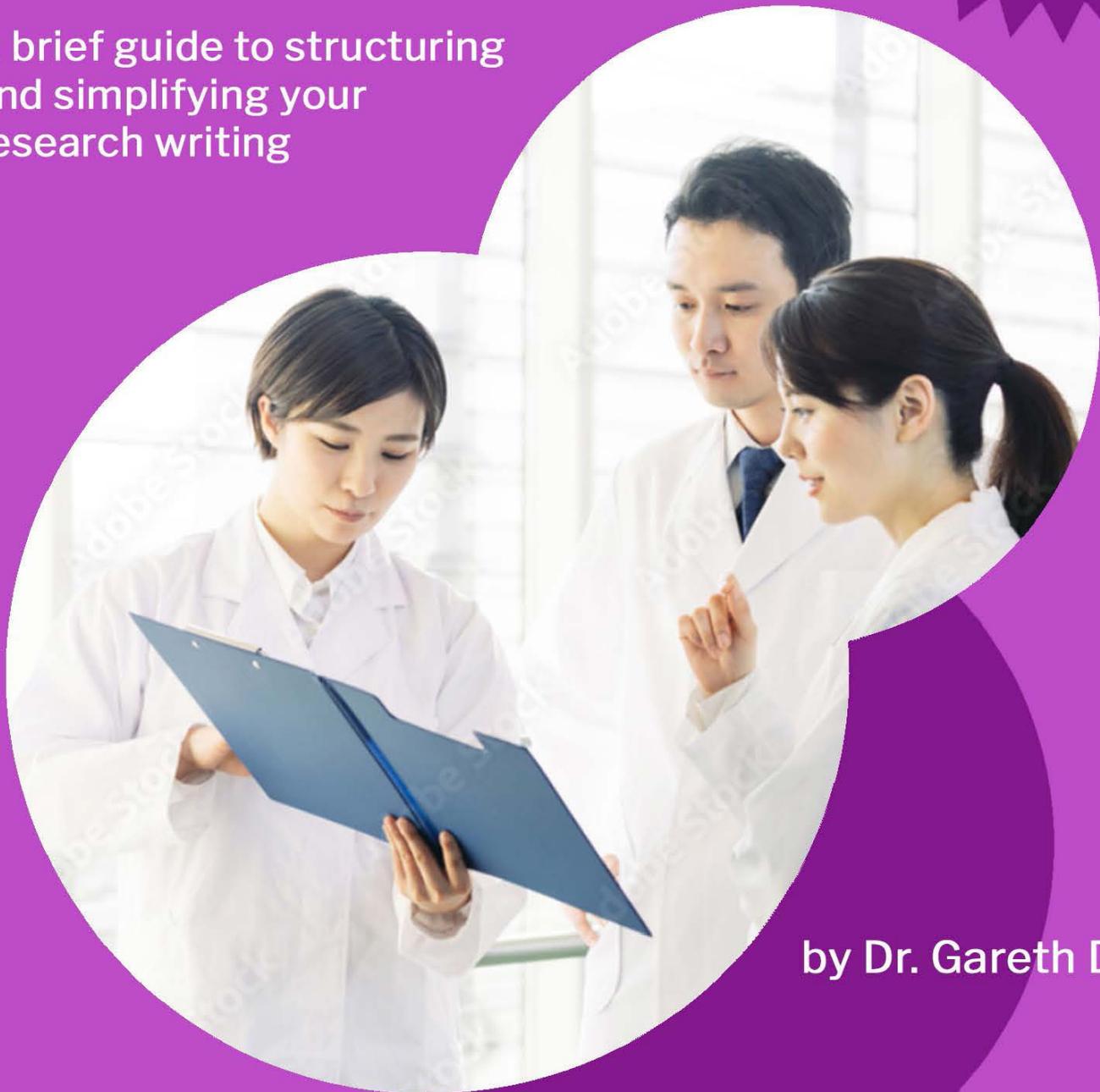


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A brief guide to structuring
and simplifying your
research writing



by Dr. Gareth Dyke

Effective English Writing for Researchers Part 1

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Introduction and Goals

How can you write English more effectively and easily?

