Literature Review

BAE 815 (Fall 2018)

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What is a literature review?

It is

- A discussion of your knowledge about the topic under study, and it is supported by the research literature

- A foundation for your own study

It is not

- A study-by-study description of studies previously done

- A brief overview of previous studies

Questions a literature review should answer

1. What do we already know in the immediate area concerned?

2. What are the characteristics of the key concepts or the main factors or variables?

3. What are the relationships between these key concepts, factors or variables?

4. What are the existing theories?

5. Where are the inconsistencies or other shortcomings in our knowledge and understanding?

6. What views need to be (further) tested?

7. What evidence is lacking, inconclusive, contradictory or too limited?

8. Why study (further) the research topic?

9. What research designs or methods seem unsatisfactory?

10. What contribution can your work be expected to make?

(Source: Write up Research using the Literature. Asian Institute of Technology)

Tip#1 Common structure: from general to specific

Broad
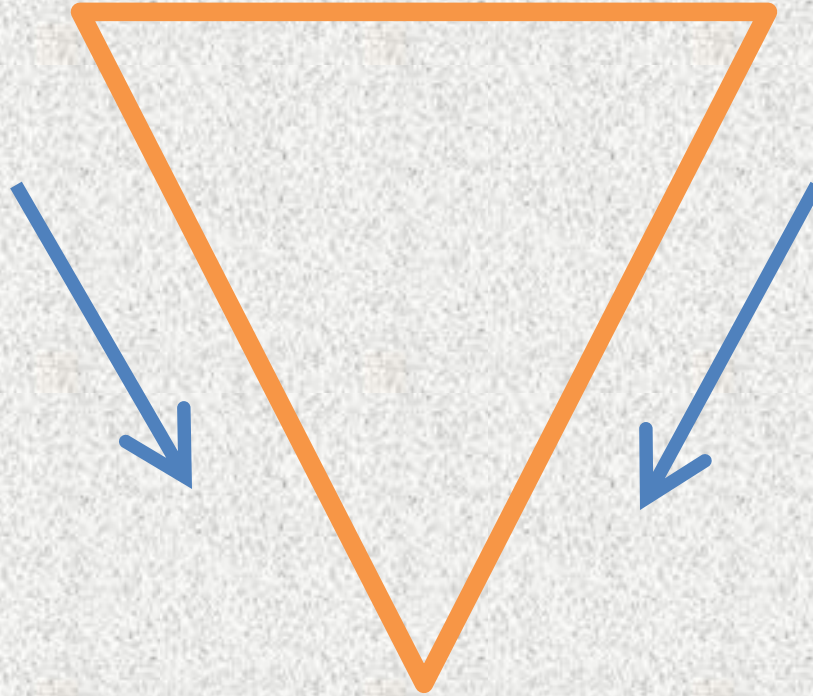
Specific

Common structure
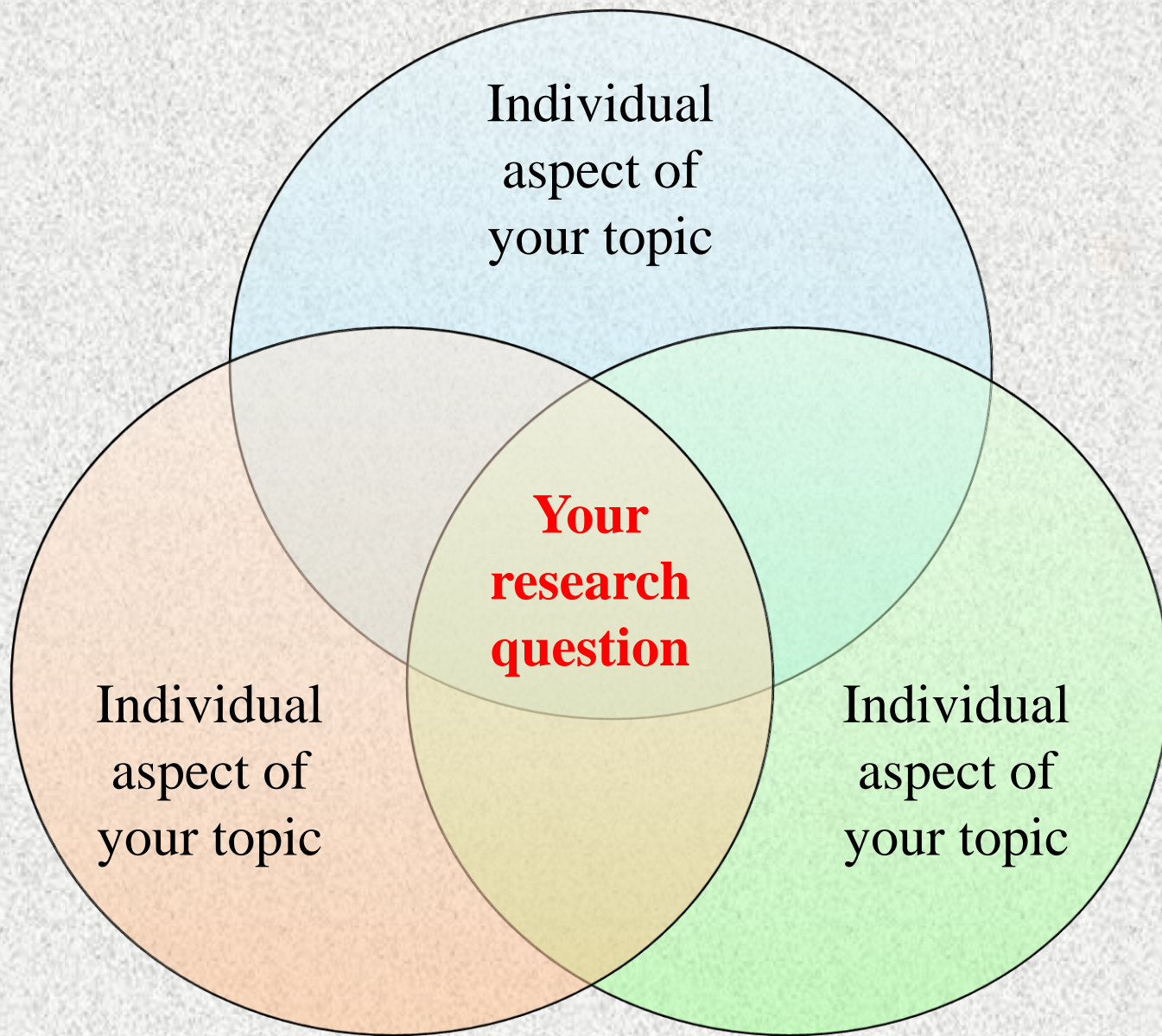
From General to Specific

Overview of key ideas

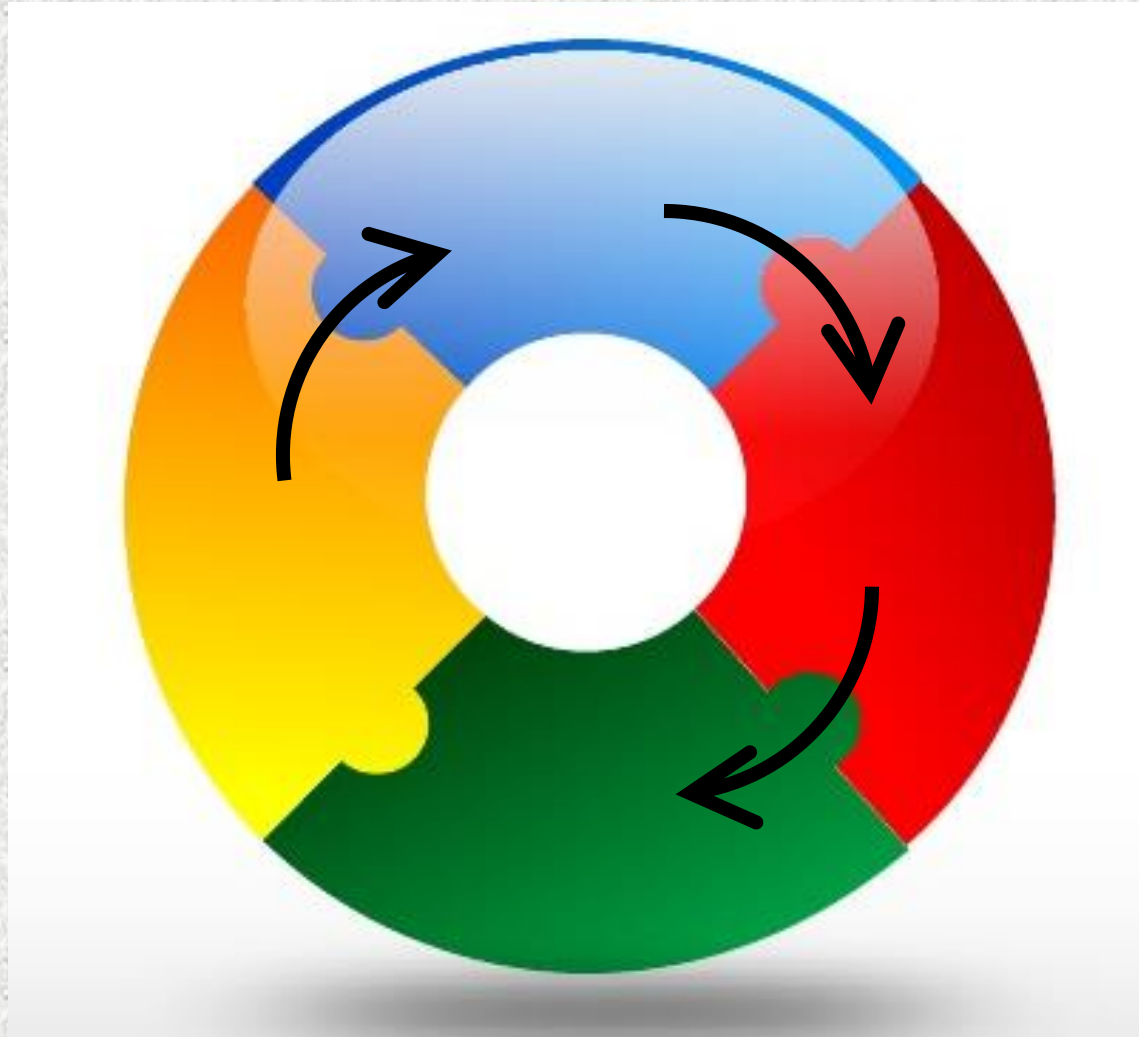Division of studies under review into categories

Summarize, compare and contrast the key studies

Narrow down to highlight the most relevant to your work

Indicate the position and contribution of your work

Common structure

Common structure

Tip#2 Organize according to the guiding concepts

Do

- Organize into sections that present themes or identify trends, including relevant theory.

- Synthesize it according to the guiding concept.

Do not

- Organize around the researchers instead of the research itself (e.g. key concepts).

- Just list all the published material chronologically.

Organization of the review

A bad example

Until recently many researchers have shown interest in the field of coastal erosion and the resulting beach profiles. They have carried out numerous laboratory experiments and field observations to illuminate the darkness of this field. Their findings and suggestions are reviewed here.

JACHOWSKI (1964) developed a model investigation conducted on an interlocking precast concrete block seawall. After a result of a survey conducted at a beach, and a storm at the coast of USA, a new and especially shaped concrete block was developed for use in shore protection. This block was designed to be used in a flexible type structure that would be both durable and economical as well as reduce wave scour at the base of the toe. It was proved that effective shore protection could be designed utilizing these units.

HOM-MA and HORIKAWA (1964) studied waves forces acting on the seawall which was located inside the surf zone. On the basis of the experimental data of the wave forces, the waves forces against a vertical wall, the authors proposed an empirical formula of wave pressure distribution on a seawall. The computed results obtained by using the empirical formula were compared well with the field data of wave pressure on a vertical wall.

SELEZOV and ZHELEZNYAK (1965) conducted experiments on scour of sea bottom in front of harbor seawalls, basing on the theoretical investigation of solitary wave interaction with a vertical wall using Boussinesque type equation. It showed that the numerical results were in reasonable agreement with laboratory experimental data.

(Source: Write up Research using the Literature. Asian Institute of Technology)

Organization of the review

- The writer has organized this literature review around the researchers, and has presented it chronologically. (the summaries are listed after the names of the people who did the research)

- By organizing it around the researchers and not around the research (e. g. around key concepts), the writer emphasizes the people but not their work.

The optimal container size in automated warehouses

Automated storage and retrieval systems (AS/RS) are being introduced into the industry and warehousing at an increasing rate. Forecasts indicate that this trend will continue for the foreseeable future (see [1]). Research in the area of AS/RS has followed several avenues. Early work by Hausman, Schwarz and Graves [6,7] was concerned with storage assignment and interleaving policies, based on turnover rates of the various items. Elsayed [3] and Elsayed and Stern [4] compared algorithms for handling orders in AR/RS. Additional work by Karasawa et al. [9], Azadivar [2] and Parry et al. [11] deals with the design of an AS/RS and the determination of its throughput by simulation and optimization techniques.

Several researchers addressed the problem of the optimal handling unit (pallet or container) size, to be used in material handling and warehousing systems. Steudell [13], Tanchoco and Agee[14], Tanchoco et al. [15] and Grasso and Tanchoco [5] studied various aspects of this subject. The last two references incorporate the size of the pallet, or unit load, in evaluation of the optimal lot sizes for multi-inventory systems with limited storage space. In a report on a specific case, Normandin [10] has demonstrated that using the 'best-size' container can result in considerable savings. A simulation model combining container size and warehouse capacity considerations, in an AS/RS environment, was developed by Kadosh [8]. The general results, reflecting the stochastic nature of the flow of goods, are similar to those reported by Rosenblatt and Roll [12]. Nevertheless, container size was found to affect strongly overall warehousing costs.

