

Wrapup: Research Papers and Process

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<http://www.cs.ubc.ca/~tmm/courses/547-17F>

Today

- writing infovis papers: pitfalls to avoid
 - **Process and Pitfalls in Writing Information Visualization Research Papers.**
Tamara Munzner. In: Information Visualization: Human-Centered Issues and Perspectives.
Andreas Kerren, John T. Stasko, Jean-Daniel Fekete, Chris North, eds.
Springer LNCS Volume 4950, p 134-153, 2008.
- other research pitfalls and process
 - review reading, review writing, conference talks
- final papers and final presentations
 - course paper vs research paper expectations
- reproducible and replicable research
- other course pitch: Rensink

Process & Pitfalls for InfoVis Papers

Idiom pitfalls

- **Unjustified Visual Encoding**
 - should justify why visual encoding design choices appropriate for problem
 - prerequisite: clear statement of problem and encoding!
- **Hammer In Search of Nail**
 - should characterize capabilities of new technique if proposed in paper
- **Color Cacophony**
 - avoid blatant disregard for basic color perception issues
 - huge areas of highly saturated color
 - categorical color coding for 15+ category levels
 - red/green without luminance differences
 - encoding 3 separate attributes with RGB
- **Rainbows Just Like In The Sky**
 - avoid hue for ordered attribs, perceptual nonlinearity along rainbow gradient

Later pitfalls: Strategy

- **What I Did Over My Summer Vacation**
 - don't focus on effort rather than contribution
 - don't be too low level, it's not a manual
- **Least Publishable Unit**
 - avoid tiny increment beyond (your own) previous work
 - bonus points: new name for old technique
- **Dense As Plutonium**
 - don't cram in so much content that can't explain why/what/how
 - fails reproducibility test
- **Bad Slice and Dice**
 - two papers split up wrong
 - neither is standalone, yet both repeat

Later pitfalls: Tactics

- **Stealth Contributions**

- don't leave them implicit, it's your job to tell reader explicitly!
- consider carefully, often different from original project goals

Contributions in research papers

- what are your research contributions?
 - what can we do that wasn't possible before?
 - how can we do something better than before?
 - what do we know that was unknown or unclear before?
- determines everything
 - from high-level message to which details worth including
- often not obvious
 - diverged from original goals, in retrospect
- state them explicitly and clearly in the introduction
 - don't hope reviewer or reader will fill them in for you
 - don't leave unsaid should be obvious after close reading of previous work
 - goal is clarity, not overselling (limitations typically later, in discussion section)

Later pitfalls: Tactics

- **Stealth Contributions**
 - don't leave them implicit, it's your job to tell reader explicitly!
 - consider carefully, often different from original project goals
- **I Am So Unique**
 - don't ignore previous work
 - both on similar problems and with similar solutions
- **Enumeration Without Justification**
 - “X did Y” not enough
 - must say why previous work doesn't solve your problem
 - what limitations of their does your approach fix?
- **I Am Utterly Perfect**
 - no you're not; discussion of limitations makes paper stronger!

Later pitfalls: Results

- **Unfettered By Time**
 - choose level of detail for performance numbers
 - detailed graphs for technique papers, high-level for design & eval papers
- **Straw Man Comparison**
 - compare appropriately against state-of-the-art algorithms
 - head-to-head hardware is best (re-run benchmarks yourself, all on same machine)
- **Tiny Toy Datasets**
 - compare against state-of-the-art dataset sizes for technique (small ok for eval)
- **But My Friends Liked It**
 - asking labmates not convincing if target audience is domain experts
- **Unjustified Tasks**
 - use ecologically valid user study tasks: convincing abstraction of real-world use

Final pitfalls: Style

- **Deadly Detail Dump**
 - explain *how* only *after what* and *why*; provide high-level framing before low-level detail
- **Story-Free Captions**
 - optimize for flip-through-pictures skimming
- **My Picture Speaks For Itself**
 - explicitly walk them through images with discussion
- **Grammar Is Optional**
 - good low-level flow is necessary (but not sufficient), native speaker check good if ESL
- **Mistakes Were Made**
 - don't use passive voice, leaves ambiguity about actor
 - your research contribution or done by others?