The goal of this guide is to help you write effectively in English. We know, it's not easy! Especially if English is your second, third, or fourth language. We are here to help.

We'll consider cognition, how to write effectively, and how to increase the resultant visibility of your research. We'll cover some rules and guidelines as well as tips and tricks.

Writing effectively in English is all about learning to be an effective communicator. It's not about grammar, it's not about learning all the rules. Writing is a skill you can develop, not a talent. This is important to keep in mind as we get started.

This guide is structured into four parts to keep things simple. First, we'll consider the logical structure of an academic paper, before moving on to help you improve your readability.

Our goal with these structured easy-to-follow guides is to help you increase your chance of publication and your research impact.

1. Understanding your reader

We don't write academic papers so we can pin them to the wall, or give them to our mothers as presents. No. We write academic research articles so others will read them and, hopefully, cite them. This is our goal: Writing a paper that does not get read and cited is almost as bad as not writing a paper at all. Readers are key!

We must appeal to our readers as academic writers. We must engage and capture their interest and do the best we can to make sure readers get to the end of our work and think: I agree! I do think that this is the correct, expected outcome. More on this later.

Here are some fun facts about your readers who, by the way, are almost certainly not going to be native English speakers. Where is most of the research in the world getting done these days? Much of it is taking place in Asia, in countries like Japan and China where English is not spoken as a first language.

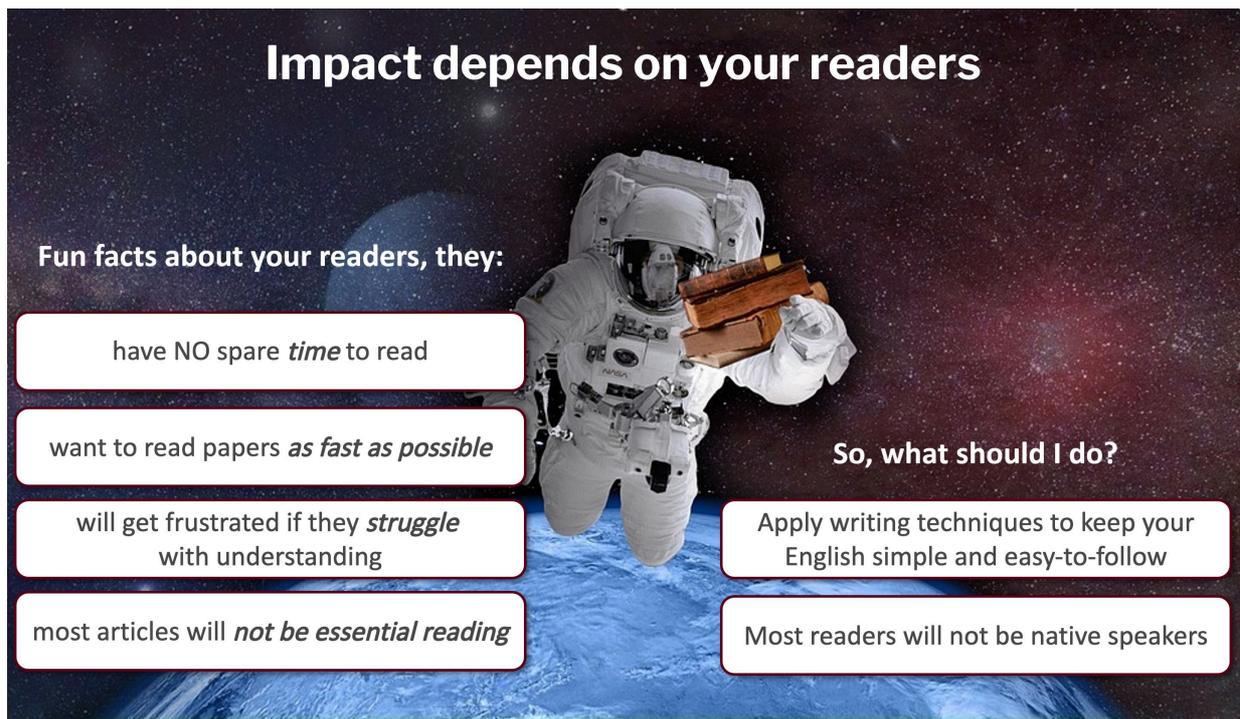


Figure 1. Your readers are the most important people in the academic writing and publishing cycle. If no-one reads your papers, then no-one will cite your papers.

