



Scientific & Academic Writing

Mark Edwards

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What we will look at together

- Positioning your writing
- Purpose & structure
- Tips on essay or thesis writing
- Style and flow exercises
- Editing
- A range of different writing tasks

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Positioning – what must be considered?

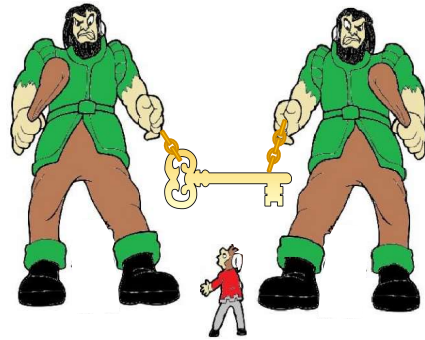
- Audience
- Purpose
- Structure
- Style
- Flow
- Appearance

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Targeting and structuring your communication



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The giants and the key

WHO

Exactly who?

My discipline only?
What level of specialisation?
My supervisors
Visiting professor
Colleagues

Sub groups e.g., Pioneers / Experimental

~~Conservatives~~

Types of people e.g., cynics / skeptics / detail-oriented

Particular interests:
e.g. Theoretical aspects / Practical applications

Wider groups – connected disciplines?



WHY

What is the purpose?

This question is as deep
as you want it to be...

WHAT

1 key message



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The ABT Formula for Scientific Writing



- A tool for clarity & impact
- Especially useful in life sciences, geology & climate studies

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Why Structure Matters

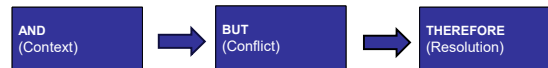
- Scientific papers must be clear and persuasive
- Many drafts sound like 'lists of facts'
- Readers need to see the storyline:
context → problem → solution

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The ABT Formula

- And → Context (What we know, background)
- But → Conflict (Gap, problem, limitation)
- Therefore → Resolution (Your study, findings, or implications)



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Example: Climate Science

- **And:** Global temperatures have been rising over the past century, and many studies show strong links to greenhouse gas emissions.
- **But:** Regional climate responses remain poorly understood, especially in polar regions.
- **Therefore:** This study analyzes 50 years of Arctic temperature records to clarify regional trends.

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Where to Use ABT in a Paper

- Abstract (especially opening sentences)
- Introduction (context → gap → aim)
- Discussion (what results mean in broader story)
- Grant proposals, talks & posters

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Common Pitfalls



- Too much **And**
Background overload, no focus
- Weak **But**
Reader doesn't see why your study matters
- Missing **Therefore**
No clear take-home message

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ABT exercise

- **Life Sciences**
Cells are very complex and contain many organelles. Mitochondria are important because they generate energy, and chloroplasts are in plants and also make energy. There are many studies on energy in cells, and researchers have looked at various processes for decades.
- **Geology**
Sedimentary rocks form in layers, and geologists often describe them in terms of grain size and composition. Rivers and oceans deposit these materials in different environments. There are many types of rocks that can be studied, and the processes take a long time.
- **Climate Studies**
Climate models are used by scientists, and they contain many variables. Some models focus on temperature, others on rainfall, and still others on sea level rise. There are always debates about which models are the most accurate, and people are continuing to collect more data.

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Example Answers

Life Sciences

Cells are very complex and contain many organelles. Mitochondria are important because they generate energy, and chloroplasts are in plants and also make energy. There are many studies on energy in cells, and researchers have looked at various processes for decades.

- Cells contain many organelles that contribute to their survival, **and** mitochondria and chloroplasts play key roles in energy production. **But** while we know mitochondria are well-studied, the regulation of chloroplast energy pathways is far less understood. **Therefore**, our study investigates how chloroplast metabolism responds to environmental stress.

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Example Answers

Geology

Sedimentary rocks form in layers, and geologists often describe them in terms of grain size and composition. Rivers and oceans deposit these materials in different environments. There are many types of rocks that can be studied, and the processes take a long time.

- Sedimentary rocks record Earth's history through their layering and composition, **and** they form from materials deposited by rivers and oceans over time. **But** in many basins, the timing and sources of these deposits remain uncertain. **Therefore**, this project uses isotope analysis to reconstruct sediment provenance in the Devonian strata

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Example Answers

Climate Studies

Climate models are used by scientists, and they contain many variables. Some models focus on temperature, others on rainfall, and still others on sea level rise. There are always debates about which models are the most accurate, and people are continuing to collect more data

- Climate models are essential tools for projecting future environmental change, **and** they integrate variables such as temperature, rainfall, and sea level. **But** current models diverge strongly in their rainfall predictions for tropical regions, creating uncertainty for policy and adaptation planning. **Therefore**, our study compares three leading models using new observational datasets to evaluate tropical rainfall projections.