Final pitfalls: Style 2

- Jargon Attack
 - avoid where you can, define on first use
 - all acronyms should be defined
- Nonspecific Use Of Large
 - quantify! hundreds? 10K? 100K? millions? billions?...

Final pitfalls: Submission

- **Slimy Simultaneous Submission**
 - often detected when same reviewer for both
 - instant dual rejection, often multi-conference blacklist
- **Resubmit Unchanged**
 - respond to previous reviews: often get reviewer overlap, irritated if ignored

Generality

- encoding: visualization specific
- strategy: all research
- tactics: all research
- results: visualization specific
- style: all research, except
 - Story-Free Captions, My Picture Speaks For Itself

Research Process & Pitfalls

Review reading pitfalls

- Reviewers Were Idiots
 - rare: insufficient background to judge worth
 - if reviewer didn't get your point, many readers won't
 - your job: rewrite so clearly that nobody can misunderstand
- Reviewers Were Threatened By My Brilliance
 - seldom: unduly harsh since intimately familiar with area
- I Just Know Person X Wrote This Review
 - sometimes true, sometimes false
 - don't get fixated, try not to take it personally
- It's The Writing Not The Work
 - sometimes true: bad writing can doom good work (good writing may save borderline)
 - sometimes false: weak work common! reinvent the wheel worse than previous one

Review writing pitfalls

- **Uncalibrated Dismay**
 - remember you've only read the best of the best!
 - most new reviewers are overly harsh
- **It's Been Done, Full Stop**
 - you must say who did it in which paper, full citation is best
- **You Didn't Cite Me**
 - stop and think whether it's appropriate
 - be calm, not petulant
- **You Didn't Channel Me**
 - don't compare against paper you would have written
 - review the paper they submitted

Conference talk pitfalls

- **Results As Dessert**
 - don't save until the end as a reward for the stalwart!
 - showcase early to motivate
- **A Thousand Words, No Pictures**
 - aggressively replace words with illustrations
 - most slides should have a picture
- **Full Coverage Or Bust**
 - cannot fit all details from paper
 - communicate big picture
 - talk as advertising: convince them it's worth their time to read paper!

Paper writing process suggestions

- pre-paper talk
 - write and give talk first, as if presenting at conference
 - iterate on talk slides to get structure, ordering, arguments right
 - then create paper outline from final draft of slides
 - encourages concise explanations of critical ideas, creation of key diagrams
 - avoids wordsmithing digressions and ratholes
 - easier to cut slides than prose you agonized over
- pre-paper/practice talk feedback session: at least 2-3x talk length
 - global comments, then slide by slide detailed discussion
 - nurture culture of internal critique (build your own critique group if necessary)
- have non-authors read paper before submitting
 - internal review can catch many problems
 - ideally group feedback session as above

Final Papers & Presentations

Final reports

- PDF, use InfoVis templates http://junctionpublishing.org/vgtc/Tasks/camera_tvccg.html
- no length cap: illustrate freely with screenshots!
 - design study / technique: aim for at least 6-8 pages
 - analysis / survey: aim for at least 15-20 pages
- ok to re-use text from proposal, interim writeup
- encourage looking at my writing correctness and style guidelines
 - <http://www.cs.ubc.ca/~tmm/writing.html>
- strongly encourage looking at previous examples
 - www.cs.ubc.ca/~tmm/courses/547-17F/projectdesc.html#examp
 - Example Past Projects
 - browse 2015, 2014, ... reports

Course requirements vs research paper standards

- research novelty **not** required
- mid-level discussion of implementation **is** required
 - part of my judgement is about how much work you did
 - high level: what toolkits etc did you use
 - medium level: what pre-existing features did you use/adapt
 - low level **not** required: manual of how to use, data structure details
- design justification **is** required
 - (unless analysis/survey project)
 - different in flavour between design study projects and technique projects
 - technique explanation alone is not enough
- publication-level validation **not** required
 - user studies, extensive computational benchmarks, utility to target audience