It's also informative to think about why we choose to share our research. What's the purpose of an academic paper? Why write at all? The goal of writing a research article is to explain new information to readers in order that they will remember and use that content. You need to get your message across. So, your goals as a writer are to explain new information in such a way that readers will remember, retain, and use your new knowledge.

The goal of this guide is to help you do this easily and effectively in English. We know that English is probably not your native language, but even if it is: We are here to help!

2. Cognitive learning: The basis for effective communication

Effective writers are able to understand their readers by applying three important learning principles. We'll deal with each of these in turn: cognitive load theory, cognitive bias, and reader expectations. The first, cognitive load theory, has to do with understanding just how much new information your readers are able to process, while the second, cognitive bias, warns us not to assume that our readers know as much as we do (we'll come back to this).

Finally, the logical presentation of information for readers is important: the readers of academic papers expect to see and absorb information in a certain specific order. This is the **logical structure of an academic article**.

2.1 Cognitive load theory: How much information can our readers process?

Did you know that research has shown that the human brain can only process between seven and nine new pieces of information at any time? This is cognitive load.

This feeds into our understanding of sentence structure and length. It's best therefore to write using sentences that are shorter rather than longer: sentences 10 words in length tend to be recalled by readers 98% of the time, while those that are 20 words in length are recalled 85% of the time. The drop-off after that is significant: sentences 30 words in length are recalled 70% of the time, while those 50 words in length have just 58% recall.



Figure 2. Average sentence understanding rates for readers. This is cognitive load theory.

What does this mean? We recommend that you aim for 10-20 words per sentence on average. Some longer and some shorter are still fine of course, but as a general rule: shorter sentences are better than longer cumbersome ones.

At the same time, aim for just one idea per sentence. This is the concept of topic sentences (which we'll return to a little later on in this guide). Use semi-colons in sentences only when necessary and make sure you clearly and thoroughly explain your ideas to your readers.

Cognitive load theory, the amount of information readers are able to process, also teaches us to avoid the use of unnecessary words that do not add value to ideas. Here's a simple rule to follow in your writing: **can you delete a word without changing the meaning of a sentence?** If yes, then **delete those words**.

The best way to manage this is to read out your work aloud: read to your pets, read to your dog, read to your cat, read to your goldfish! Reading your work aloud helps to identify those cumbersome phrases and words that are not needed for meaning, words that do not add values to a presented idea.

"It is **well known** that most of the intense diffraction peaks..."

"~~As a matter of fact, such a~~ **This** low-temperature reaction..."

"~~A number of studies have shown that the~~ charged group..."

"~~That is another reason why~~ **Therefore**, we believe..."

"...as described **previously** in ~~our previous study.~~"

"...at a **flow rate of 1.0 mL/min.**"

Figure 3. Deleting unnecessary words. The best way to identify these words is to read your work aloud. I usually do this in front of a mirror!

Another great trick is to become **friends with adverbs**. These are an editor's best friends! Adverbs are great because their shorten sentences and augment meaning.

Introducing an editors best friends: ADVERBS!

Adverbs are awesome: They can be used to make writing **shorter** and more **effective**



An **adverb** is a word or an expression that modifies a verb, adjective, another adverb, determiner, clause, preposition, or sentence.



Something complex → Simple and concise

It was **evident** that... **Evidently...**
 It was **possible** that... **Possibly...**
 It is interesting to **note** that... **Notably...**
 It was **obvious** to conclude **Obviously...**

Effective English writing always involves shorter sentences

Why use **six** words when **one** will do?