In this paper, we present an analytical framework for approximating the optimal size of a warehouse container. The approximation is based on series of generalizations and specific assumptions. However, these are valid for a wide range of real life situations. The underlying assumptions of the model are presented in the following section.

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Indicate the position of the work in the research area history

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Move from a general discussion of the research in AS/RS to the more specific area (optimal container size) that they themselves are researching.

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Group similar information.

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> Show the relationship between the work of different researchers, showing similarities/differences.

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Tip#3 Learn and think

"Learning without thinking leads to confusion; thinking without learning ends in danger."

-Confucius

- Learning without thinking
  - ➢ Gullible, credulous
  - ➢ Drowning in a sea of information
  - ➢ Be misled
  - ➢ Loss of direction

- Thinking without learning
  - ➢ Stubborn
  - ➢ Ignorant
  - ➢ Waste of effort
  - ➢ Dead end

- Learning: Collect all the major studies that are relevant.
  - ➢ Up to date?
  - ➢ References that are counter to your own opinion

- Thinking:
  - ➢ Critical thinking
    - Reliability and validity
    - Significance and relevance
    - Strengths and weaknesses
    - Doubt, breakthrough the current knowledge framework
  - ➢ Analyzing
    - Compare; look for similarities (patterns); inductive reasoning
    - Contrast; look for differences (essence); deductive reasoning
    - Obtain insights; abductive reasoning

Tip#4 Tell and sell

- Be systematic (complete)
  - ➢ Cover all the major concepts (categories) and different opinions
  - ➢ Provide sufficient information (evidences)
    - ➢ Distinguish opinion from fact. How much evidence does it have?

- Be logic (Ethos-Logos-Pathos)
  - ➢ Why it is important?
  - ➢ I learned something from literature, but there is still something need further study

Tell a story

- Background, history
- Problems, challenges
- Attempted solutions
- Experiences, failure
- Modified solutions
- Success, significance
- Remaining problems

A example storyline
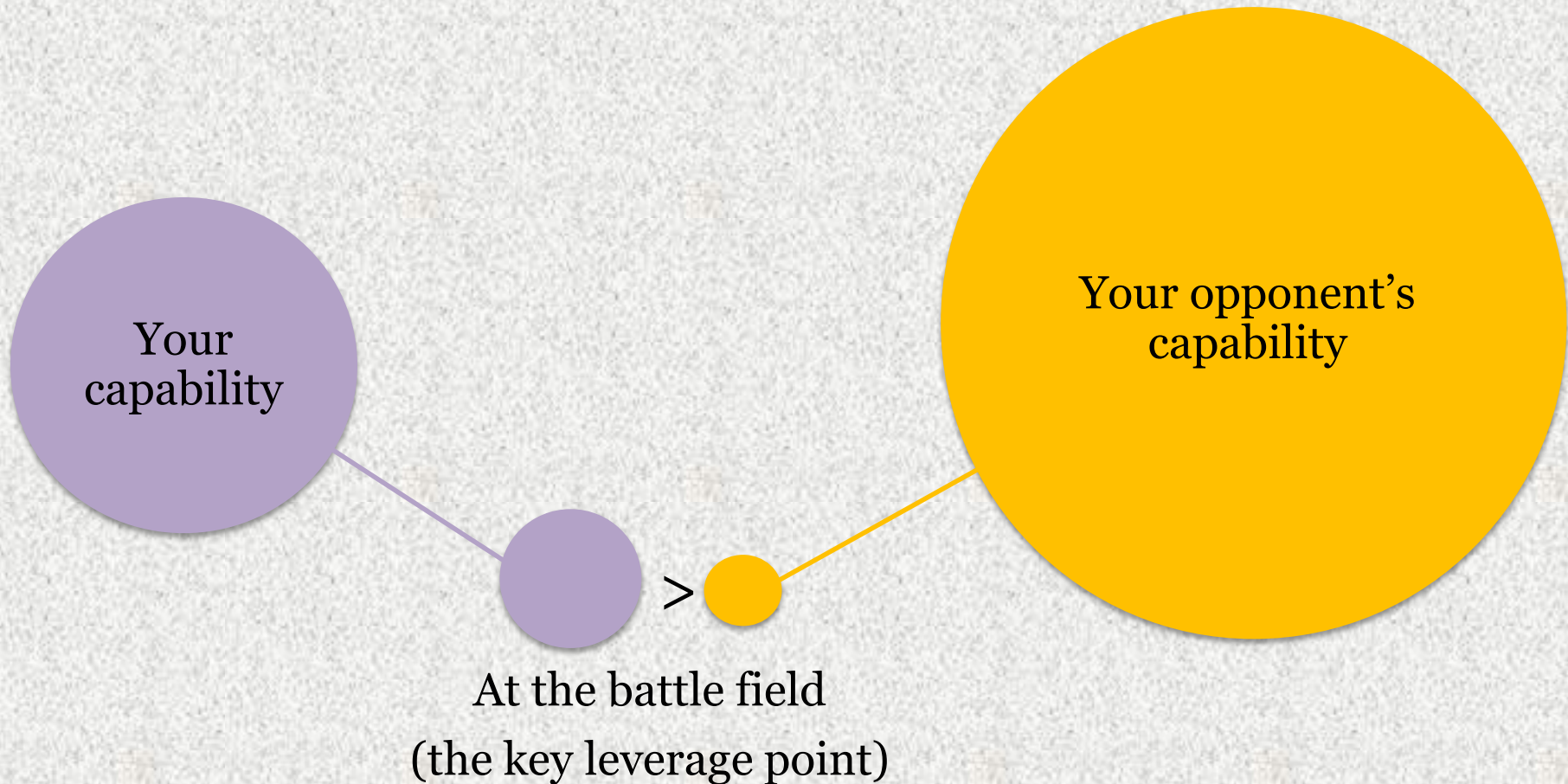
Write with your reader in mind

➢ Provide what they want to know

➢ Convince them what they need to know

➢ Explain what they may not know
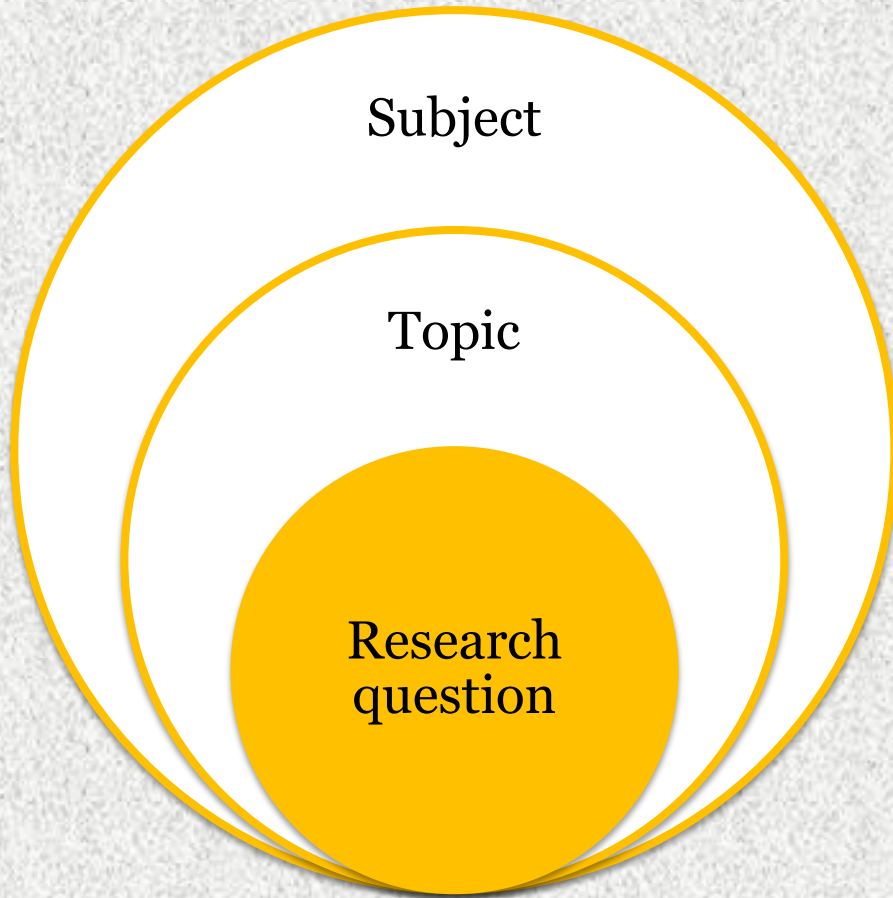
➢ Do not repeat what everybody already knows

Sell your points

Tip#5 Define your research question

The secret to win a war or any kind of competition:
- Find a key point (set up the battle field to maximize your advantages).
- Be the strongest at the key point.

Your opponent's capability

Your capability

>

At the battle field
(the key leverage point)

Subject

Topic

Research question

"Asking the right question is half the answer."

- Aristotle

"90% of a research job is done when you find a good research question."

- Anonymous

- Who is my audience?

- What do I already know?

- What do I need to know?

- What could my product be?

- What's the benefit of my research?

- Is this a hot area? Will you get a good job in this area after graduation?

  ➢ Research subject hotspot index:

$$\frac{\text{\# of top papers}}{\text{\# of total papers}}$$

Understand your field

- Know what has been done by others and the current trend
    - Read a few papers every week
    - Follow technology news
    - Monitoring activities of leading research group in your field
    - Think about which organizations would be interested in your topic and look at their websites for their publications.

- Think about the big picture
    - Read outside your area as well

Is it a significant problem? Is it an old problem or a new problem?

- New problems, or even new areas
- Old problems
  - How have others answered it?
  - How does your study fit in with what others have done?
  - New solution, may from other areas.
  - What's the novelty of your study?

The Topic (Problem)

Innovation! Innovation! Innovation!

What is desirable to users? (Policy, market)

Innovation

What is possible with technology?
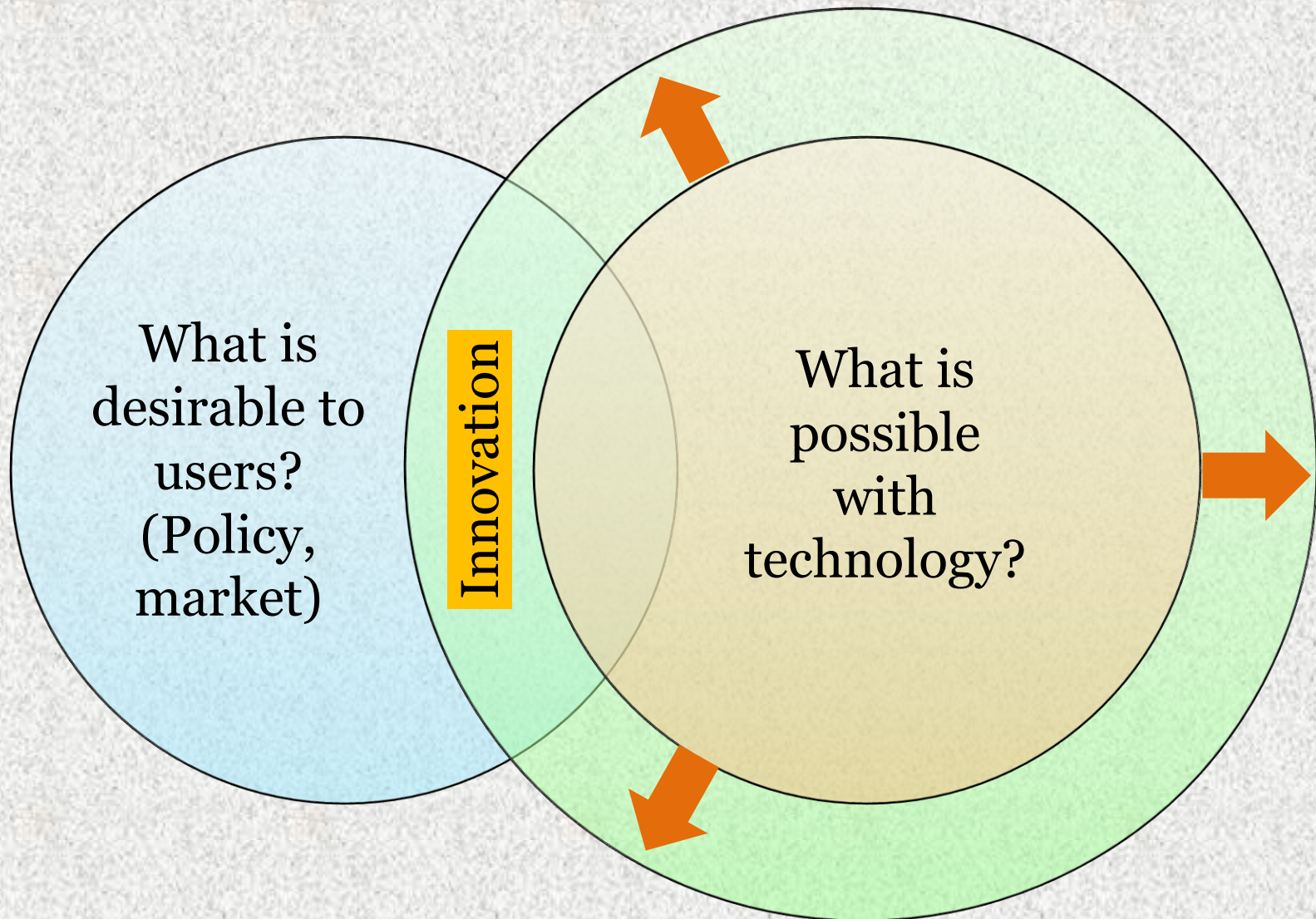
- Prediction – What is the likely result of X?
- Historical – How have we got from X to Y?
- Intervention – Is doing X better than doing Y?
- Exploration – What are the possible explanations for X?
- Attitudes – How do people feel about X?
- Causation – What are the likely causes of X?
- Measurement – What is the size of X, how often does it occur, etc.?
- Characterization – How can we understand and specify X?