Report structure: General

- low level: necessary but not sufficient
 - correct grammar/spelling
 - sentence flow
- medium level: order of explanations
 - build up ideas
- high through low level: why/what before how
 - paper level
 - motivation: why should I care
 - overview: what did you do
 - details: how did you do it
 - section level
 - overview then details
 - sometimes subsection or paragraph level

Sample outlines: Design study

- www.cs.ubc.ca/~tmm/courses/547-17F/projectdesc.html#examp
- abstract
 - concise summary of your project
 - do not include citations
- introduction
 - give big picture, establish scope, some background material might be appropriate
- related work
 - include both work aimed at similar problems and similar solutions
 - no requirement for research novelty, but still frame how your work relates to it
 - cover both academic and relevant non-academic work
 - you might reorder to have this section later

Sample outlines: Design study II

- data and task abstractions
 - analyze your domain problem according to book framework (what/why)
 - include both domain-language descriptions and abstract versions
 - could split into data vs task, then domain vs abstract - or vice versa!
 - typically data first then task, so that can refer to data abstr within task abstr
- solution
 - describe your solution idiom (visual encoding and interaction)
 - analyze it according to book framework (how)
 - justify your design choices with respect to alternatives
 - if significant algorithm work, discuss algorithm and data structures

Sample outlines: Design study III

- **implementation**

- medium-level implementation description

- specifics of what you wrote vs what existing libraries/toolkits/components do

- breakdown of who did what work

- **results**

- include scenarios of use illustrated with multiple screenshots of your software

- walk reader through how your interface succeeds (or falls short) of solving intended problem
- report on evaluation you did (eg deployment to target users, computational benchmarks)
- screenshots should be png (lossless compression) not jpg (lossy compression)!

- **discussion and future work**

- reflect on your approach: strengths, weaknesses, limitations

- lessons learned: what do you know now that you didn't when you started?

- future work: what would you do if you had more time?

Sample outlines: Design study IV

- conclusions
 - summarize what you've done
 - different than abstract since reader has seen all the details
- bibliography
 - make sure to use real references for work that's been published academically
 - not just URL
 - check arxiv papers, many have forward link to final publication venue - use that too!
 - be consistent! most online sources require cleanup including IEEE/ACM DLs
 - do pay attention to my instructions for checking reference consistency
 - <http://www.cs.ubc.ca/~tmm/writing.html#refs>

Sample outlines: Technique (diffs)

- *Abstract, Introduction (same as above)*
- Related Work
 - big focus on similar solutions, some discussion of similar problems (same task/data combo)
- Data and Task Abstractions
 - much shorter than the corresponding one for design studies, framing context not core contrib
- Solution
 - describing proposed idiom exactly, not justifying its use for particular domain problem
 - as above, analyze in terms of design choices, justify why appropriate vs alternatives
- *Implementation (same as above)*
- Results
 - less emphasis on scenarios with particular target users
 - more emphasis on characterizing the breadth of possible uses
 - still definitely include screenshots of the system in action
- *Discussion / Future Work, Conclusions, Bibliography (same as above)*

Sample outlines: Survey (diffs)

- *Abstract (same as above)*
- **Introduction**
 - discuss the scope of what you're covering, why it's interesting/reasonable partition compared to visualization as a whole
- **Related Work**
 - **only** previous surveys
 - focus on how your work is similar to or different from them, especially wrt coverage
- **Main**
 - break up into sections based on your own synthesis of themes of work covered
 - you might want a Background section at the start if domain-focused survey
 - where there's important vocabulary/ideas to establish before diving into main discussion
 - analyze visualizations proposed in these papers in terms of what/why/how framework
 - include images from papers
- *Discussion / Future Work, Conclusions, Bibliography (same as above)*

Sample outlines: Other types

- see page for implementation & analysis project types
 - implementation, analysis

www.cs.ubc.ca/~tmm/courses/547-17F/projectdesc.html#outlines
- interactive explanations: meet with me in advance to discuss

