National Technical University of Athens

The Introduction section of a research paper

Week 10

Goni Togia

Source material

- The following sources have been used:
  - Glasman-Deal, H. 2010. *Science Research Writing*. London: Imperial College Press.
  - Wallwork, A., 2016, *English for Writing Research Papers*, 2nd.ed., Springer, Heidelberg,.

1. Read the excerpt on Helios and answer the following questions:

- Identify the major purpose of each paragraph.
- How detailed are the authors' descriptions of others' works?
- What do you notice about the language and writing conventions used by the authors?
- What tenses are used? Find two examples of each. Based on this Introduction, what general trends might you suggest about the use of tenses in the Introduction of a journal article?

- Excerpt: Helios > Week 10 > Sample_Introduction

1. Read the following excerpt and answer the following questions:

- Reread the first and last paragraphs and restate the importance of the work in your own words.
- Examine the ways in which the authors cite others' works. Propose two citation rules that the authors appear to be following.

What is the Introduction section?

- The Introduction presents the background knowledge that readers need so that they can appreciate how the findings of the paper are an advance on current knowledge in the field.

- A key skill here is:
  - to be able to say the same things that have been said many times before but in a different, interesting, intriguing way.

2.Your task:

- Based on your understanding of the purpose and intended audience of research papers and textbooks examine the excerpts on Helios > Week 10 > Further Intro_Tasks and state which ones are from research papers (introduction or discussion sections) and which from textbooks.
  - Two are from Introduction sections, two from Discussion sections and two from textbooks.

The structure of the Introduction

- An Introduction generally answers the following questions.
  - What is the problem?
  - Are there any existing solutions (i.e. in the literature)?
  - Which solution is the best?
  - What is its main limitation? (i.e. What research gap am I hoping to fill?)
  - What do I hope to achieve?
  - Have I achieved what I set out to do?

    - If your Introduction is more than a couple of pages, subheadings will make it much more 'digestible' for the reader (more likely in a Diploma/Ph.D. thesis)

Abstract vs. Introduction

- There is some overlap between the Abstract and the Introduction.

- However, a frequent problem is that authors may cut and paste from their Abstract into their Introduction,
  - which can be very repetitive for readers.

Abstract vs. Introduction

- The following slides contain the Abstract and Introduction of a paper entitled:
  - *Fragmentation of Rods by Cascading Cracks: Why Spaghetti Does Not Break in Half*
    - by B. Audoly and S. Neukirch.

Abstract vs. Introduction

- Abstract
  - When thin brittle rods such as dry spaghetti pasta are bent beyond their limit curvature, they often break into more than two pieces, typically three or four [general problem area]. With the aim of understanding these multiple breakings, we study the dynamics of a bent rod that is suddenly released at one end [focus of the paper]. We found that the sudden relaxation of the curvature at this end leads to a burst of flexural waves, whose dynamics are described by a self-similar solution with no adjustable parameters [result]. These flexural waves locally increase the curvature in the rod, and we argue that this counterintuitive mechanism is responsible for the fragmentation of brittle rods under bending [implication/importance of the study]. A simple experiment supporting the claim is presented [method].

Abstract vs. Introduction

- Abstract:
  - immediately informs the readers of the specific topic of the paper and the authors' goal.
  - It contains no unnecessary background information, but highlights what the authors found in their research.
  - An minimum number of words is used (121), which is effective, in this case, in that it tells readers only what they need to know to enable them to decide whether to read the whole paper.
    - Typically, abstracts are not longer than 250 words.
  - As is standard for Abstracts, no references to the literature are made (i.e. no citations are used).

Abstract vs. Introduction

- Introduction
  - The physical process of fragmentation is relevant to several areas of science and technology. Because different physical phenomena are at work during the fragmentation of a solid body, it has mainly been studied from a statistical viewpoint [1–5]. Nevertheless a growing number of studies have included physical considerations: surface energy contributions [6], nucleation and growth properties of the fracture process [7], elastic buckling [8, 9], and stress wave propagation [10]. Usually, in dynamic fragmentation, the abrupt application of fracturing forces (e.g. by an impact) triggers numerous elementary breaking processes, making a statistical study of the fragments sizes possible. This is opposed to quasi-static fragmentation where a solid is crushed or broken at small applied velocities [11].

Abstract vs. Introduction

- Introduction:
  - It starts by setting the context in very general terms.
  - Then the writers introduce the main line of research in this area, which is countered by another line of research.
    - Readers are alerted to the alternative line of research by the linking word *nevertheless* .
  - References to the literature are abundant.