Examples of researchable questions

Tip#6 Think big, but be realistic

- Find a fundamental question which may have a significant impact
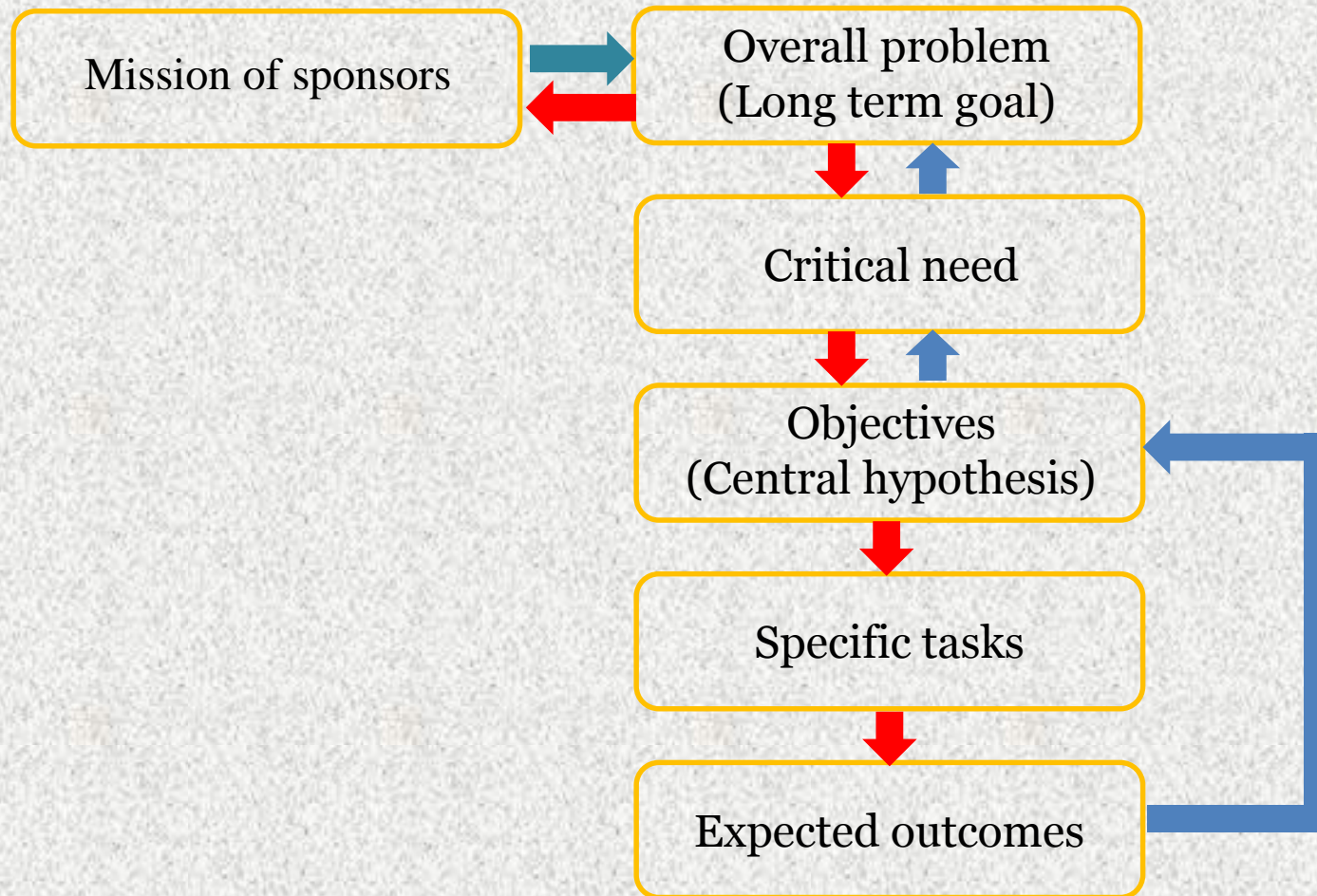- Do not focus on a small hole

- Accept low, satisfied with small gains
- Don't try to do too much in one study

A viable research question

Address a "critical need"

Have right level of detail or complexity

The flow of logic

Overview of your research topic

Please spend some time to answer the following questions, which may help you to develop an overview of your research topic.

1. Describe the "critical need" that provides the driving force for you to look for the solution.

2. What are the important known and unknown for your topic?

3. What is the long term goal of your study?

4. What are the specific objectives of your study? How does it match the "critical need"?
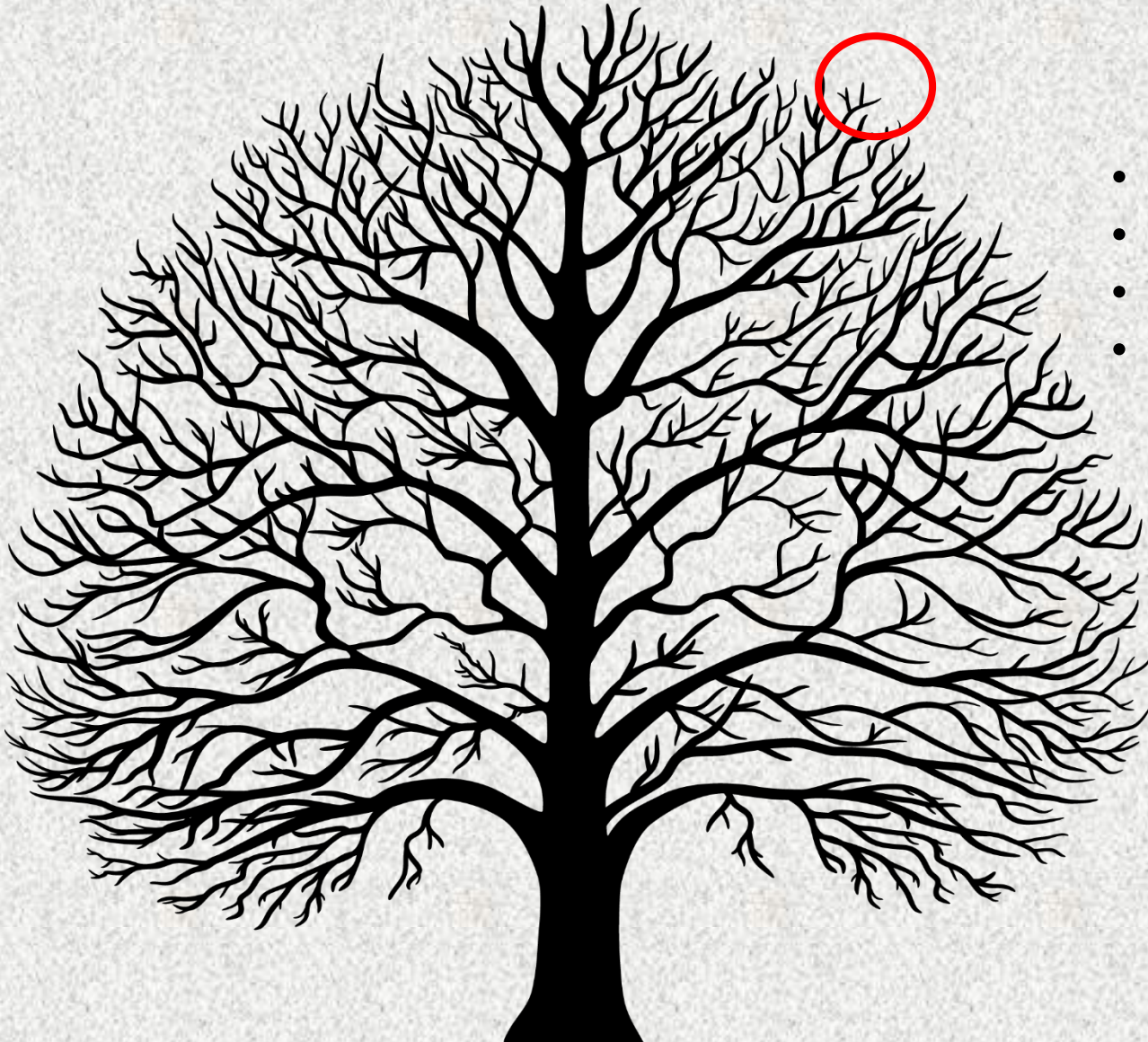
Best research topics

- After the research, more people will follow you and be doing it
  - you opened the door

- After the research, nobody can improve it
  - you closed the door

From Michael

Tip#7 Prove relevance and significance of your work
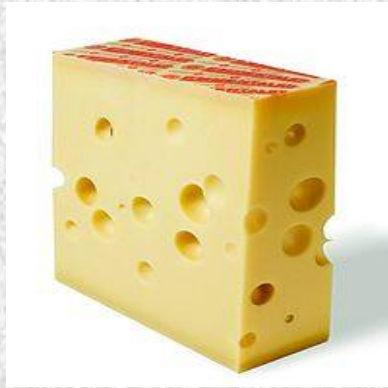
Relevance

- Abstract
- Introduction (literature review)
  - Establishing a research territory
  - Establishing a niche
  - Occupying the niche.
- Methods
- Results
- Conclusion
- References

$n \rightarrow n+1$

Significance

Identify a "critical need"

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Swiss cheese

Present a picture of current knowledge, identifying gaps or holes in the field, and argues why the current research plugs up one of the holes.

Road map

Trace the history of knowledge in this field, one achievement after another, all of which points to one destination which is your work.

Deja Vu again

Identify current knowledge or existing methodology, but argues for some kind of replication for verification or variation such as a different sample population.

Rhetorical patterns of literature review

(Obenzinger, 2002)

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Tip#8 Focus your topic to the appropriate level

Phrase a question on the topic

↓

Understand the topic

↓

Evaluate the scope of the topic

↓

Explore aspects of the topic

- What exactly do you want to find out?
- What is a researchable question?
- What kind of information do you need?
- Breaking down your questions into concepts.

Focus your topic to the appropriate level

Phrase a question on the topic

↓

Understand the topic

↓

Evaluate the scope of the topic

↓

Explore aspects of the topic

Get an overview of the topic, identify key terms and concepts

- Find a book on the topic: read the introduction or first chapter
- Read a chapter in a specialized textbook or encyclopedia
- Find and read a literature review

Focus your topic to the appropriate level

Phrase a question on the topic

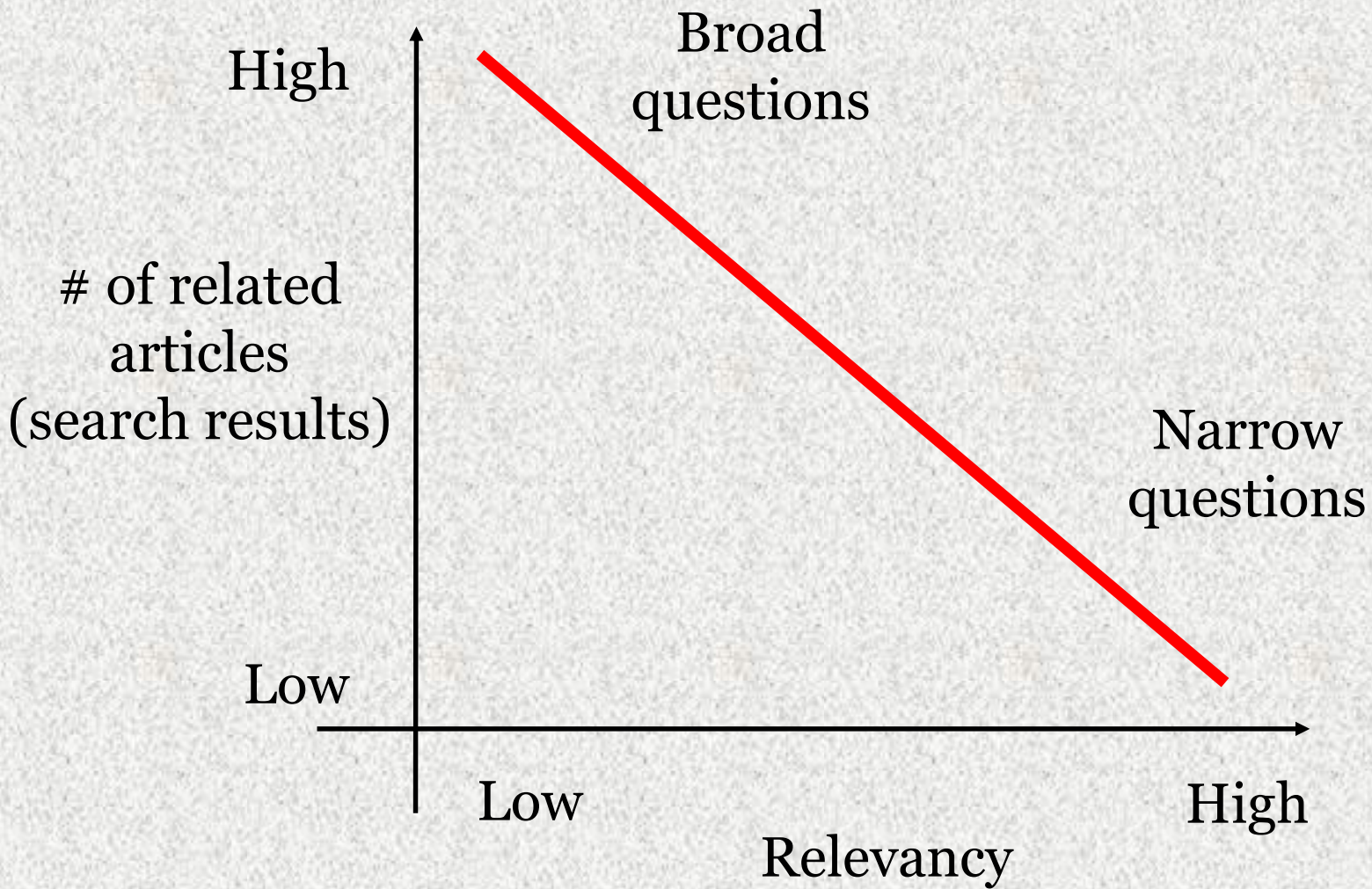Understand the topic

Evaluate the scope of the topic

Explore aspects of the topic

- Evaluate the available resources.
- Run your search by concepts.
- Scan the first 10 or so items in your results list.