Report marking

- required: at least material I've listed
 - you may include more material, you may choose alternate orderings
- probable marking scheme (may change!)
 - design study & technique: 12.5% each for
 - intro, related work, abstractions, solution, implementation, results, discussion, style
 - style: 10% main, 2.5% bibliography
 - survey: intro (10%), relwork (10%), main (60%), style (20%)
 - analysis: intro/domain (8%), abstr (8%), relwork (8%), analysis (52%), methods/tools (8%), discussion (8%), style (8%)
- reminder: project content is 60% of entire project mark
 - report is 25%, presentation is 15%

Code / Video

- required: submit your code
 - so I can see what you've done, but I will not post
 - include README file at root with brief roadmap/overview of organization
 - which parts are your code vs libraries
 - how to compile and run
 - I do not necessarily expect your code compiles on my machine
- encouraged but not required
 - submit live demo URL
 - open-source your code (if so, fine to just send me that URL)
 - submit supporting video
 - with or without voiceover
 - very nice to have later, software bitrot makes demos not last forever!
 - can be same or different from what you show in final presentation

Showcase image

- new this year: showcase image for projects page
 - 300x300 image
 - call it showcase.png or showcase.jpg

Logistics

- **Assignments: Final Presentations on Canvas**
 - upload due Tue Dec 12 6pm
- **Assignments: Final Report on Canvas**
 - upload due Fri Dec 15 11:59pm
 - required & posted: report, showcase image
 - required but not posted: code including README
 - encouraged: live demo URL, video

Final presentations

- **context**
 - CS department will be invited, also feel free to invite others
 - refreshments will be served, short breaks every hour (or so)
 - order: alphabetical by last name
- **code freeze**
 - no additional work on project after presentation deadline
 - additional three days to get it all written down coherently for final report

Final presentations: Tue Dec 15 1-5 FSC 2300A

- length
 - 15 min per team presentations, plus 1-2 min questions, 7 teams
 - 12 min per individual project presentations, plus 1-2 min questions, 2 people
- session structure
 - order alphabetical by first name, as on project page
 - 2 breaks, between each set of 3 presentations
 - in theory end by 4pm, reserve buffer of 1 hour extra since we often run over
 - dept invited, friends welcome, refreshments served
- presentation structure
 - slides required
 - demo or video encouraged
 - if plan is for demo, screenshots and/or video for backup strongly encouraged
 - but do practice, demos eat up time!
 - should be standalone
 - don't assume audience has read proposal or updates (or remembers your pitch)
- slide upload
 - post your slides by 6pm if using your laptops (best), or by 11am if using mine
 - upload to Canvas Assignments: Final Presentations

Final presentations marking

- last year's template
 - Intro/Framing:
 - Main:
 - Limitations/Critique/Lessons:
 - Slides:
 - Style:
 - Demo/Video:
 - Timing:
 - Question Handling:

Marking: Course overall

- 50% Project, summative assessment at end
 - 15% Final Presentation
 - 25% Final Report
 - 60% Content
 - (penalty to 20% for missed Milestones, pass/fail)
 - pitch, proposal, peer review 1, peer review 2
- 20% Presentations
 - 75% Content:
 - Summary 50%, Analysis 25%, Critique 25%
 - 25% Delivery:
 - Presentation Style 50%, Slide Quality 50%
- 30% Participation
 - 60% Written Questions
 - 6 weeks, 10% each
 - 40% In-Class Discussion & Group Work (pass/fail)
 - 4 weeks, 10% each
- marking by buckets
 - great 100%
 - good 89%
 - ok 78%
 - poor 67%
 - zero 0%

Come talk!

- encourage meeting with me to get advice/feedback before final present
 - chance to get feedback while you can still act on it
 - optional, not mandatory
 - do send email to schedule, can't meet with all 10 teams in last few days!

