Why learn about scientific reading?

- Reading & understanding research articles can be a daunting task
  - It is a skill that every scientist has to learn, but seldomly taught
  - Inexperienced reader often read a scientific article in a linear fashion
  - May have difficulties following the equations & derivations half-way through
  - Often accept the authors’ claims without challenging them

Reasons for reading an article

- Scientists read scientific articles for various reasons
  - Stay up to date with the latest developments
  - Find evidence to support or their own ideas
  - Broaden their avenues of research
  - Gain background information on a topic
  - Determine how other scientists conducted their research

Based on the reasons, one may choose to skim through or thoroughly read an article

How to thoroughly read an article

- Reading a scientific article is completely different from reading a novel
  - Use 2 thinking hats: critical thinking hat & creative thinking hat
  - Need to fully understand and critically assess the scientific contributions
  - Need to think creatively about what else can be done
  - Steps for reading an article more critically:
    - Gather information
    - Skim read
    - Thorough re-read
    - Criticism & evaluation

Step 1: Gather Information

- Examine the scientific article as a whole
  - Establish the purpose & content of the article as well as the audience it was written for
- Specific questions to guide you through this step:
  - What are the major ideas that are being addressed in the article?
  - Who are the authors? Are the authors’ affiliations credible?
  - Is the article published in a reputable journal?
**STEP 2: SKIM READ**

- Read the title & abstract
- Identify the problem that the article is trying to address
- Know the field of research within which the article falls
- Read the conclusion
- Assess whether the goal summarized in the abstract has been reached
- Identify if the described work is of interest to your own research
- Identify and look up any unfamiliar terms, techniques & key concepts
- It will be difficult to fully understand scientific articles if there are key terms & concepts that you do not understand

**STEP 2: SKIM READ (CONT’D)**

- Identify the most prominent tables or figures
- Understand what is going on
- Get a first impression of a paper
- A picture is worth 1,000 words
- Many articles in Visual Computing put the most important figure at the beginning as “teaser”

**STEP 3: THOROUGH RE-READ**

- Read the entire article from beginning to end
- Going through the sections in the order they appear
- Follow the flow of work that the authors want to communicate
- A dedicated attempt aimed at understanding the details
- Try answer different questions at different sections

**QUESTIONS FOR INTRODUCTION SECTION**

- What is the purpose of the article?
  - Is it a review of previous studies or does the article present new results?
- What topic is being researched?
  - Why is it an interesting topic?
- What is already known about the topic?
- Where are the gaps and how does this article fill these gaps?
- What are the specific questions/hypotheses addressed?

**QUESTIONS FOR METHODS SECTION**

- What research techniques are used?
  - How do they compare to other techniques?
- Is the method employed appropriate?
- Has any variable been overlooked?
- What assumptions were made?

**QUESTIONS FOR RESULTS SECTION**

- What do the figures & tables show?
  - Scrutinize the figures & tables before reading the author’s interpretations of the results
- How do the results relate to the questions/hypotheses presented in the introduction?
- Are the results reported & analyzed in an unbiased manner?
- Are there other ways of interpreting the data presented?
QUESTIONS FOR CONCLUSION SECTION

• Have the appropriate interpretations been made?
• Are there ways of interpreting the results that have not been considered?
• Is the evaluation of the findings unbiased?
• What are the implications of the findings?
• What suggestions are being made about future research efforts on this topic?

STEP 4: CRITICISM AND EVALUATION

• Critically evaluating an article:
  • Was anything left unfinished?
  • Did the author miss any questions/make points that were left unaddressed?
  • A good article should raise more questions than the ones it answered
  • Did the article make its case convincingly?
  • What does the point made by the authors' argument mean in terms of the larger context of the discipline?
  • Is the organization of the article clear?
  • Were there any problems with grammar, sentence structure/word usage?
  • What did you learn?

STEP 4: CRITICISM AND EVALUATION (CONT’D)

• Understanding the merits:
  • What good ideas were presented in the article?
  • What are the possible applications of these ideas?
  • What improvements would you have made?
  • Is there anything in the article, be it writing style, methods used, graphics, that you can use for your own research?
  • A breakthrough idea might seem obvious when you look back
  • Need to understand the limitations at the time the article was written

WRITE AS YOU READ

• Take notes while you read
  • Helps you to be an active reader, rather than reading without thinking
  • In future, you only need to read the notes instead of re-reading the articles

• Background section
  • Write down how the authors evaluated related works
  • Help you to write your own literature review for your paper/thesis

• Method & result section:
  • Record the key idea proposed in the article
  • Save all new ideas you may have for further exploration

WHAT TO LEARN FROM SCIENTIFIC READING

• Improve your critical & creative reading skills
  • In the beginning, following the steps above may cause you longer time to read an article
  • With practice, reading scientific articles can become as straightforward as reading more conventional material

• Improve your writing skills
  • Learn to appreciate how academics write
  • Understand why they write the way they do