Focus your topic to the appropriate level

Nurture good taste in research

- Read selectively
  - Only abstraction >80%
  - Introduction & conclusions ~50%
  - Methods, results and details <20%

- Consider highly cited articles first

High

# of related
articles
(search results)

Broad
questions

Narrow
questions

Low

Low

High

Relevancy

(Credit: Robin Featherstone)

Phrase a question on the topic

↓

Understand the topic

↓

Evaluate the scope of the topic

↓

Explore aspects of the topic

- Identify several aspects of the topic that might be used to further focus your topic. e.g. different method, geographic locations, categories of processes, etc.

- Consider resent papers that point out directions for future research.

- Revise your research question.

Focus your topic to the appropriate level

Tip#9 Cycles of the review process

DEFINE your research question

SCAN and evaluate

READ and take notes

WRITE and synthesize
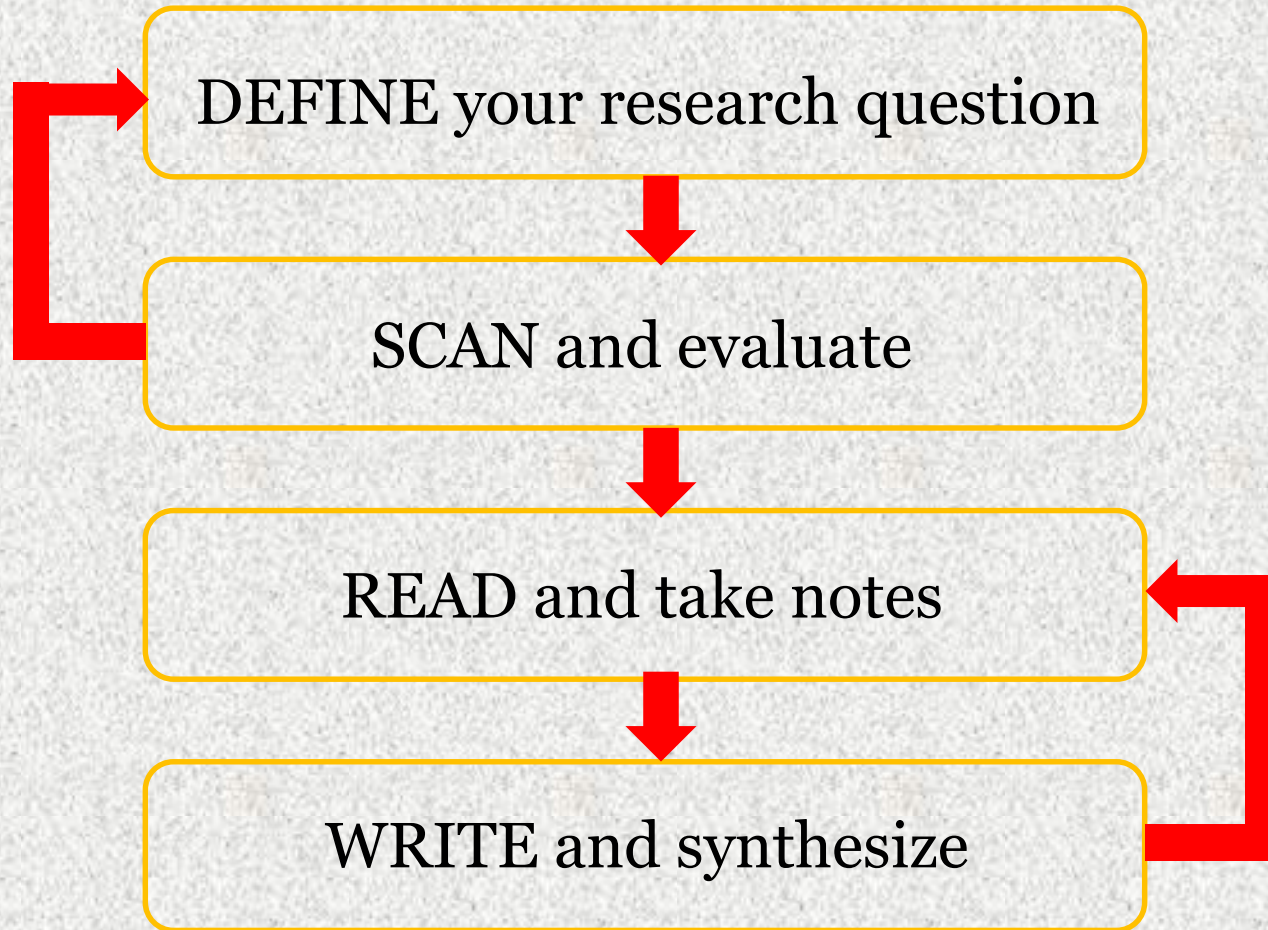
Cycles of review
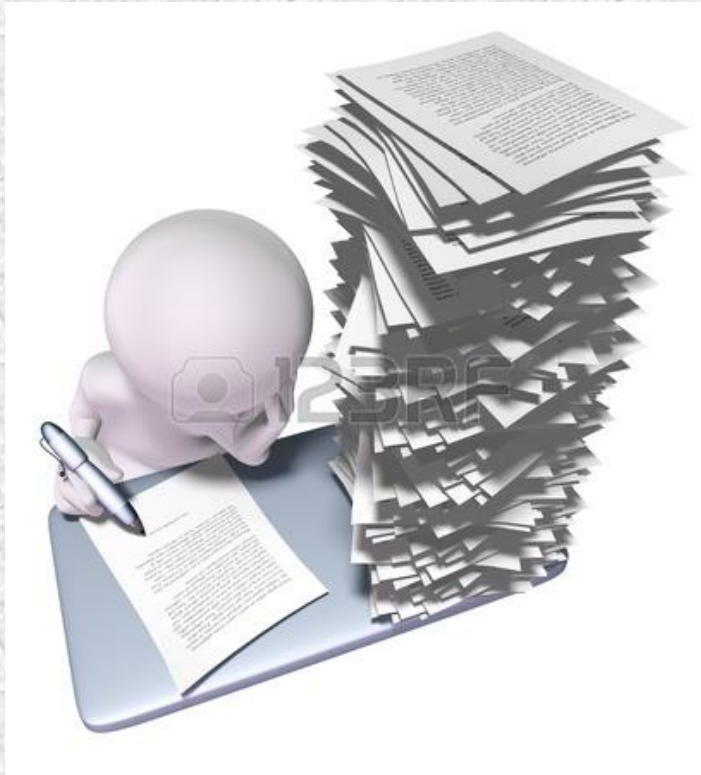
Traps to avoid

- Trying to read everything
- Reading but not writing
- Not keeping bibliographic information

Tip#10 Critical thinking

Significance and relevance

Is the study significant?
Who is the target reader?
Public, academic peers, policy makers
What theories or methods are used?
Is it relevant to my research?
Interesting, but does it help?

An attitude of skepticism
Distinguish between fact and opinion
Document assumptions
Reading between lines
Being open-minded
Being constructive

Critical thinking

Critical Review
Evaluate others' attempts
Look for answer to your own questions

No study is perfect
Strengths and weaknesses

Falsifiability?

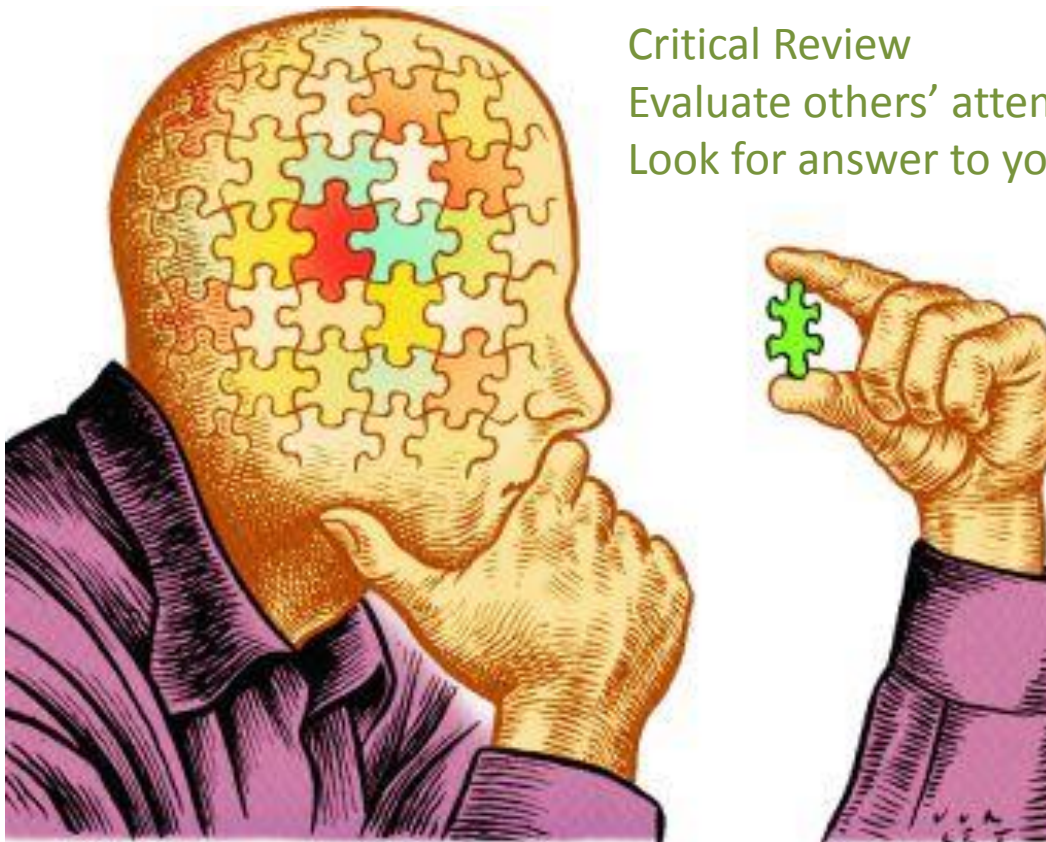**Reliability and validity**

Peer-reviewed?
Does the researcher have the
knowledge to work in this area?
Documentation and assumptions
Reliable data collection?
Conflict of interest
Is the research biased?

- Identify general patterns in research.

- Identify main gaps in knowledge

- Identify principal areas of dispute and uncertainty.

- Juxtapose studies with conflicting findings and explore explanations for discrepancies.
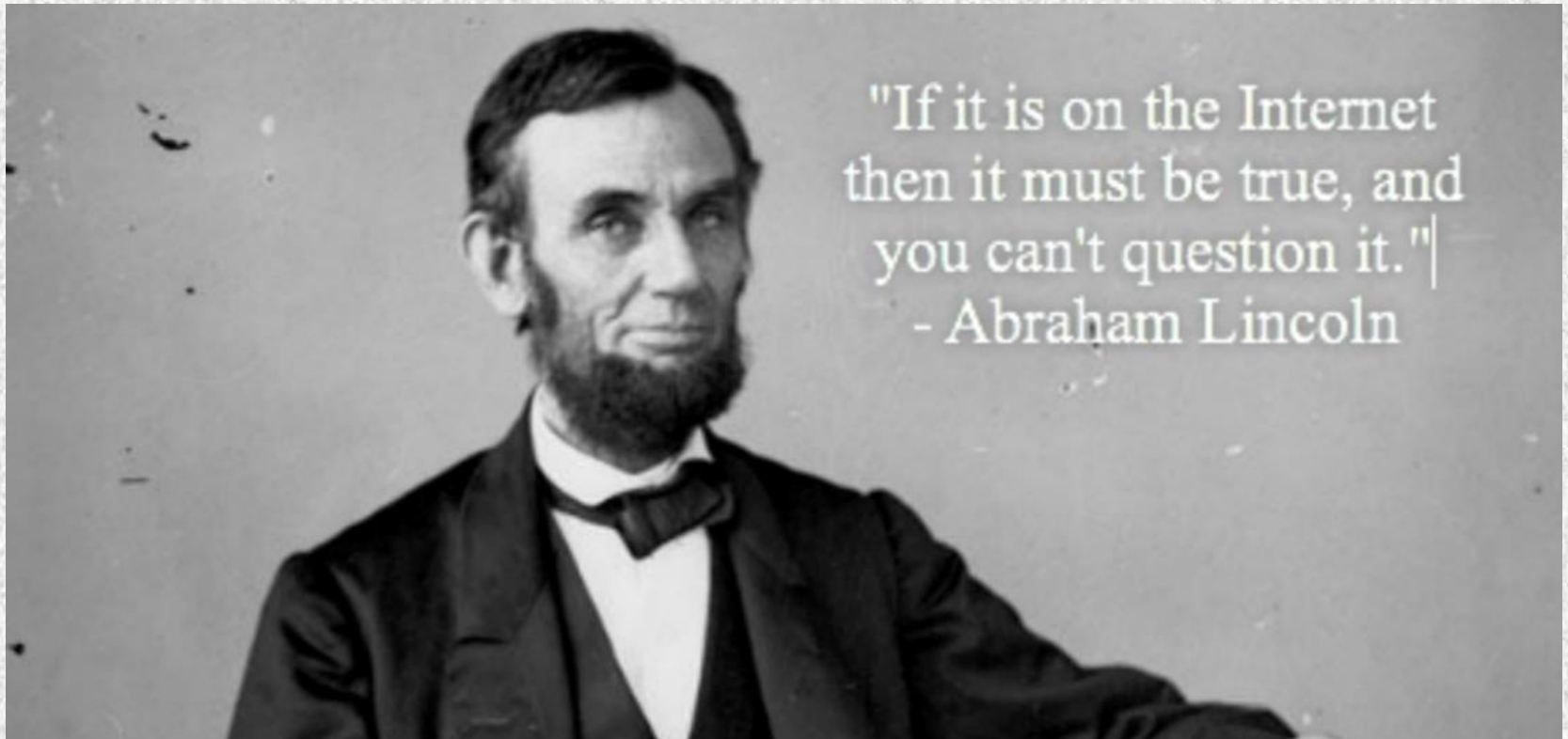
Develop critical thinking

