RYERSON UNIVERSITY

Research Methods

Evaluating Research

Department of Computer Science

Faculty of Science

Topics

- Defining Research Success
- Evaluating Researchers
- Evaluating Research
- The Peer Review Process
- The Ugly Side of Peer Review

How do we Define Research Success?

- Many different ways
  - We learn something new we did not know
  - Something improves
  - Something is explained
  - More peer-reviewed papers are created
  - Patents are filed
  - Grants become larger and more abundant

How do we evaluate a researcher?

- Sometimes called "The Excellence of the Researcher"
- Look for success in the past
  - Number Grants awarded and values
  - Number and type of scholarly awards
  - Number of patents
  - Number of supervisions (graduate and post-doc)
  - **Publication counts**
  - **Citation counts**
  - **Various mathematically derived impact indicators**
- Look for success in the future
  - Peer Review

Evaluating Research

- Primary form in which research proposals and results are disseminated in Computer Science
- Proposals
  - Permission and $$$
- Conference papers (shorter)
  - Faster means of dissemination of a quickly changing field
- Journal papers (longer)
  - Often the complete version of a conference paper
  - May come out several years after the conference paper

Peer Review

- Weak definition
  - Review of research by equals
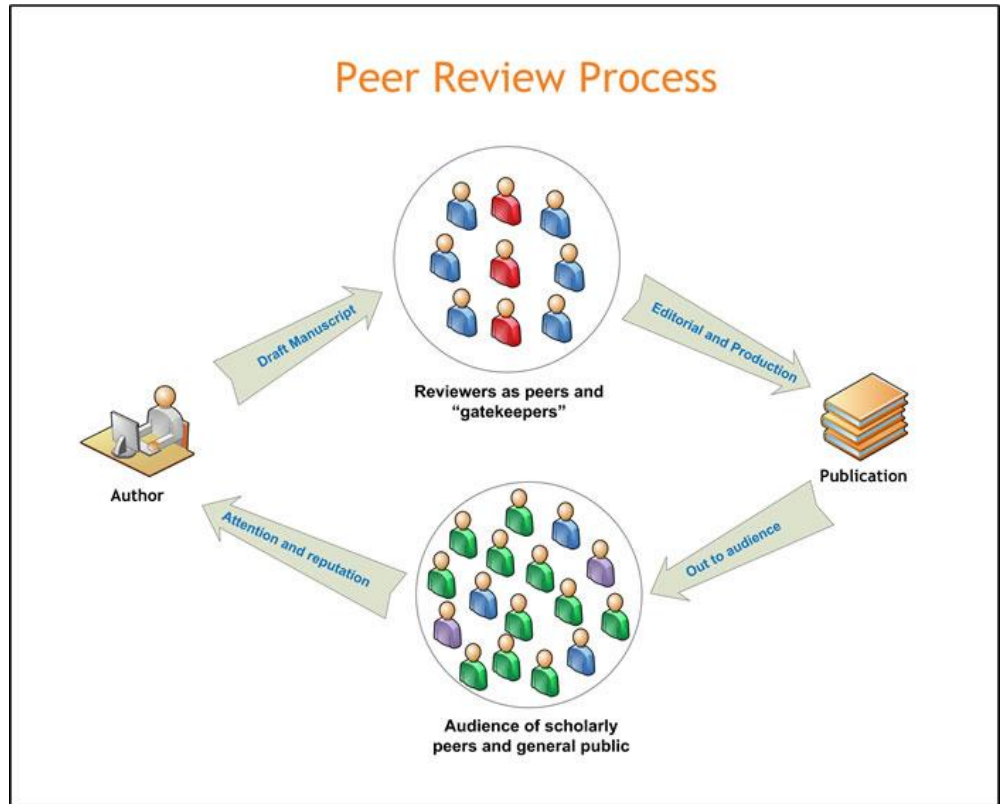   - Self-regulating

Image from blog.historians.org

Peer Review

- Peer review is the gold standard of the evaluation process

- Problems
  - Who is a peer?
  - Slow
  - Expensive
  - Inconsistent

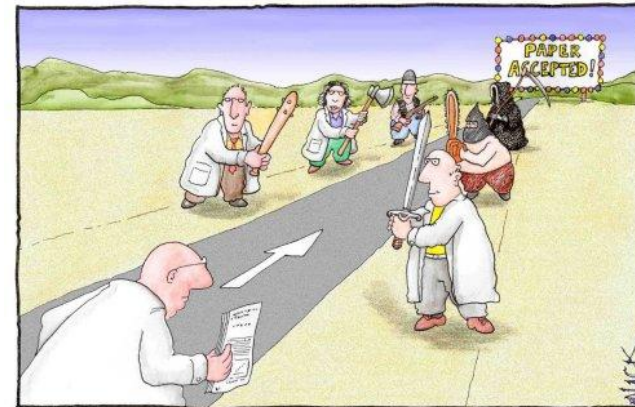> **Reviewer A:** `I found this paper an extremely muddled paper with a large number of deficits'
> **Reviewer B:** `It is written in a clear style and would be understood by any reader'.
> J R Soc Med 2006;99:178–182

- An excellent resource is provided by ELSEVIER at:
  - http://www.elsevier.com/reviewers/reviewer-guidelines#Conducting-the-Review

"Relax, Dr. Adams, this is only a peer review from two Noble laureates."

