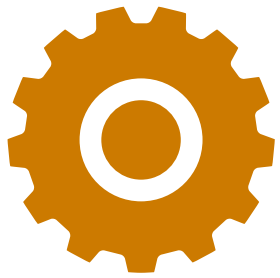
- Most intuition (ideally) already given in intro.
- Need to be precise, but also clear.

Example: Should I give an example?

- “The buyer’s utility is $v - p$. So for example, if $v = 5$ and $p = 1$, the buyer’s utility is 4.” Useless!
- “The buyer’s utility is $f(v) - g(p)$, for f, g convex. Observe that our model captures quasi-linear utilities ($v - p$) when $f(v) = v$ and $g(p) = p$. We will use this as a running example to illustrate the main ideas.” Helpful!

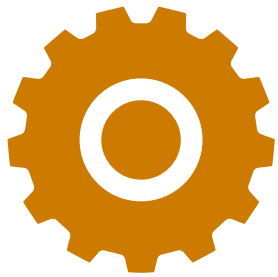
Results/Proofs.

Slides assume that results are mainly proofs, but this could also be simulations/experiments/statistics.



key tool: sign posting

- Remind a (distracted / skimming) reader of the current state.
- What are the current challenges? Which previous results inform your current approach?
- Balancing act to not be overly verbose/repetitive.



key tool: sign posting

Good example (Freeman, Shah, Vaish. EC'20):

“In the previous section, we showed that ex-ante EF and ex-post EF1 **can be achieved simultaneously in polynomial time. The obvious next question, then, is whether we can achieve stronger guarantees.** One property that our algorithms from Section 3 lack is **efficiency**. We **defined three efficiency notions in Section 2** that are related through the following logical implications:
ex-ante PO \Rightarrow ex-post fPO \Rightarrow ex-post PO.”

Results/Proofs.

Purpose: Thought experiment:

- Do I **want** the reviewer to read this?
- Yes, try to fit in body. No, put in appendix.

results.

Good

intuition in main text

interesting proofs
that build intuition

illustrative examples
instead of tedious proofs

Bad

list of theorems/proofs

boring proofs included
because they're short

long unintuitive proofs

Results/Proofs.

Purpose: Thought experiment:

- Do I **want** the reviewer to read this?
- Yes, try to fit in body. No, put in appendix.

Example: Should I include complete proofs in the body?

- Sure! If full details are engaging.
- Sure! If full details resolve an interesting subtlety.
- No, if details are tedious.

Results/Proofs.

Purpose: Thought experiment:

- Do I **want** the reviewer to read this?
- Yes, try to fit in body. No, put in appendix.

Example: Overview entire proof in body?

- Don't leave reviewer confused, but...
- If back half of proof is "hard, but unilluminating", OK to summarize in a few sentences and move on.

Results/Proofs.

Purpose: Thought experiment:

- Do I **want** the reviewer to read this?
- Yes, try to fit in body. No, put in appendix.

Example: What about a subtle proof?

- Is the subtlety engaging/illuminating, or just “hard”?
- If engaging, try to explain in body.
- If just “hard”, OK to state subtlety, but move on.

Results/Proofs.

Purpose: Thought experiment:

- Do I **want** the reviewer to read this?
- Yes, try to fit in body. No, put in appendix.

Example: Is it OK to have only 13 pages (for EC)?

- Sure! If 13 pages of exciting material, and 20 pages of calculations, break it into 13+20.
- But, 5 remaining pages are opportunity to be extra clear, overview additional connections, etc.

Results/Proofs.

Purpose: Thought experiment:

- Do I **want** the reviewer to read this?
- Yes, try to fit in body. No, put in appendix.

Guiding Principle: **The entire body should be engaging.**

If you're bored writing, reviewer will be bored reading.

Make it exciting! Or maybe it belongs in appendix.

Try to make body as effortless to follow as possible.

If ideas too complex, distill main digestible aspects.

Appendix.

Purpose: Verify details that aren't necessarily engaging.

- Yes, very few people will read the appendix, but...
- Details matter.