- Critical Reading
  - Evaluate others' attempts
  - Look for answer to your own questions

- Critical Writing
  - Convince your audience
  - Provide answer to your audience

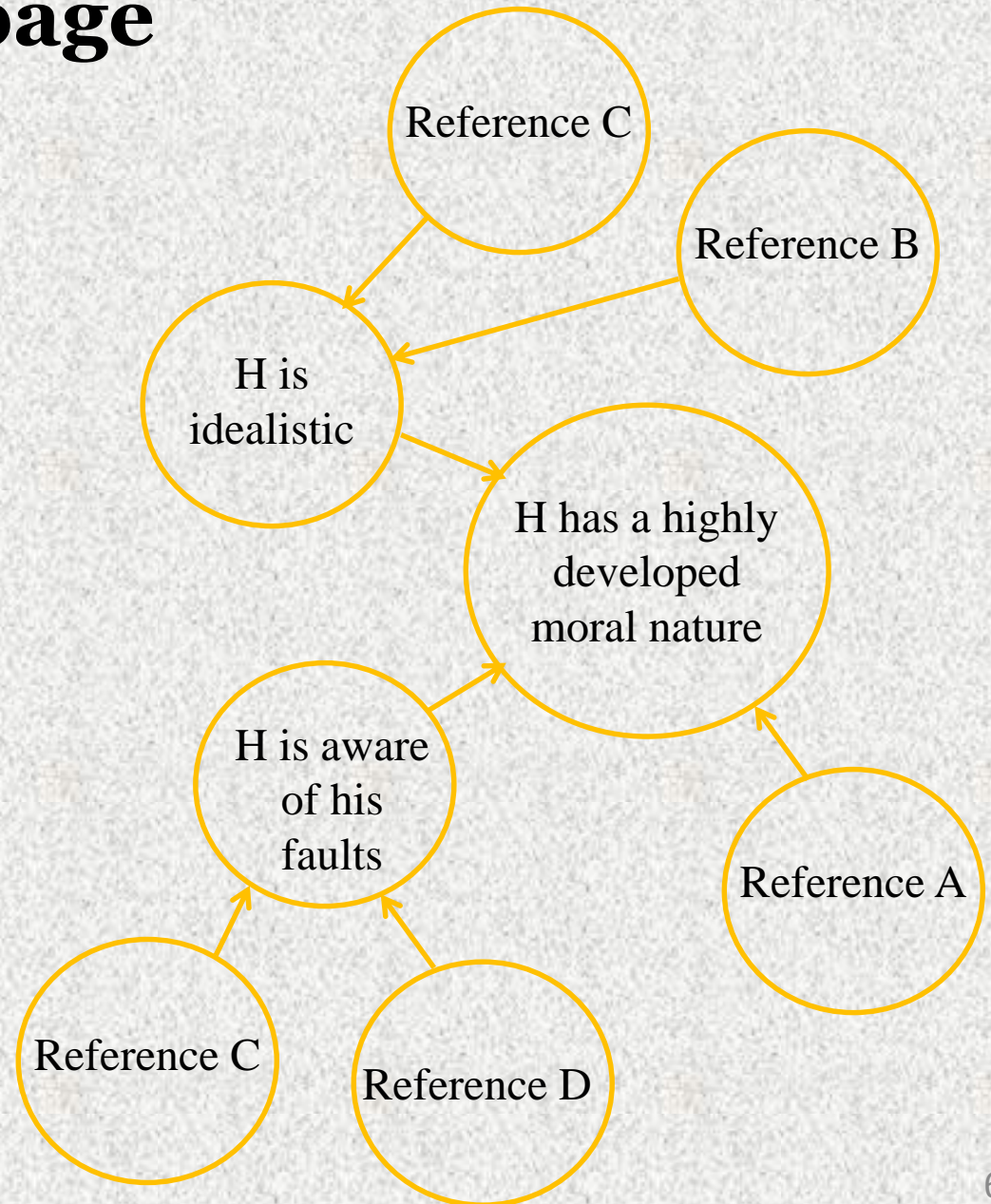**From reading to writing**

Going beyond google

Convenient but has limitations

"If it is on the Internet then it must be true, and you can't question it." - Abraham Lincoln

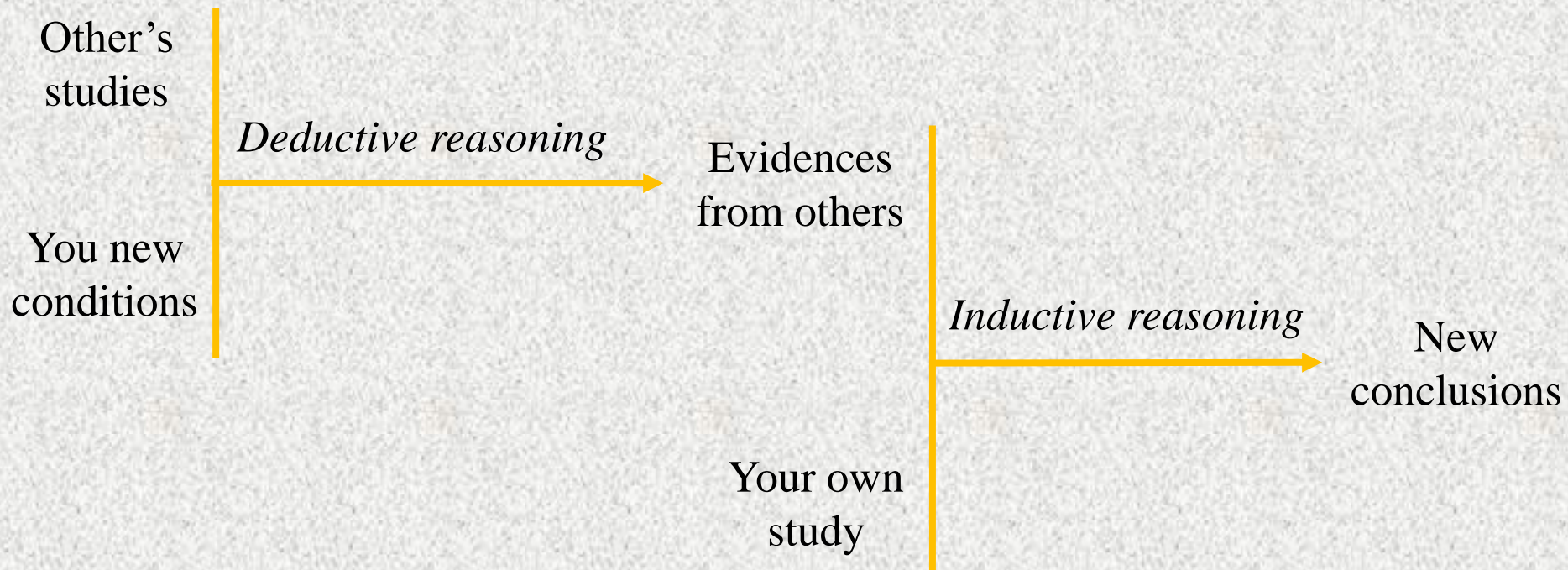# Tip#11 Visualize your idea on one page

Visualize on one page

- When you have an idea, write it down and draw a circle around it.

- When you have another idea or a reference which supports this idea, do the same, and connect the two circles with a line.

- Get your ideas on one page, so you can see them all at once.

(Credit: Jerry Plotnick. University of Toronto)

Reference C

Reference B

H is idealistic

H has a highly developed moral nature

H is aware of his faults

Reference A

Reference C

Reference D

Learn from the best, and apply what's learned under the new conditions.

Other's
studies

Deductive reasoning

You new
conditions

Evidences
from others

Inductive reasoning

New
conclusions

Your own
study

Tip#12 Break down your research questions into concepts

Generating key words (search terms)

Creating a well-focused question

Breaking down your questions into concepts

An example

"The effects of television violence on children"

Concepts	Television	Children	Violence	Effects
Brainstorming synonyms and related concepts	TV, movie, DVD, parental control	Teenagers, youth, adolescent, juvenile	Aggression, crime, brutality	Influence, impact

Running your search(es)

Concept 1

Search #1 =

Search #2 =

Search #3 =

Search #4 =

Search #5 = #1 OR #2 OR #3 OR #4

Concept 2

Search #6 =

Search #7 =

Search #8 =

Search #9 =

Search #10 = #6 OR #7 OR #8 OR #9

Search #11 = #5 AND #10
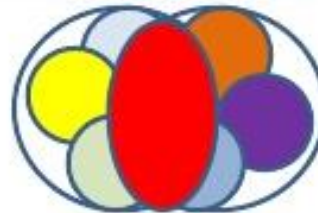
Results

Test your searching strategy

- Checking to see if your "target articles" appear in the results.

- Judge not by what you have retrieved but by what you may have missed!

Citation Searching

- Find a key reference
  - Trace backward: follow its reference list
  - Trace forward: follow all references that cite it
  - Look at subject indexing for the key reference and use to modify your search terms

- A feature of Web of Science: citation map

Tip#13 Critical appraisal of literature

Why we do critical appraisal?

- Conducting a literature review or putting research into practice
  - Reliability and validity
  - Significance and relevance

- No study is perfect
  - Strengths and weaknesses

Reliability and validity

- Peer-reviewed?
- Does the researcher have the knowledge to work in this area?
- Documentation and assumptions
- Reliable data collection?
- Conflict of interest
- Is the research biased?

Significance and relevance

- Is the study significant?
- Who is the target reader?
  - Public, academic peers, policy makers
- What theories or methods are used?
- Is it relevant to my research?
  - Interesting, but does it help?

Strengths and weaknesses

High

Degree of
generalization

Low

Moderate
vulnerability

High
vulnerability

Low
vulnerability

Moderate
vulnerability

Low   Degree of certainty   High
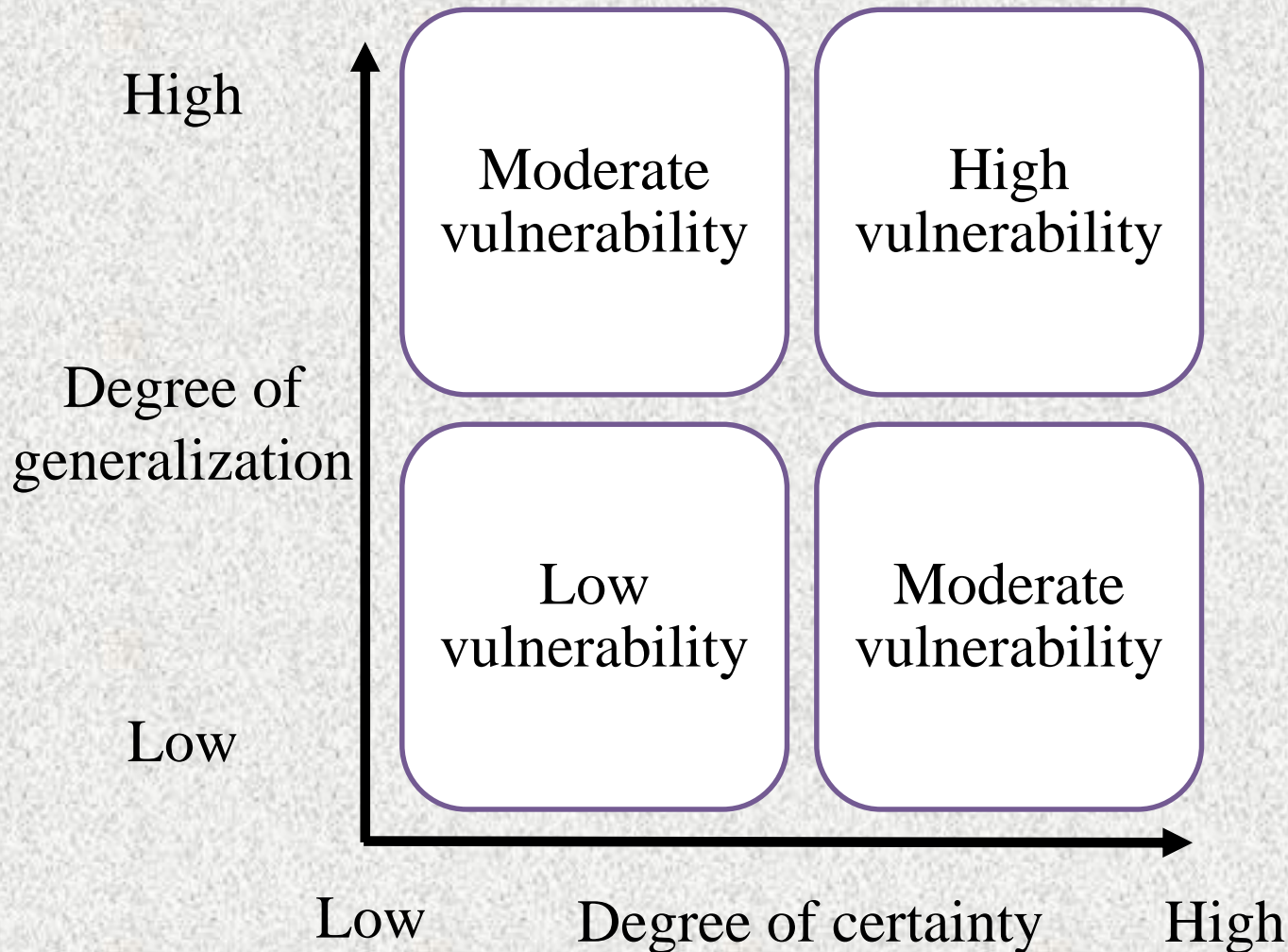
Principals of Critical Appraisal

- An attitude of scepticism
- Distinguish between fact and opinion
- Document assumptions
- Reading between lines
- Being open-minded
- Being constructive

Tip#14 Read selectively

Abstract

Introduction
Conclusion

Methods
Results

Move on to
next paper

Abstract

Introduction
Conclusion

Methods
Results

Move on to next paper

- What are the main findings of the research?
- Do you want to know more after reading the abstract?