• Select	• Survive	• Access	• Pursue	• Identify	• Require	• Seek	• Locate	• Enforce	• Adapt
• Link	• Derive	• Refine	• Assume	• Occur	• Assist	• Create	• Validate	• Facilitate	• Deduct
• Focus	• Allocate	• Emerge	• Contract	• Conduct	• Consume	• Modify	• Impose	• Retain	• Comprise
• Assess	• Imply	• Justify	• Categorize	• Contrast	• Grant	• Classify	• Invest	• Compound	• Insert
• Analyze	• Publish	• Rely	• Evaluate	• Integrate	• Occupy	• Monitor	• Survey	• Contribute	• Expand
• Approach	• Specify	• Attribute	• Participate	• Deviate	• Indicate	• Achieve	• Constrain	• Emphasize	• Promote
• Estimate	• Isolate	• Publish	• Implement	• Restore	• Attain	• Legislate	• Document	• Interact	• Consult
• Involve	• Submit	• Clarify	• Prioritize	• Diminish	• Claim	• Compensate	• Allocate	• React	• Assign
• Respond	• Detect	• Guide	• Define	• State	• Decline	• Communicate	• Precede	• Obtain	• Fund
• Remove	• Establish	• Generate	• Consent	• Maintain	• Confirm	• Comprehend	• Channel	• Restrict	• Reinforce
• Commit	• Process	• Inhibit	• Demonstrate	• Regulate	• Intervene	• Contradict	• Convert	• Alternate	• Confine
• Perceive	• Affect	• Aid	• Illustrate		• Reverse	• Function	• Conclude	• Coordinate	• Argue



Adverbs typically express manner, place, time, frequency, degree, level of certainty, etc.



Figure 4. This is why I love adverbs! They are great for shortening sentences and making English writing clearer and more effective.

2.2 Cognitive bias: Understanding your reader

Cognitive bias is where you assume that your readers know the same amount about a particular subject as you do, the expert researcher. Sounds obvious, but you'd be amazed how many academic papers do just that: confuse the reader by assuming a level of knowledge that's just not there. It's like my nephew: when I visit him, he is invariably playing computer games. I'm a little older. But he talks to me as though I really do know what he's talking about: cognitive bias in action. **Make sure to take the time to carefully explain things in your papers so that your readers don't lose interest.**

It's important to remember that your interests boil down to a small area within a much larger field of research. Science is vast and difficult. Never assume your readers know as much as you do about your work. Provide helpful background information so that your readers are able to understand your new, important, information.

As editors, we encounter **cognitive bias** throughout academic articles. In the Introduction, writers don't define their ideas or theories effectively and don't tell readers about their research problem. What's the issue that your paper seeks to address? Similarly, in the Methods, writers don't define their methodologies or the significance of their data. How was the study conducted? What was done? How can the work be repeated? Conclusions too; writers don't discuss the implications of their research or possible future directions. Which new hypotheses or ideas stem from your project? Talk about these ideas in your discussion and conclusions so that other researchers will be forced to cite you. They will have to use your work: Don't just let others come up with ideas on their own on the basis of your work! This is also key, by the way, as a strategy to get your work successfully through peer review. Don't be **ambiguous in your writing**: As we've discussed, it's important to clearly explain your ideas to your readers. With this in mind, try to avoid the use of unclear subjects in your writing: words like 'this', 'that', 'these', 'those', 'they', and 'it' can be confusing for readers.

'... 320 and 531 participants were randomly allocated into experimental and control groups. **They** were they'

This is confusing. Which group? What was the treatment? This is an example of cognitive bias: You know what you mean (of course, you are the subject area specialist, the expert, but does your reader? Perhaps not). In this example we might rather write "The participants were" to avoid any issues in understanding.

In a similar vein, let's talk about the issue of **qualitative words**. Words 'some', 'most', and 'few'. You are a quantitative researcher, you deal in absolutes: there is no place for these words in your papers. 'Few of the participants experienced an issue in treatment' What does this mean? What does 'few' refer to here? Are we talking about 10%, 5%, 1% ..? This is just another example of where, and why, it's important to clearly explain your ideas to your readers to avoid a loss of understanding. Better to write: '10 participants experienced adverse events out of a total sample of 2,000'.