Abstract vs. Introduction

- Introduction (continued):
  - Here we consider such a quasi-static experiment whereby a dry spaghetti is bent beyond its limit curvature. This experiment is famous as, most of the time, the pasta does not break in half but typically in three to ten pieces. In this paper, we explain this multiple failure process and point out a general mechanism of cascading failure in rods: a breaking event induces strong flexural waves which trigger other breakings, leading to an avalanche-like process.

  - Compare the above paragraph to the sentence in the abstract where the method is explained using only 8 words.

Abstract vs. Introduction

- Abstract:
  - A simple experiment supporting the claim is presented.

- This eight-word sentence is expanded considerably in the Introduction, by describing more about what the experiment consisted in, and the result it gave.

What is the typical structure of an Introduction?

- A typical Introduction consists of a sequence of ten parts, each with a specific role.
- You don't always need to include all ten parts nor sequence them in the same order.

- Your aim is to include only enough background information to allow your reader to understand:
  - The general context in which your research is placed.
  - Why your hypotheses, predictions or expected results are reasonable.

What is the typical structure of an Introduction?

- Nearly every Introduction, irrespective of discipline, would incorporate those parts marked with an asterisk (*).

- The proportion of space given to each part (particularly with regard to the review of the literature) will obviously vary from discipline to discipline, and from paper to paper.

What is the typical structure of an Introduction?

	FUNCTION	AUTHOR'S TEXT
1	definition of the topic plus background	An XYZ battery is a battery that… The electrodes in an XYZ telephone battery are made of a composite of gold and silver, coated with a layer of platinum. The gold and silver provide structural support, while the platinum provides resilience.
* 2	accepted state of the art plus problem to be resolved	The performance of the battery can be strongly affected by the number of times the battery is recharged and the duration of each individual recharge. The battery is subject to three possible failure modes. …
3	authors' objectives	A research program has recently been started by the authors in collaboration with a major battery manufacturer, with the goal of developing new design models for XYZ batteries. Analytical techniques are needed that can predict …
* 4	introduction to the literature	Computational techniques have been extensively applied to the study of the lifetime of XYZ batteries, in particular with regard to the number of times a battery is charged. However, little research to date has focused on the length of each individual recharge.

Parts that are necessary in every Introduction are marked with *

Wallwark, 2016, pp 254-55

What is the typical structure of an Introduction?

	FUNCTION	AUTHOR'S TEXT
*5	survey of pertinent literature	More recent research has occurred in the field of laptop and jPud batteries. Evans [15] studied the lifetime in 5G jPud batteries. Smith [16] and Jones [18] found that … However their findings failed to account for …
*6	authors' contribution	To the best of our knowledge there are no results in the literature regarding how the length of each recharge impacts on the silver and gold in the electrodes.
*7	aim of the present work	The aim of the present work is to construct a model to perform a comprehensive investigation of the effect of recharging on the electrodes, and to find a new proportion in the amount of metals used. The assumptions of Smith [16] and Jones [18] are used as a starting point …
8	main results / conclusions	The results of the model are encouraging and show that …
9	future implications	This new model will be able to …
10	outline of structure	Section 2 introduces the concept of …

The research gap

How the authors have addressed the research gap

Parts that are necessary in every Introduction are marked with *

Wallwark, 2016, pp 254-55

1. Definition of the topic plus background (1-3 sentences)

- Here the definition of the XYZ battery indicates to the reader that this is the background topic (i.e. the general context) of the paper. This is the place to include notations, technical definitions, and explanations of key words.

- The second and third sentences give information that readers should already be familiar with and suggest why the topic is important and of interest.

2. accepted state of the art plus problem to be resolved (2–4 sentences)*

- The authors now move from a general context to their specific area of research:
  - XYZ batteries in telephones, and more specifically, the problems inherent in such batteries.
- This is the general problem area in which the current research is placed.
  - This part is new and therefore most interesting for the readers.

- Here you should state in a clear way:
  - exactly what the problem is, why you chose it and why you claim it is important.

Sections marked with an asterisk indicate sections that should appear in every Introduction irrespective of discipline

3. Authors' objectives (1-2 sentences)

- Here the authors outline their major objectives, i.e. how they intend to address the problem.
- Parts 6 and 7 could be incorporated here. This part also serves as a transition into the literature review.

- This can be introduced here or it can introduced later in parts 6 and 7.

4 + 5. Literature review *

- This introduces the background literature that the authors intend to refer to in order to motivate their particular research.

- This may be in a separate section with its own heading.
  - Usually, this is the case in Diploma theses, Master's dissertations, or Ph.D. theses.