Abstract

Move on to next paper

Introduction

Conclusion

Methods

Results

- Look for a clear statement of the purpose of the study.
- How similar is the study population or setting to yours?

Abstract

Move on to next paper

Introduction

Conclusion

Methods Results

- Are the aims in the introduction addressed in the conclusions?
- Is the work a significant advance?
- Limitations of the research and possible implications

Abstract

Introduction

Conclusion

Methods

Results

Move on to next paper

- Is the fundamental design appropriate?
- Are the methods valid and reliable?

Move on to next paper

Abstract

Introduction

Conclusion

Methods

Results

- Flaws and inconsistencies.
- Are there other possible interpretations?
- How these results compare with prior research?

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Read efficiently

- It isn't really a matter of reading fast, but of focusing selectively.

- Read the abstract first to see if the article will be of use to you.

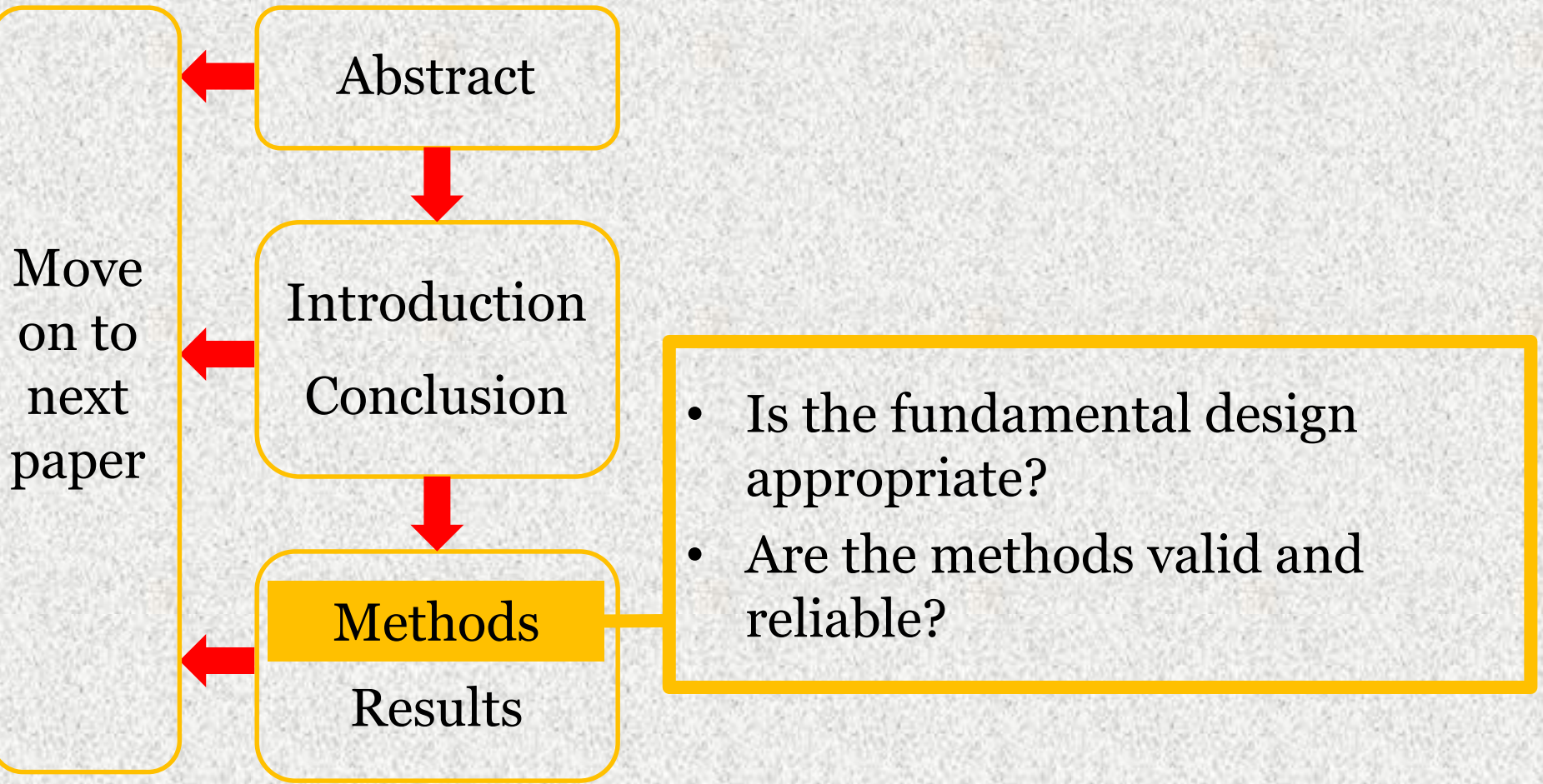- Keep a specific set of goals in mind as you scan the text, and avoid becoming distracted by other material.

- Read carefully the first one or two sentences of each paragraph, as well as the concluding sentence or sentences.

- Ask yourself questions about the specific topic.

- Look for controversies in the material to find issues that need discussing.

Getting the most out of reading

Tip#15 Critical report of a study

Critical Report of a Study

- Brief summary of the work
- Your opinion of the work
    - Make clear the criteria you used to judge it
    - Support your opinion with evidences from the text
- Conclude with a recommendation

Additional Critique

- References
  - Do they reflect fairly and appropriately the current state of knowledge?
  - Is important work ignored?

- Presentation
  - Is the text clear and succinct?
  - Is the data presentation optimal?

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Appraisal of a Review Paper

- Does it set out to answer a specific question?
- Is there anything key literature missing?
  - Up to date?
  - References that are counter to their own opinion
  - Inclusion and exclusion criteria
- Have the authors been objective?
- Does it use clear referencing?

Tip#16 A step-by-step guide for writing literature review

- Identify the broad problem area.
- Indicate why the topic being reviewed is important.
- Specify your point of view.
- State explicitly what will and will not be covered.

1. Overview

(Adapted from: Galvan, 2006)

- Indicate why certain studies are important; discuss other literature reviews on your topic.

- If the results of previous studies are inconsistent, cite them separately; justify comments such as, "no studies were found".

- Provide strong "umbrella" sentences at beginnings of paragraphs, and brief "so what" summary sentences at the end to aid in understanding comparisons and analyses.

2. Body

(Adapted from: Galvan, 2006)

- Evaluate the current "state of the art" for the body of knowledge reviewed.

- Point out major methodological flaws or gaps in research, inconsistencies in theory and findings, and areas or issues pertinent to future study.

- Indicate the position and contribution of your work.

3. Conclusion

(Adapted from: Galvan, 2006)

Tip#17 Develop an one page overview of your research project

A template for the overview

Identify the "critical need"

↓

Outline the solution

↓

Spell out the approach

↓

Summarize expectations/impact
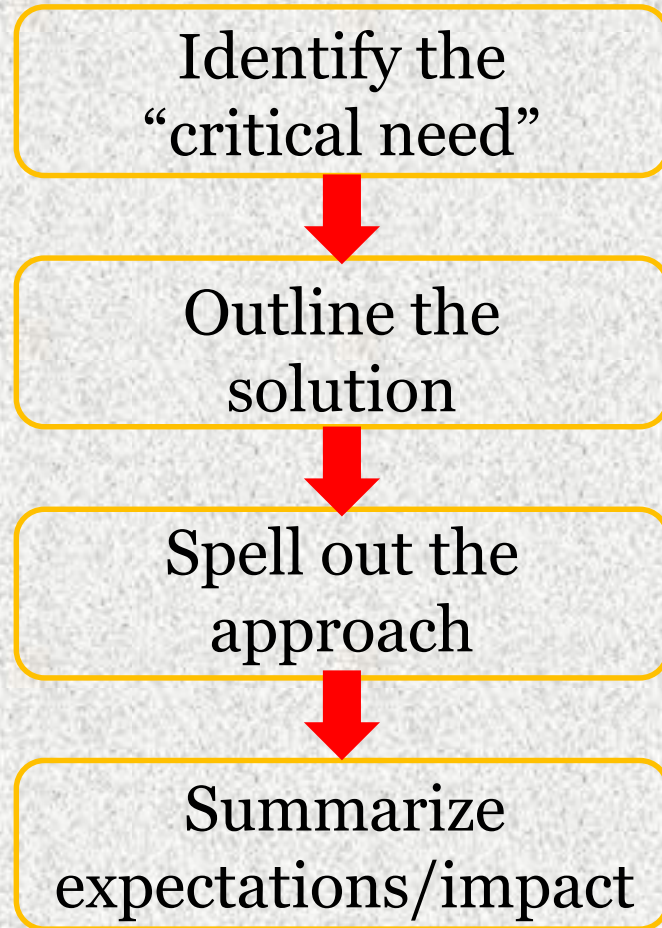
Four paragraphs, all on one page!

Credit: David Morrison, Grant writers' seminar & workshop

Identify the "critical need"

Outline the solution

Spell out the approach

Summarize expectations/impact

- Opening sentence
- Important known and unknown in the field
- Frame the problem/need
  - The "critical need" provide the driving force for you to look for the solution

Opening sentence

First draft

"The long-term stability of reinforced concrete structure is critical for safety of America's highways and bridges."

Second draft

"Detection of delamination and void defects in reinforced concrete structures is an essential, but currently difficult, aspect of effective construction and maintenance of highway bridges."

Opening sentence

"Strong evidence indicates that the highly invasive characteristics of prostate cancer cells are mediated by complement receptor C1q-dependent signaling through NF-kB and AP-1 transcription factors leading to secretion of matrix metalloproteinase-9 (MMP-9)."

Important known and unknown

"This serves to promote prostate cancer cell adhesion, cellular migration and invasion of tissues.

Of potential importance, Crocetin, a traditional Oriental medication recognized for centuries for its therapeutic potential in preventing or treating various human diseases, has been suggested as an effective therapeutic strategy to treat several cancers.

Extracted from the Crocus plant, this molecule has been frequently reported to show significant antiviral, anti-inflammatory and anticancer effects in a number of the experimental animal models of disease pathogenesis, however the mechanism(s) by which these effects are manifest have not been determined. "

Frame the problem/need

"Given the current polarization of thought between the skepticism that often surrounds therapeutic efficacy of alternative medical strategies to treat diseases, and the highly suggestive evidence in support of beneficial effects of Crocetin, there is a <u>critical need</u> to identify a specific mechanism by which Crocetin manifests its therapeutic benefit in prostate cancer.

In the absence of such evidence, decisions concerning adoption of this alternative strategy for treatment/prevention of prostate cancer will not be possible. "

Linkage of three components

Goal: Design strategies for reinforced concrete structures with optimal safety features.

Objectives: Develop improved non-destructive diagnostic procedures to detect structural flaws in concrete.

Hypothesis: Application of ground penetrating radar and impact echo techniques will allow accurate non-destructive detection of flaws in concrete structures.

The objectives

First draft

"Our objective is to study the effects of family environment and language skills on preparedness for kindergarten."

Second draft

"Our objective is to determine the key factors that predict success for failure in transition from preschool to kindergarten."

Example: Prostate cancer

"Our <u>long term goal</u> is to develop novel and effective therapeutic intervention strategies for the treatment of cancer that are based upon natural remedies.

Our <u>objective</u> in this application is to determine the molecular mechanism(s) of action and therapeutic efficacy of Crocetin in inhibition of prostate cancer cell metastases. "

Example: Prostate cancer

"Our <u>central hypothesis</u> is that Crocetin specifically inhibits C1q-dependent signaling pathways leading to cell migration by selectively targeting the activation of key transcription factors NF-kB and AP-1 in vitro, and that the these activities will be faithfully reproduced in an in vivo animal model of prostate cancer metastases. We have formulated this hypothesis on the basis of our preliminary data suggesting an inhibitory effect of Crocetin extract on nuclear translocation of NF-kB and AP-1, and our observation that enhanced activation of NF-kB and AP-1 are required for secretion of MMP-9 from prostate cancer cells.