Reproducible and Replicable Research

Reproducible research

- 5: 15 minutes with free tools
- 4: 15 minutes with proprietary tools
- 3: considerable effort
- 2: extreme effort
- 1: cannot seem to be reproduced
- 0: cannot be reproduced

*[Vandewalle, Kovacevic and Vetterli.
Reproducible Research in Signal Processing - What, why, and how.
IEEE Signal Processing Magazine, 26(3):37-47, May 2009.]*

Why bother with reproducibility

- moral high ground
 - for Science!
- enlightened self-interest
 - make your own life easier
 - you'll be cited more often by academics
 - your work is more likely to be used by industry

Reproducibility: Levels to consider

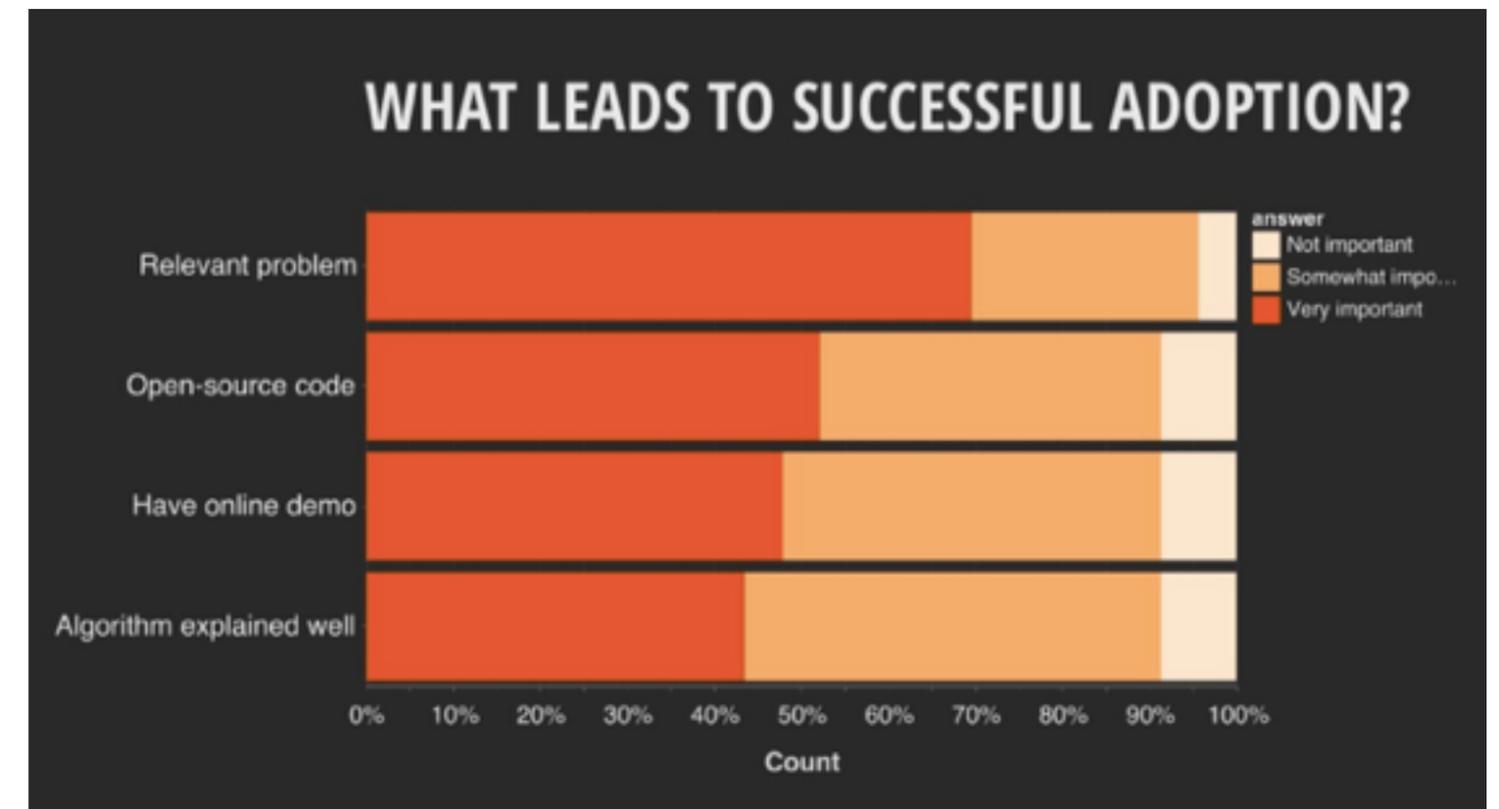
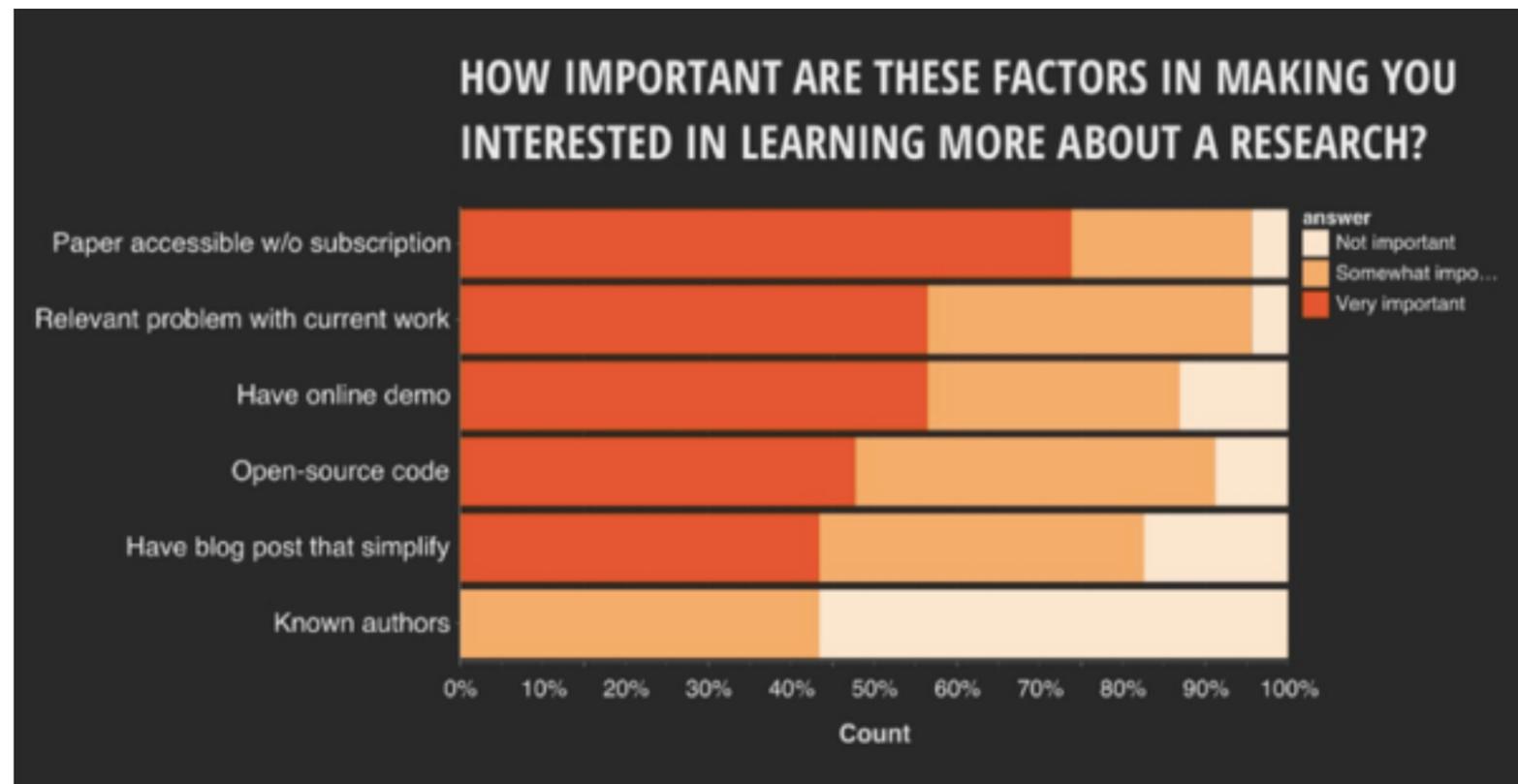
- paper
 - post it online
 - make sure it stays accessible when you move on to new place
- algorithm
 - well documented in paper itself
 - document further with supplemental materials
- code
 - make available as open source
 - pick right spot on continuum of effort involved, from minimal to massive
 - just put it up warts and all, minimal documentation
 - well documented and tested
 - build a whole community

Reproducibility: Levels to consider, cont.