Single Blind Review

- Names of the reviewers hidden from the author
  - most common type
- **Advantage:**
  - impartial decisions free from influence by the author.
- **Disadvantages:**
  - robbery: reviewers working in the same field may withhold submission of the review in order to delay publication--reviewer can publish first.
  - cruelty: Reviewers may be unnecessarily critical or harsh when commenting on the author's work.
  - incompetence: The reviewer may not be competent.

Most scientists regarded the new streamlined peer-review process as 'quite an improvement.'

Double Blind Review

- Both the reviewer and the author remain anonymous

- **Advantages:**
  - Author anonymity prevents reviewer bias
    - Eg. previous controversial work, fame of author

- **Disadvantage:**
  - In practice, hard to make it "blind"
    - 'niche' areas. Reviewers identify the author through the paper's style, subject matter or self-citation.

Open Review

- Reviewer and author are known to each other

- **Advantages**:
  - prevent malicious comments,
  - stop plagiarism
  - prevent reviewers from "soap boxing"
  - encourage open, honest reviewing.

- **Disadvantage:**
  - politeness or fear of retribution may cause a reviewer to withhold or reduce criticism.
    - junior reviewers may hesitate to criticize more esteemed authors for fear of damaging their prospects.
      - Independent studies tend to support this.

Reviewer Theory

- Understand the problem being addressed
  - Eg. Determine the longevity of a network, sorting a list, simulating a process, rendering an image
- Understand the proposed solution
  - How will/has the problem be/been addressed
- Understand competing approaches/designs
  - A literature review of some sort is part of most papers/proposals.
  - This may not be sufficient
- Evaluate the paper/proposal based on
  1. Merit
  2. Completeness
  3. Contributions

1) Merit

- Is this original work?
- Is this work sufficiently novel and interesting to warrant publication/ examination?
- Does it add to the "canon" of knowledge?
- Is the research question an important one?

2) Completeness: The beginning

- Are paper norms being followed?
  - abstract, introduction, methodology, results, conclusions

- Title
  - Does the title relate to the content?

- Introduction:
  - Describes what the author hoped to achieve accurately?
  - Clearly states the problem being investigated?
  - Relevant other research summarized (mini-lit review)?
  - Hypothesis(es) and experiments revealed?

Beginning
Middle
& End

2) Completeness: The Middle

- Methodology:
  - Does the author accurately explain how the data was collected?
  - Is the design suitable for answering the question posed?
  - Is there sufficient information present for someone to replicate the research?
  - Does the article identify the procedures followed?
  - Are these ordered in a meaningful way?
  - If the methods are new, are they explained in detail?
  - Was the sampling appropriate?
  - Have the equipment and materials been adequately described?
  - Does the article make it clear what type of data was recorded;
  - has the author been precise in describing measurements?

Beginning
Middle
& **End**

3) Completeness: The End

- Results:
  - What was/will be discovered?
  - Is there useful analysis
    - not simply mathematical tricks or charts/graphs/equations that suggest "magic"?
    - Is the analysis correct?
  - Are the statistics correct?.
  - Remember the guiding principle: We write to explain. If you do not understand, the explanation needs to be revised.
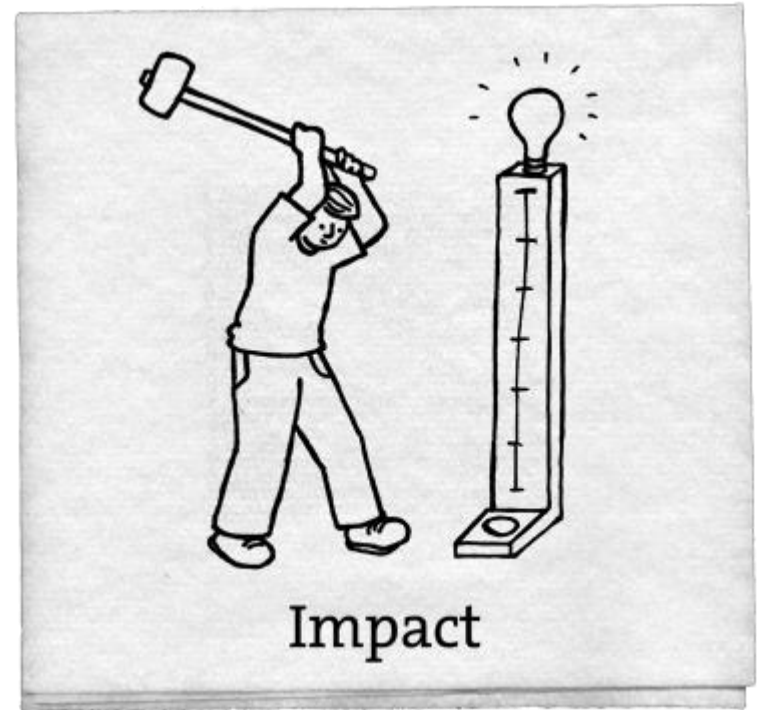
3) Contributions