Our <u>rationale</u> for these studies is that development of scientifically-based evidence to support a therapeutic benefit of Crocetin would provide a foundation for Phase 1/Phase 2 clinical trials to test potential benefits in cancer patients."

Identify the "critical need"

⬇

Outline the solution

⬇

Spell out the approach

⬇

Summarize expectations/impact

- Provide a logical step-by-step development of the key tasks (aims) by which you will fulfill the objectives (test the hypothesis) so as to address the "critical need".

Example: Prostate cancer

"Specific Aim #1: Identify the molecular pathway(s) responsible for Crocetin-mediated inhibition of prostate cancer cell adhesion and cell migration in vitro. Our working hypothesis, based upon strong preliminary data, is that Crocetin suppresses NF-kB and AP-1 mediated transcriptional activation leading to reduced production of MMP-9 by inhibition of nuclear translocation.

Specific Aim #2: Evaluate the therapeutic efficacy of Crocetin in inhibition of prostate cancer growth and metastases in vivo. Our working hypothesis is that oral daily administration of Crocetin to mice will inhibit prostate tumor growth and metastases by down regulation of the same pathways identified to be inhibited in vitro in a mouse model of human prostate cancer."

Identify the "critical need"

↓

Outline the solution

↓

Spell out the approach

↓

Summarize expectations/impact

- What are the expected outcomes? How the outcomes will fill the identified need?
- What do you expect your specific contributions will be?

Example: Prostate cancer

"At the completion of this project, it is our <u>expectation</u> that we will have elucidated the mechanism(s) by which Crocetin suppresses growth and migration of prostate cancer cells in vitro, and the extent to which similar events can be extrapolated to in vivo modulation of prostate cancer cell growth and metastases. It is likely, based upon our preliminary data, that the inhibitory effect will be a direct inhibition of translocation of transcription factors required for enhanced expression of the MMP-9 metalloproteinase.

The primary positive <u>impact</u> of our anticipated findings would be evidence-based scientific verification of a traditional Chinese medicine from the Crocus plant as a dietary supplement that could be considered for the prevention and/or treatment of prostate cancer. Such results would also provide opportunities for evaluating Crocetin as a therapeutic agent in other cancers and inflammatory diseases."

Tip#18 Systematic review and meta-analysis

- Systematic review
  - Identify comprehensively all studies for a specific question
  - Appraise characteristics of individual studies
  - Synthesize data from different studies
  - Pinpoint crucial area and questions that need further research

- Meta-analysis
  - Statistical techniques for combining summary statistics from similar studies.
  - Individual studies often not large enough
  - Limiting bias helps to improve reliability and accuracy of results
  - Combing results can increase power and precision of estimates of effectiveness

Comparing results from different studies to identify

- Consistent patterns (estimation of summary)
  - Synthetic objective

- Sources of disagreements among these results (estimation of differences)
  - Analytic objective

Two objectives of Meta-analysis

Example: a forest plot created using SAS SGPLOT procedure

Forest Plot:
A simple visual representation of multiple studies
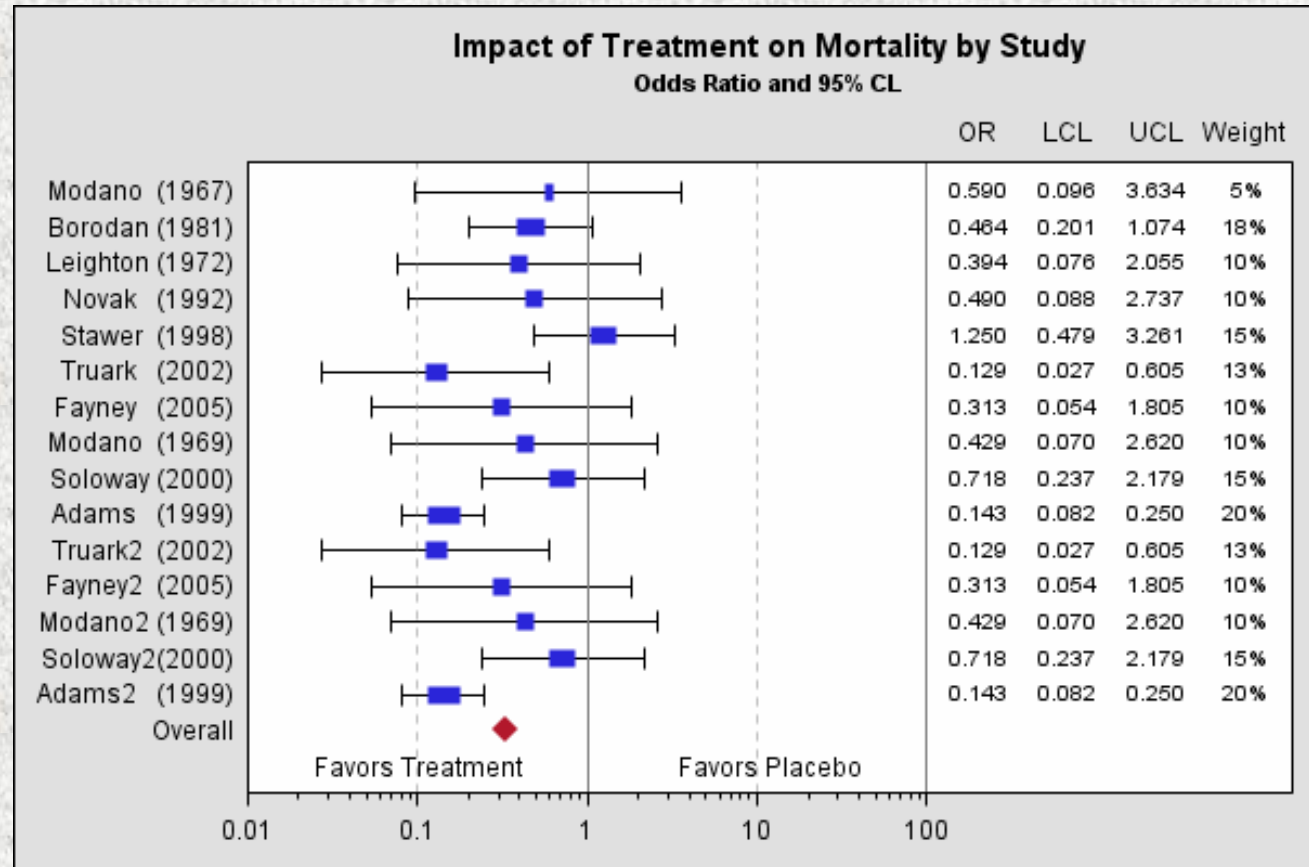
Pooling the results

- Heterogeneity is variation between the studies' results
  - When effect sizes differ consistent with chance error, the effect size estimate is considered to be <u>homogeneous</u>.
  - When the variability in effect sizes is greater than expected by chance, the effects are considered to be <u>heterogeneous</u>

- The presence of heterogeneity affects the process of the meta-analysis.

  1. Do not pool at all

  2. Ignore heterogeneity: use ***fixed effect model***

  3. Allow for heterogeneity: use ***random effects model***

  4. Explore heterogeneity: ***meta-regression***

Assessing between study heterogeneity

- The difference between the studies is due to random error
  – Observed study effect = Fixed effect + error

Key assumption:
- There is one real value for the treatment effect
- All trials estimate this one value
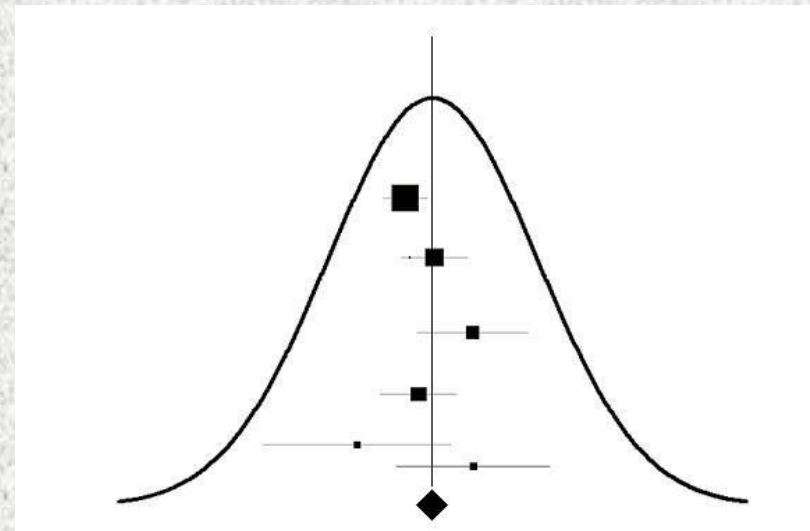
Fixed effect model

- Each study is seen as representing the mean of a distribution of studies
- There is still a resultant overall effect size

Key assumption:
- There are many possible real values for the treatment effect (depending on different conditions in different studies).
- Each trial estimates its own real value
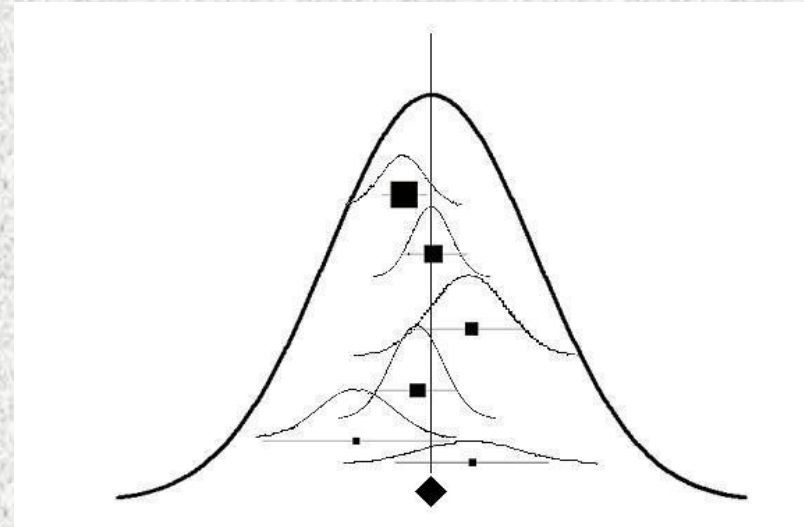
Random effects model

- Studies with significant results are more likely to be published.
- Funnel plots are used to assess publication bias.

Assumptions:
- ✓ larger studies are more likely to be accurate
- ✓ smaller studies will be more widely scattered
- ✓ publication bias will lead to asymmetry
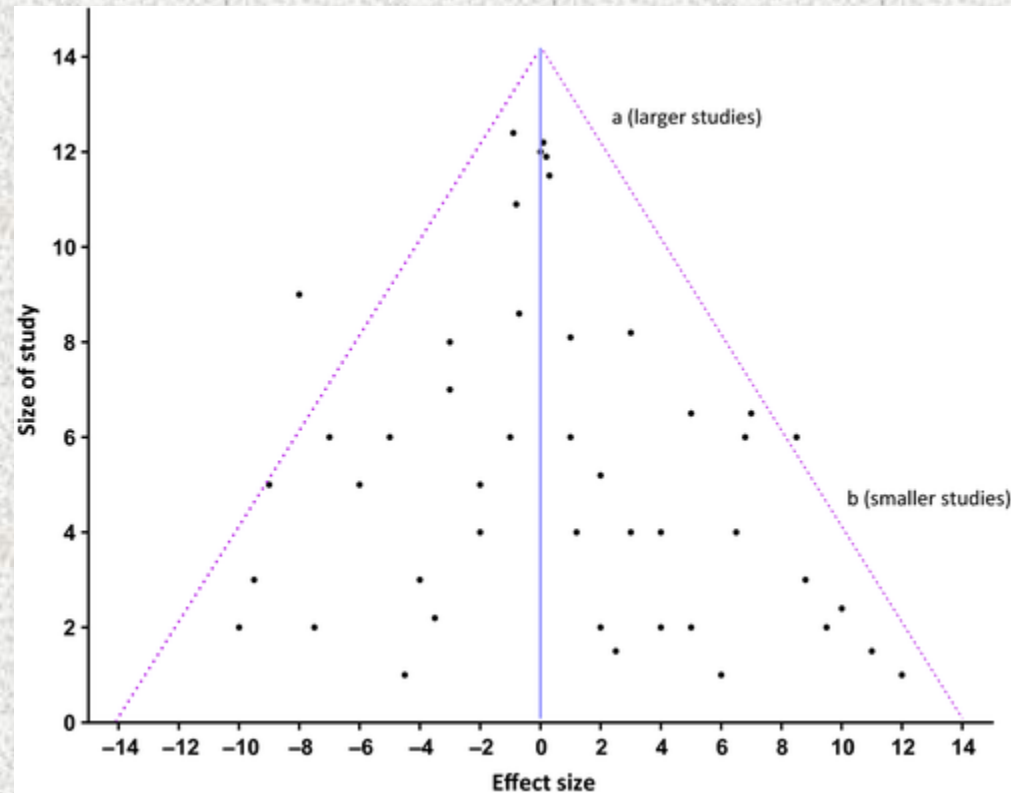
(Choi and Lam, 2015)

Publication bias

Tip#19 The nature of academic writing

- Scientific text is precise, impersonal and objective.

  – Your paper is understood to present your own opinion. Therefore, phrases such as "in my opinion" or "I think," are superfluous and a waste of words.

- It typically uses complex terminology, and various footnoting/referencing systems.

The nature of academic writing

What are the differences?

A lot of people think that the weather is getting worse. They say that this has been going on for quite a long time. I think that they are quite right. Research has shown that we now get storms etc all the time.

It is widely believed that the climate is deteriorating. It is claimed that this process has been continuing for nearly 100 years. This belief appears to be supported by McKinley (1997) who shows a 55% increase in the frequency of severe winter gales since 1905.