- data
 - make available
 - technique/algorithm: data used by system
 - tricky issue in visualization: data might not be yours to release!
 - evaluation: user study results
 - ethics approval possible if PII sanitized, typically needs advance planning
- parameters
 - how exactly to regenerate/produce figures, tables
 - example: <http://www.cs.utah.edu/~gk/papers/vis03/>

View from industry

- Increasing the Impact of Visualization Research panel, VIS 2017
 - Krist Wongsuphasawat, Data Visualization Scientist, Twitter



<https://www.slideshare.net/kristw/increasing-the-impact-of-visualization-research>

Replication: crisis in psychology, medicine, etc

- early rumblings left me with (ignorable) qualms
 - papers: Is most published research false?, Storks Deliver Babies ($p = 0.008$), The Earth is spherical ($p < 0.05$), False-Positive Psychology
- groundswell of change for what methods are considered legitimate
 - out
 - p-hacking / p-value fishing / data dredging
 - Hypothesizing After Results are Known (HARKing)
 - in
 - replication
 - pre-registration
 - brouhaha with bimodal responses
 - some people doubling down and defending previous work
 - many willing to repudiate (their own) earlier styles of working

Remarkable introspection on methods

- thoughtful willingness to change standards of field
 - Andrew Gelman's commentary on the Susan Fiske article
 - <http://andrewgelman.com/2016/09/21/what-has-happened-down-here-is-the-winds-have-changed/>
 - Simone Vazier's entire Sometimes I'm Wrong blog
 - <http://sometimesimwrong.typepad.com/>
 - especially posts on topic Scientific Integrity
 - Joe Simmons Data Colada blog post What I Want Our Field to Prioritize
 - <http://datacolada.org/53/>
 - Dana Carvey's brave statement on her previous power pose work
 - http://faculty.haas.berkeley.edu/dana_carney/pdf_My%20position%20on%20power%20poses.pdf

When and how will this storm hit visualization?

- they're ahead of us
 - they have some paper retractions
 - we don't (yet) have any retractions for methodological considerations
 - they agonize about difficulty of getting failure-to-replicate papers accepted
 - we hardly ever even try to do such work
 - they are a much older field
 - we're younger: might our power hierarchies thus be less entrenched??...
 - they are higher profile
 - we don't have vis research results appear regularly in major newspapers/magazines
 - they have rich fabric of blogs as major drivers of discussion
 - crosscutting traditional power hierarchies
 - we have far fewer active bloggers
- replication crisis will be focus of BELIV 2018 workshop at IEEE VIS
 - evaluation and BEyond - methodoLogical approaches for Visualization
 - <http://beliv.cs.univie.ac.at/>

Terrain of blog critiques

- meta: methods for methodological critique
 - Uri Simonsohn post Mentsplaining: Three Ideas for Civil Criticism
 - <http://datacolada.org/52>
 - don't label, describe
 - don't infer motives
 - reach out: contacting authors whose work you discuss before making things public
 - as a heuristic check on tone, imagine going to dinner with authors and their parents that night
- resonates with my own first foray into blog critique
 - <https://tamaramunzner.wordpress.com/2016/01/16/on-the-memorability-debate/>
 - tone check advice is spot on
 - I **did** go out to dinner with Stephen Few the night I wrote my blog posts!
 - leading me to pick my tone with suitable care
 - I did not reach out, but now I think it would be wise indeed

Other Courses

Visualization course in Psych

- Ron Rensink course
Special Topics in Perception: Visual Display Design
- <http://www2.psych.ubc.ca/~rensink/courses/psyc579/>