Subjective words are also an issue in this context. These are superlative words, informal words like ‘surprisingly’, ‘strikingly’, and ‘interestingly’. Again, academic writing should be objective, not subjective and so, please, have a think about whether your result was really so ‘surprising’ or ‘interesting’. The use of these words can imply a lack of knowledge, at least to readers and peer reviewers.

One of my favourite subjective words, is ‘unexpectedly’. Although sometimes good to use as a linking word, it’s nevertheless important to think about meaning as often words like this are used at the start of sentences but could just be deleted. ‘Unexpectedly, the results of this study imply ...’ would be better just written as ‘The results of this study imply ...’. Simpler and to the point.

I once worked with a French researcher who started lots of his English sentences with ‘Be that as it may, ...’. Again, this is subjective and not needed. As we’ve discussed, read your work aloud and you’ll be able to much more easily highlight these kinds of issues with word choice and word use.

2.3 Logical information presentation

If you are interested in learning more about the shape of academic papers, especially ones in STM subjects, then check out our other guidebook in this series, our ‘Clinical Research Writing Template’. In this companion guide, we talk in detail about the shape of research articles and provide templates for effective (and easier) academic writing. Here, we’ll talk more about effective communication in English.

Effective communicators are effective guides, leading their readers through their articles from one idea to the next. This is what you are aiming for with your articles. You want your readers to get to the end of your articles and think: ‘I agree, I expected that’. ‘I think the paper was well-written and engaging’, and lets face it: if people don’t find your papers interesting, well-written, and engaging they’ll probably turn off after the Title and Abstract and go off and do something else.

Academic papers are no different from any other kind of creative writing, such as detective stories or film plots. Readers need to be kept engaged and they need to know where they have come from and where they are going. Structure is key to creating a road map for readers as well as the use of signposting words and phrases. The use of these kinds of linking words and phrases help readers to more quickly understand expected ideas.

Similarity	Contrast	Outcome/Result	Addition
In a similar way, In a similar fashion, Likewise, Similarly,	Although Despite this, However, In contrast, Whereas	As a result of Because of Consequently, Due to Owing to	Additionally, Also, Furthermore, Moreover,

Figure 5. Words commonly used in academic articles to link one sentence to another.

The logical structure of sentences builds into the structure of paragraphs, as we'll see. Let's have a think about sentences to start with. One good idea to think about to get us started is to place the topic at the start and then the stress position, the most important message, at the end of your sentence in order to link one sentence into the next one. This stress position at the end of a sentence links into the next, as well as giving readers the topic of the next. This is an important rule of thumb for sentence writing in general: flow from one into another with key information linking into the next sentence there at the end. This technique is called 'signposting', and it also works at the level of paragraphs (building on this simple approach for sentences).