(Source: Bailey, Academic Writing: A handbook for International Students, 2nd edition, 2006)

- Clarity
  - If it can be misinterpreted, then it is wrong.

- Conciseness
  - Shortening the text without reducing clarity
  - Not the same as brevity
  - If a word or phrase can be removed or shortened without losing meaning, do it.

Clarity and conciseness

- Summarizing
  - Expressing someone's work in a reduced manner, capturing the most important points.

- Paraphrasing
  - Expressing someone else's ideas in your own words. Effective paraphrasing is vital in academic writing to avoid the risk of plagiarism.

Summarizing and paraphrasing

Summarizing: Example

Researchers in France and the United States have recently reported that baboons are able to think abstractly. It has been known for some time that chimpanzees are capable of abstract thought, but baboons are a more distant relation to mankind. In the experiment, scientists trained two baboons to use a personal computer and a joystick. The animals had to match computer designs which were basically the same, but had superficial differences. In the experiment the baboons performed better than would be expected by chance. The researchers describe their study in an article in the Journal of Experimental Psychology.

(Source: Bailey, Academic Writing: A handbook for International Students, 2nd edition, 2006)

(a) According to a recent article in the Journal of Experimental Psychology, baboons are able to think in an abstract way. The article describes how researchers trained two baboons to use a personal computer and a joystick. The animals did better than would be expected.

(b) French and American scientists have shown for the first time that baboons have the ability to think in an abstract way. The animals were taught to use a computer, and then had to select patterns that were similar, which they did at a rate better than chance.

Paraphrasing: Example

- The growth of the car industry parallels the development of modern capitalism.

- The rise of the automobile industry matches the progress of contemporary capitalism.

- Evidence of a lost civilization has been found off the coast of China.

- Remains of an ancient society have been discovered in the sea near China.

(Source: Bailey, Academic Writing: A handbook for International Students, 2nd edition, 2006)

Some professionals argue that you must do more than merely substitute phrases here and there. You must also completely alter the sentence structure.

Tip#20 Combining sources and developing an argument

Combining Sources: Example

Source A

Genetic modification (GM) is the most recent application of biotechnology to food, which can also be called genetic engineering or genetic manipulation. The phrase 'genetically modified organisms' or GMOs is used frequently in the scientific literature to describe plants and animals which have had DNA introduced into them by means other than the 'natural' process of an egg and a sperm.

New species have always evolved through natural selection by means of random genetic variation. Early farmers used this natural variation to selectively breed wild animals, plants and even micro-organisms such as yogurt cultures and yeasts. They produced domesticated variants better suited to the needs of humans, long before the scientific basis for the process was understood. Despite this long history of careful improvement, such procedures are now labelled 'interfering with nature'.

(Source: Bailey, Academic Writing: A handbook for International Students, 2nd edition, 2006)

Source B

Genetic modification (GM) is in fact far more than a mere development of selective breeding techniques. Combining genetic material from species that cannot breed naturally is an interference in areas which may be highly dangerous. The consequences of this kind of manipulation cannot be foreseen.

It seems undeniable that these processes may lead to major benefits in food production and the environment. Furthermore, there is no doubt that some medical advances may have saved millions of lives. However, this level of technology can contain a strong element of risk.

Our ignorance of the long-term effects of releasing GM plants or even animals into the environment means that this step should only be taken after very careful consideration.

Combining Sources: Example

Essay extract: Should genetically modified (GM) foods have a role in future agriculture?

It has been claimed that GM technology is no different from breeding techniques which have been practiced by man for thousands of years. Source A states that this process is similar to natural selection and remarks: 'such procedures are now labelled "interfering with nature"'. On the other hand, Source B considers that, although GM technology could bring considerable benefits in medicine and agriculture, it is quite different to traditional processes of selection. He believes that crossing the species barrier is a dangerous step and that there is insufficient knowledge of the long-term results of such developments.

(Source: Bailey, Academic Writing: A handbook for International Students, 2nd edition, 2006)

What phrase is used to mark the point in the text where there is a shift from one point of view to another?
What phrases are used to introduce summaries?

- You are expected to be able to defend your own claims and to persuade the reader that your claims are considered, reasonable, credible and valid.

- You will need facts, statistics, scholarly and authoritative sources of literature, examples and cases to develop and defend your argument.

- You may be required to make an argument about which there is divided opinion.
  - You should demonstrate that you are aware of the range of the current opinions.
  - You should be able to provide clear evidence to support your point of view.

Developing an argument

Developing an argument: Example

Currently, roads are often congested, which is expensive in terms of delays. It is claimed that building more roads, or widening existing ones, would ease the congestion. But not only is the cost of such work high, but the construction process adds to the congestion, while the resulting extra road space may encourage extra traffic. Therefore constructing extra roads is unlikely to solve the problem, and other remedies, such as road pricing or greater use of public transport, should be examined.
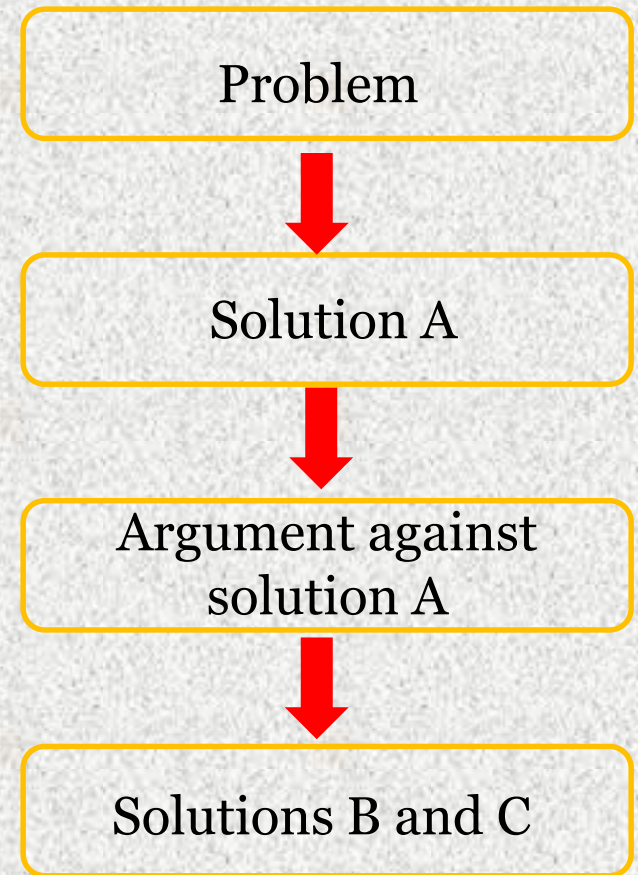
(Source: Bailey, Academic Writing: A handbook for International Students, 2nd edition, 2006)

Problem

↓

Solution A

↓

Argument against solution A

↓

Solutions B and C

- State the central idea of each paragraph explicitly in a topic sentence
- Expand on the topic sentences
- Show connections
  - Use linking words (therefore, in addition, on the other hand, …)
  - Deliberate repetition of key words

Developing coherent paragraphs

It's perhaps not surprising that Marshall McLuhan, the most influential communications expert of the twentieth century, was a Canadian. As a nation, we have been preoccupied with forging communication links among a sparse, widespread population. The old Canadian one-dollar bill, with its line of telephone poles receding to the distant horizon, illustrates this preoccupation. Year after year we strive to maintain a national radio and television broadcasting system in the face of foreign competition. We have been aggressive in entering the international high technology market with our telecommunications equipment.

(Source: Northey, Impact: A Guide to Business Communication. Toronto: Prentice-Hall, 1993)

Developing Coherent Paragraphs: Example

Tip#21 Providing references

- Avoid the charge of plagiarism
- Obtain more authority to your writing
- Allow the reader to find the original source

Providing references

Don't keep repeating "XXX says." There is a wide choice of verbs of reference.

Pattern 1: verb + **that**

assert	assume	believe	claim
conclude	consider	decide	demonstrate
determine	discover	emphasize	explain
find	imply	indicate	note
observe	point out	prove	reveal
show	state	suggest	think

Reaction to another writer's position

accept	admit	agree
argue	deny	doubt

Pattern 2: verb + sbd/sth + **for**

blame	criticize	praise
ridicule	Single out	thank

Pattern 3: verb + sbd/sth + **as**

assess	characterize	classify
define	depict	describe
evaluate	identify	interpret
present	refer	view

Verbs of reference

Tip#22 Writing a thesis/dissertation

- Generate a timetable a timetable with clear deadlines.
  - Start writing early, even before you think you are ready to write.
  - Set yourself targets to allow you progress little by little.
  - Plan to write a small amount regularly.
- Don't try to write a paper from beginning to end in order, but rather write what seems readiest to be written.
- Use outlines help you divide the writing project into many smaller, easy-to-handle pieces.

Generate a timetable

- Content
  - Miss out key literature
  - Claim too-much from the evidence

- Style
  - Poor organization
  - Lengthy sentences, redundancy
  - Ignore the style guide provided

- Process
  - Stopping after the first draft

Common traps to avoid

- Read your text aloud to yourself.

- Ask people to read what you've written. Let them know what sort of feedback you want. Ask them to point out where they find it difficult to follow.

- Don't wait until your writing is "perfect" because then people may suggest changes you won't want to make them!

Cons	**Pros**
- You might get feedback that rocks your confidence in your writing. - You may loose face if the work is not great.	- Opportunities to improve as a writer

Find readers! And request feedback

Tip#23 Writing the introduction

- Introduction
  - Moving from general to specific
  - Moving from problem to solution
  - Engage your readers' interest

- Conclusion
  - Moving from specific to general
  - Stimulate further thought

A typical structure
Abstract
Key words
Introduction
Methods
Results
Discussion/Conclusion
Acknowledgment
References

Introduction and conclusion

The create-a-research-space (CARS) Model

- Move 1: Establishing a research territory
- Move 2: Establishing a niche
- Move 3: Occupying the niche

Source: Swales and Feak (2009) Academic Writing For Graduate Students. Ann Arbor: University of Michigan Press

The Introduction Section

Move 1: Establishing a research territory

- Show that the general area is important, problematic, or relevant in some way
    - Recently, there has been a growing interest in____
    - The development of ____is a classic problem in____
    - The _____ has been extensively studied in recent years
    - The relationship between ____and ____ has been investigated by many researchers

- Review previous research in the area
    - Beginning with established major theories then moving to theories associated with individual authors

Source: Swales and Feak (2009) Academic Writing For Graduate Students. Ann Arbor: University of Michigan Press

Move 2: Establishing a niche

- Indicate a gap in the previous research, or extend previous knowledge in some way
  - However, little information …(attention, work, data, research, few studies, investigations, researchers, attempts)
  - However, it remains unclear whether …
  - Previous research has not addressed …
  - Although considerable research has been devoted to …, less attention has been paid to …
  - The findings suggest that this approach might be less effective when …
  - It would seem, therefore, that further investigations are needed in order to …

Source: Swales and Feak (2009) Academic Writing For Graduate Students. Ann Arbor: University of Michigan Press

Move 3: Occupying the niche

- Make an offer to fill the gap that has been created in Move 2.
  - Outline purposes or state the nature/value of present research
  - List research questions or hypothesis
  - Announce principal findings

Source: Swales and Feak (2009) Academic Writing For Graduate Students. Ann Arbor: University of Michigan Press

Tip#24 Writing the conclusion

The Discussion/Conclusion Section

- Discussions should be more than summaries.
  - They are difficult to write because their aim is to discuss and comment on the findings, rather than just to report them.
- They should go beyond the results.
  - more theoretical – or
  - more abstract - or
  - more general - or
  - more integrated with the field - or
  - more connected to the real world - or
  - more concerned with implications or applications.
  - or combination of the above.

(Source: Kayfetz, Academic Writing workshop, 2009)

The Discussion/Conclusion Section (a typical structure)

- Consolidate your research space; evaluate how the results fit in with the previous findings
- List the limitations of your study
  - what cannot be concluded from the study
- Offer an interpretation/explanation of the results and ward off counter-claims.
- State the implications (connect the objectives) and recommend further research

(Source: Kayfetz, Academic Writing workshop, 2009; James Hartley, Academic Writing and Publishing: A practical handbook. 2008)

The Discussion/Conclusion Section

- Indicate limitations of your study
  - It should be noted that this study has been primarily concerned with …
  - The findings of this study are restricted to …
  - We would like to point out that we have not …
  - The results of this study cannot be taken as evidence for …
  - Unfortunately, we are unable to determine from this data …
  - Notwithstanding its limitations, this study does suggest

There is some merit in indicating limitations of your study.

(Source: Kayfetz, Academic Writing workshop, 2009)

Tip#25 Writing the abstract

The Abstract

- The abstract, although it heads the article, is often written last, together with the title.

- The function of an abstract is to allow readers to judge whether or not the paper is of relevance to them.

- Many scientists browse research papers outside their area of expertise. Abstracts should be self-contained and written for as broad a readership as possible.

The Abstract

- Why did you do this study or project?
- What did you do, and how?
- What did you find?
- What do your findings mean?

Key words

- A wise choice of key words increases the probability that a paper will be retrieved and read, thereby potentially improving citation counts and journal impact factors.
    - Avoid terms that are too common.
    - Do not repeat key words from the title.
    - Include alternative terminology.

Tip#26 Checklist for your review

Checklist for your review

- Does your review start at a more general level?
- Have you summarized each subtopic and made clear connection between the subtopics & the topic?
- Have you covered the key theories of recognized experts in the area?
  - Up to date?
  - References that are counter to your own opinion
- Have you uncovered gaps or inconsistencies in knowledge?
- Are facts and opinions clearly distinguished?
- Have you presented a rationale for your study?