4 + 5. Literature review *

- It often draws attention to problems that have still not been solved.
- For example, you may think a particular study did not investigate some necessary aspect of the area, or that the authors failed to notice some problem with their results.
- You only need to describe what is necessary for the specific purposes of your paper and not all aspects relating to that research.
  - In the Discussion section of the paper, this literature will be used for comparative purposes.
- The length of the literature review (i.e. Parts 4 and 5) ranges from a paragraph to several pages.

6. Authors' contribution (1-2 sentences)*

- Here the authors make a very clear statement of how they advance on current knowledge (i.e. the knowledge outlined in parts 2, 4, and 5).
- This is where the research gap is explicitly described; this is made clear by the use of expressions such as:
  - However
  - To the best of our knowledge there are no …
  - It is not yet known / has not yet been established whether X can do Y…
  - *A* major difficulty / drawback / disadvantage / flaw *of X is* …
  - *One of the main issues* in our knowledge of / what we know about *X is a lack of* …

7. Aim of the present work (1-2 sentences)*

- This describes the objectives of the research and the expected outcome.

- You will need to tell readers what method you used and possibly why you chose this method.

8. Main results of the present work (1-4 sentences)

- Although your main results will be given in other sections of your paper (typically in Results, Discussion and Conclusions),
  - many authors also announce them here to show how the background situation plus their contribution have led to particular results.

9. Future implications of the work (1-2 sentences)

- Some authors prefer to delay mentioning implications to the Discussion or even to the Conclusions.

- However, mentioning implications here gives readers an instant idea of the possible importance of your work, which may be useful for them as they read the rest of the paper.

10. Outline of structure (3-4 very short sentences)

- This outlines the structure of your paper.
- It may not be necessary if the structure of your paper is completely standard for your chosen journal, and thus readers will already know in what order the various elements of your research will be presented.

Introduction structure at a glance

- Background information and the importance of the current study.
- *More background information and the general problem area.
- *Literature review.
- *Research gap.
- *The objectives of the research, authors' contribution / objectives.
- Methods/results/conclusions.
- Implications.
  - The last 2 parts can be discussed in the same paragraph.
- Outline of the paper.

Introduction structure at a glance

- Background information and the importance of the current study.
- More background information and the general problem area
- Literature review
- Research gap
- The objectives of the research, authors' contribution / objectives
- Methods/results/conclusions
- Implications
  - The last 2 parts can be discussed in the same paragraph.
- Outline of the paper.

What tenses would I use?

- The present simple:
  - is generally used to begin the Introduction in order to describe the general background context, i.e. what is known already.
- The present perfect:
  - is then used to show how the problem has been approached from the past until the present day.
- During the review of the literature, several tenses are used.
- At the end of the Introduction, the present simple is used again when the authors state what they will do in the rest of their paper (*we explain, I hypothesize*).

What are the typical pitfalls of an Introduction?

- It is necessary to:
  - (i) Describe, with at least one sentence, what others have done in relation to your own work.
  - (ii) Describe how your contribution is original and where it differs from previous work.

- To do this you can:
  - List the shortcomings of previous approaches and clearly state how your proposed approach is an improvement.
  - Introduce an approach, algorithm, procedure, experiment, and so on and validate it.
- A key issue is to make it clear whose work you are talking about: yours or another author's.

What are the typical pitfalls of an Introduction?

- We ***performed*** two tests. Blake et al [1]. ***carried out*** one replication.
- Two tests ***were performed***. One replication ***was carried*** out by Blake [1].

- This is a limitation of our data assimilation system, which **we plan** to change in the near future.

- The same lack of regard for others was present amongst subjects who used their mobile phone while driving their car, in agreement with the higher values of selfish behaviour that **we observed** in cigarette smokers and which **has also been found by other authors / has also been ackowledged in other studies** [1-4].

2.Your task:

- Briefly state the general topic of each article based on the sentences given.
- Helios > Week 10 > Further Intro_Tasks, Task 2

Summary

- To make a self-assessment of your Introduction, you can ask yourself the following questions:
  1. Does my Introduction occupy too large a proportion of the entire paper?
  2. Does it contain too many general statements that are already widely known?
  3. Is the background information all related to the objective of the paper?
  4. Are the rationale and objectives defined?
  5. Is it clear what problem I am addressing or trying to solve and why I chose my particular methodology?
  6. Have I referred to pertinent literature that motivated my research?

Summary

- To make a self-assessment of your Introduction, you can ask yourself the following questions:
  7. Is it clear what the reader can expect in the rest of the paper (i.e. main results and conclusions)?
  8. Is it sufficiently different from the Abstract, without any cut and pastes?
  9. Have I been as concise as possible?
  10. Have I used tenses correctly? present simple (general background context, description of what will be done in the paper), present perfect (past to present solutions), past simple (my contribution, although this may also be expressed using the present simple or future simple)