Style suggestions:

- Appendix should be **easy to read**.
- It does **not** need to be engaging/stellar-ly written.
- Appendix should be **easy to navigate**.

Huge pet peeve: appendices with serious errors which were obviously never proofread.

appendix.

Good

clean to follow, but
perhaps not engaging

no pointers to/from
body

Bad

unreadable

disorganized

Part 2: Reviewing Papers

impact.

You will be **judged** by the quality of your review.

People who read your review: Basically everyone you're meeting through this workshop (through the PC).

Every visibility opportunity counts! For some PC members, this may be the first time they see your name. Make a good first impression!

purpose.

Your job is not to directly decide whether to accept/reject the paper.

Your job is to give arguments/evidence/information to the PC so they can decide whether to accept/reject.

Parse remaining advice in this context.

content.

Briefly describe main results. Should contain enough context to explain why authors think its exciting.

Thought experiment: Would the authors agree?
This is not the place to disagree with authors.

Excellent: So clear that PC doesn't need re-read intro.

Bad: PC needs to read entire intro, ignore your summary.

content.

List major concerns. Is there an error in a proof, is the result a trivial generalization of existing work? (rare)

Excellent: “I might be misunderstanding something, but as stated, it seems that Theorem 2 is false. Here is a sketch of a counterexample. Is it possible that the authors meant to place additional assumptions?”

Point: You may be about to kill the paper. If it needs to be done, it needs to be done. But be thoughtful.

content.

List major concerns. Is there an error in a proof, is the result a trivial generalization of existing work? (rare)

Bad: “Theorem 2 is false, integral might diverge.”
(Often resolved by: “It is easy to verify that if integral diverges, results still hold with notational updates.”).

Point: Totally valid minor concern to be rigorous with divergence (and this should be raised). But don't kill papers for oversights which can be easily resolved.

content.

Form subjective evaluation. Quality of results, general interest in techniques, quality of presentation.

This is the time to disagree with the authors!

Results: (In your opinion)

- What makes the results significant (or not)?
- Is there any context that the PC needs to appreciate?

content.

Form subjective evaluation. Quality of results, general interest in techniques, quality of presentation.

This is the time to disagree with the authors!

Results: Rough scale to have in mind:

- So strong it doesn't matter how it's proved.
- Strong.
- Motivated enough if the techniques are awesome.
- Extremely specialized or toy.

content.

Form subjective evaluation. Quality of results, general interest in techniques, quality of presentation.

This is the time to disagree with the authors!

Techniques: (In your opinion)

- Will they help you/others solve problems?
- Did you find them engaging/illuminating?
- **Don't ask:** "How much hard work?"
- Trivial proofs are bad because aren't engaging, don't help others, **not** because they're not hard enough.
- But simple, engaging, thoughtful proofs are great!

content.

Form subjective evaluation. Quality of results, general interest in techniques, quality of presentation.

This is the time to disagree with the authors!

Techniques: Rough scale to have in mind:

- Super interesting, loved reading it even if results meh.
- A strength.
- Enjoyed reading, but not a strength.
- Trivial or entirely (hard but) tedious calculations.

content.

Form subjective evaluation. Quality of results, general interest in techniques, quality of presentation.

This is the time to disagree with the authors!

Presentation: (In your opinion)

- Did the body back up the sale of the intro?
- Was it a pleasure to read?
- Do you understand everything you want to?
- Do you understand what the authors want you to?

content.

Form subjective evaluation. Quality of results, general interest in techniques, quality of presentation.

This is the time to disagree with the authors!

Presentation: Rough scale to have in mind

- Truly a pleasure to read. (could help tie-break).
- Fine.
- I was truly miserable reading. (could kill paper).

content.

Briefly describe main results. Should contain enough context to explain why authors think its exciting.

List major concerns. Is there an error in a proof, is the result a trivial generalization of existing work? (rare)

Form subjective evaluation. Quality of results, general interest in techniques, quality of presentation.

Recommendation: Accept? Enjoy it? **Why or why not?**