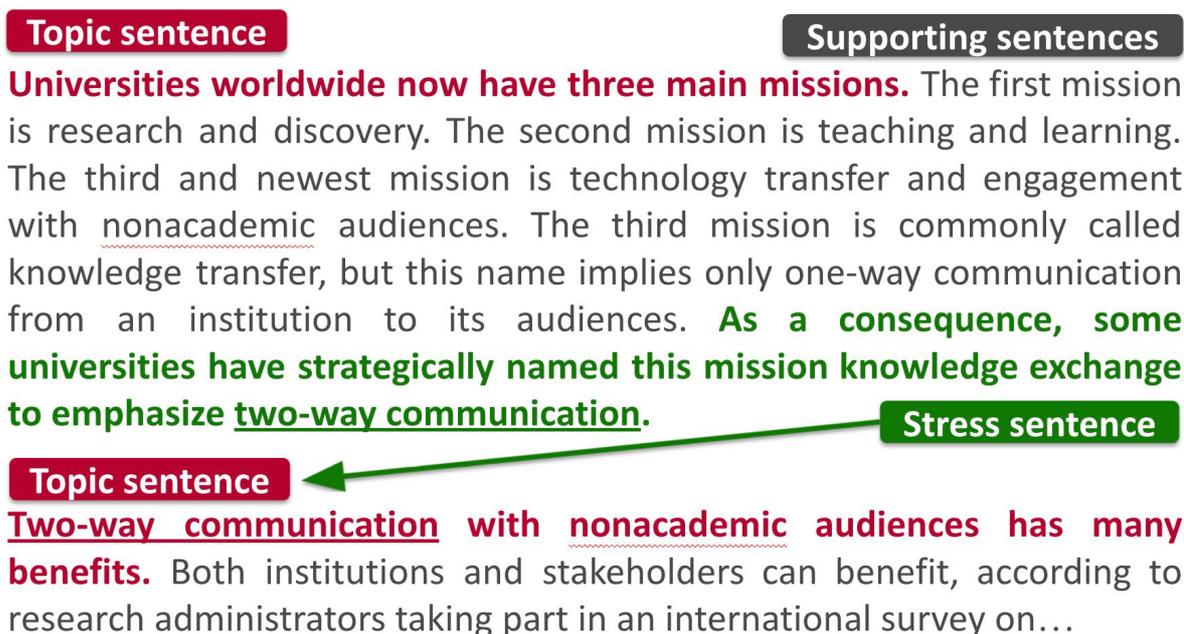


Figure 6 The shape of a well-structured paragraph builds on the shape of a well-structured sentence. Note the topic at the start of the sentence and then the stress at the end. This is a good way to structure your academic writing when putting articles

In this regard, think about logically structuring your writing to get your message across to readers by introducing an idea, then developing it, and then going onto expanding on the importance of this theme. The end of each section then links into the next: readers will know what the next phrase or paragraph is about. This simple approach enables you to more

effectively structure your writing **around ideas**. These are themes, topics for sentences. Keep your readers engaged with a logical writing structure.

3. Logical structure to writing

Clearly, the structure of sentences can influence your reader's interpretations. Getting this right is tricky, however, and includes word placement and paragraph structure. We'll deal with each of these topics in turn and provide some insights into effective writing.

3.1 Word placement

Verbs are movement words. Action words. Words that do something. Readers expect verbs to closely follow the subject in a sentence, or they tend to get confused. Thus, a sentence with a subject placed earlier in the word order and separated far away from a verb tends to be harder to understand than one where the subject and verb are placed much closer together.

Let's consider an example:

'The **viral infection** over five years as measured in our data had **declined** greatly within the Japanese population'

'The **viral infection** had **declined** greatly over five years within the Japanese population'

General rule: try to keep the subject and action towards the beginning of a sentence in order to aid understanding for readers. Words at the beginning of a sentence do tend to carry more weight than those in the middle. In addition to subjects and actions, important words should also therefore be placed as early as possible.

'The conversion from one kind of engine to another, however, was more frequent after initial testing'.

Compared to:

'However, the conversion from one kind of engine to another was more frequent after initial testing'.

The second sentence is the easier to read.

Similarly, it is also important to place negative words towards the start of sentences, again, in order to get your message across. Consider one example:

‘We found evidence supporting the role of social programs in increasing wages **was lacking**’.

or

‘We found no evidence supporting the role of social programs in increasing wages.’

3.2 Clause length

Sounds complex. Do you know the difference between a so-called ‘main’ clause and a ‘subordinate’ one? A main clause is a sentence, or part of a sentence, that contains a subject and an object while a subordinate clause is a sentence fragment that does not make sense alone. Subordinate clauses can be short, one word like ‘but’ or ‘however’, or longer – like my personal favourite, ‘but be that as it may’.

Knowing a writing trick involving clause length in this context is useful because, as we have discussed, sentence structure influences reader’s interpretations. What this means in practice is that you can use the position of clauses to influence interpretations.

How about this example (imagine you are a peer-reviewer of a paper):

‘Although this paper is important, there are a number of issues including in the methods’

‘Although this paper is important, there are a number of issues including in the methods, the results, the data presentation, and in the figures’.

Which of these sentences comes across as **more** negative?