- These are normally disclosed at the end of any document

- Conclusion/Discussion:
  - Are the claims in this section supported by the results?
    - do they seem reasonable?
  - Have the authors indicated how the results relate to expectations and to earlier research?
  - Does the article support or contradict previous theories?
  - Does the conclusion explain how the research has moved the body of scientific knowledge forward?

Other factors in evaluations

- Impact
  - Will this work make any difference?
  - Useful indicators
    - Does other work build on this work?
    - Do other papers uses techniques and solutions proposed in this paper?
  - Other indicators
    - All those math tricks that yield some kind of number equating to "impact".
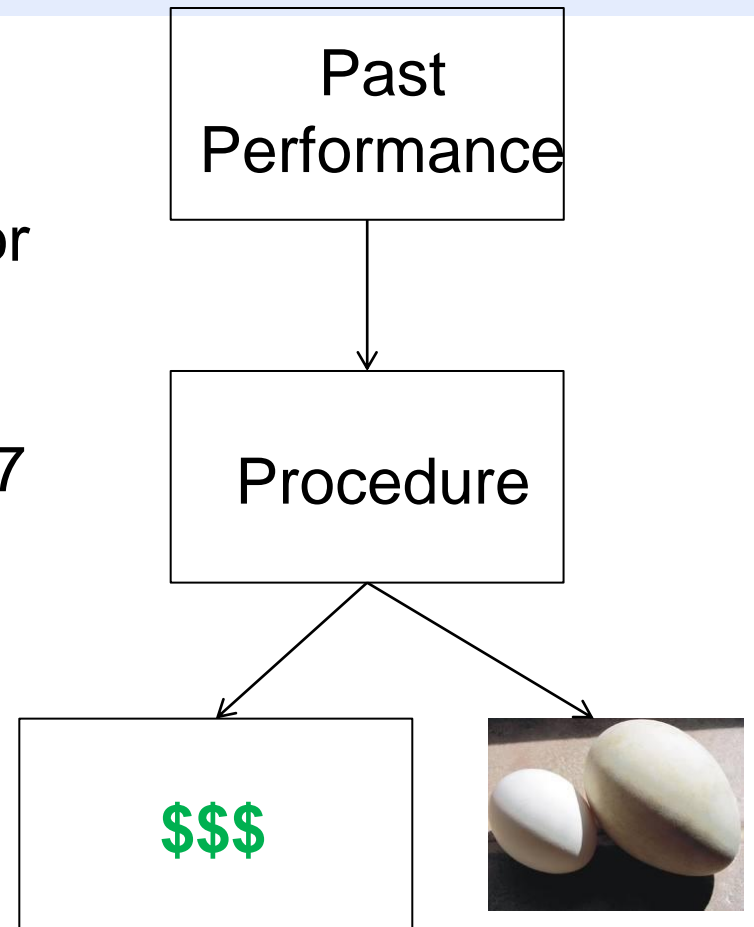

Impact

How to Evaluate

- Read <u>carefully</u>
    - take notes
    - Question
        - assumptions,
        - importance of the problem
    - Write questions to track what you don't understand
- Watch out for omissions
    - Work that impinges on this work but is not mentioned or is downplayed.
- You must understand
    - Do not assume something is worthy just because the rhetoric is complex
- Be skeptical about correctness
    - Check facts and assumptions. If you cannot, reject the result

How Research Gets Funded

- From
  - "Past performance as predictor of successful grant applications", van den Besselaar & Leydesdorff, 2007

- Basic Research Funding Model Assumed

- Dutch Social Sciences Granting Agencies2003-5

Past Performance

↓

Procedure

$$$

Conclusion

- ## Past Performance
  - Let
    - Publications == productivity
    - Citations == diffusion

- ## Correlations
  - $$$ not strongly correlated with Publications
  - Citations are a slightly better indicator of $$$ success

- ## Less than 1/3 of successful applicants correlate with Measures of Past Performance

Freaky Conclusion

- Peer Review
  - Low Correlation with Past Performance
  - Stronger indicator of $$$ received
    - But still less than 0.5 correlation
  - ***There seems to be a large amount of funding that is being distributed to researchers for reasons unknown.***