Adding clauses to a sentence can be used to reinforce a point or to ensure that your opinion is effectively communicated. What will the editor think when she/he reads this? If you write an opinion but all additional clauses to reinforce that point-of-view then your message gets across more clearly to your readers. This is a good one for peer-review, as we mentioned.

3.3 Paragraph structure

The structure of academic writing is important if you are going to be effective because science is vast. Your own specific subject area is just a small point in the wider universe of science and so it’s key, as we’ve discussed, to work on techniques you can apply in your writing to get your message across as clearly and effectively as possible. This means that we

have to act as guides when writing academic papers to ensure that our readers are brought into a broad field and then led to the narrow topic of your research.

What this means in practice is that it is a bad idea to start of your article writing with the specifics of your own research question. Not too many people will care about that from the outset. First you have to tell your reader **why** your work is important in a broader context, as we've already discussed in this guide.

Start of your articles in the Introduction then by being broad: talk about the wider question, the bigger picture. Imagine: you are an ecologist working on heavy metal pollution in soil. Don't start your paper with the specific details of your question, start by broadening the scope and telling your reader who your work fits into a bigger picture:

'Soil pollution is important globally' → 'Within the soil heavy metals accumulate' → The aim of this paper is to ...' etc.

Structure like this can work well.

This is the reason that academic papers are often described as being 'hourglass' (or 'egg-timer') shaped.

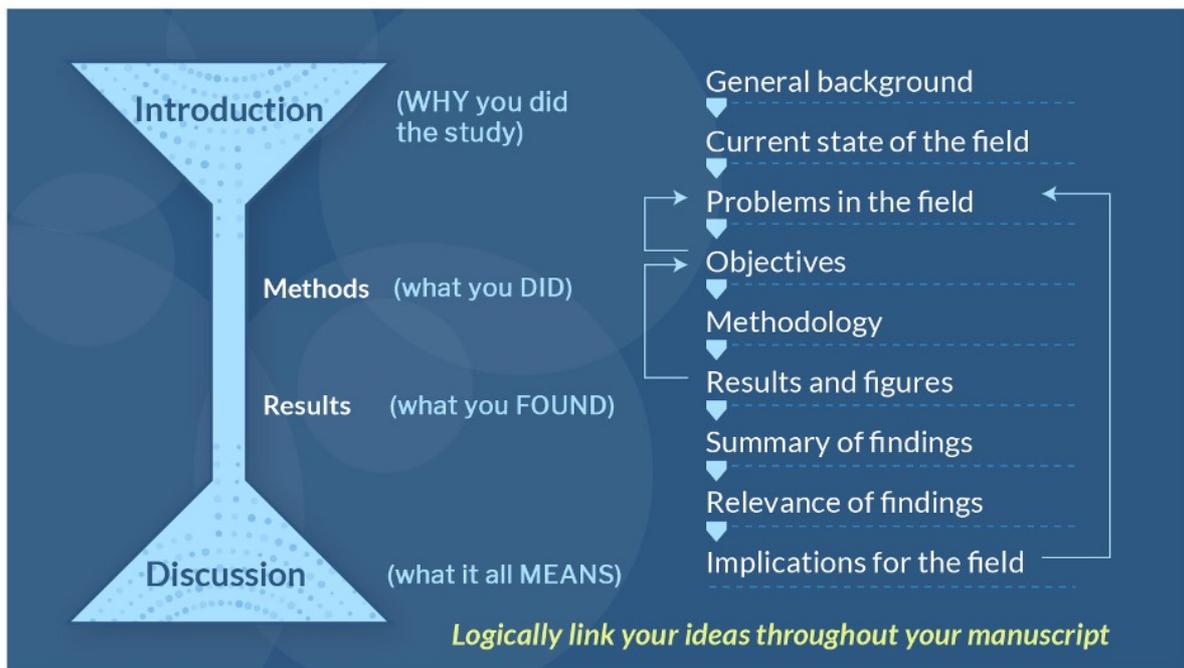


Figure 7. The shape of an academic paper. The classic egg timer diagram.