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Day 1 – Homework Exercise

- Take some selected text from your research:
- 1. Identify the **And** (context)
- 2. Add the **But** (problem/gap)
- 3. End with a **Therefore** (your contribution)

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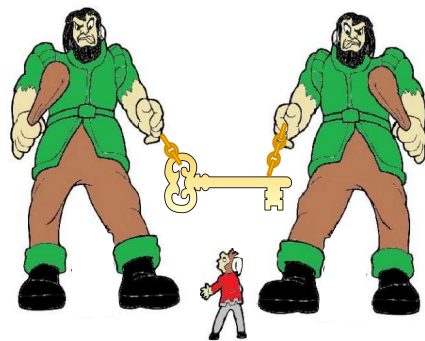
So why use ABT?

- ABT = simple but powerful framework
- Moves writing from descriptive to compelling
- Helps readers (and reviewers!) see why your study matters

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Targeting and structuring your communication

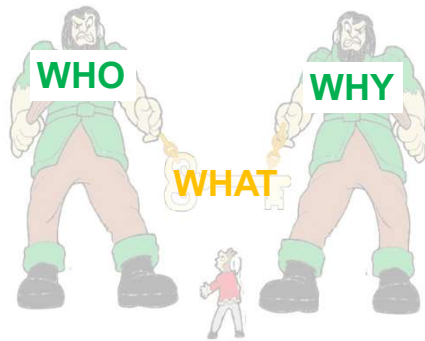


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Targeting and structuring your communication



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The 5 Earlys

- Early start date
- Early finish date
- Key message: Early in the piece
- Main point of paragraph: Early in the paragraph
- Most important element: Early in the sentence

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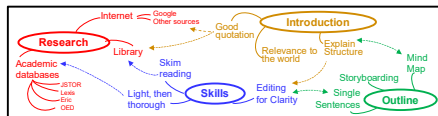
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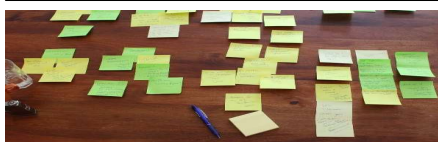
Tips on writing: outlining

3 methods to define your outline – the 'backbone' of your writing

1. Reduce paragraphs to single sentences
2. Mind map



3. Concept Cluster / Storyboard

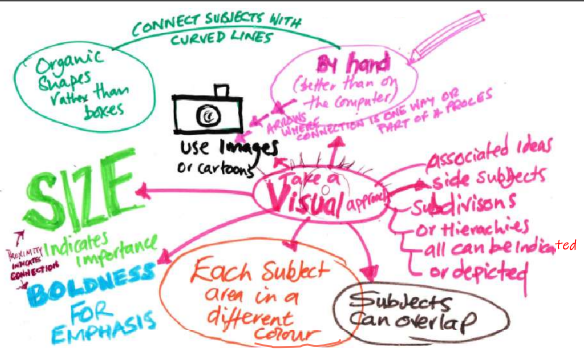


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Mind Mapping (Tony Buzan)



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Academic & scientific style

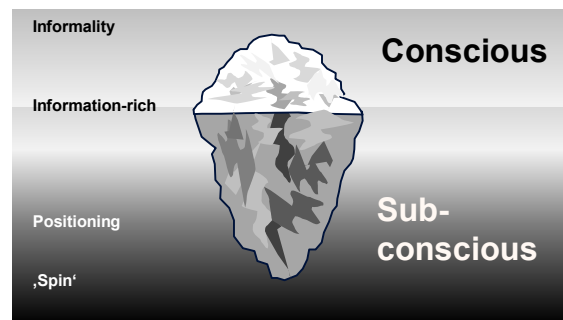
- Appropriate style - what is 'Scientific'?
- Some differences between disciplines
 - Use of language is important to set tone and be easily understood
 - Style guides give good guidance e.g.
 - New Oxford Style Guide
 - New Hart's Rules
 - The Chicago Manual of Style
- More formal than spoken English

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Careful word choice



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Careful Word choice

built	proposed	pursued
constructed	presented	identified
produced	suggested	developed
generated		put forward
created		advanced
manufactured		established
engineered		
invented		
made		
made up		

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Commonly confused

- Rise: moving upwards , being increased
- Raise - move to higher position
- Arise – to get up. To come to notice, to emerge from someth./Someone.

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Verb optimisation – a summary

- Check compound verbs (specifically verb / preposition) for informality
 - *Einstein worked out a completely new way of looking at things.*
 - Einstein achieved a breakthrough in the understanding of the essential principles of physics.
- Is there a verb that will give the reader more information, and save wordiness?
 - *Halgar's research has brought out this new theory, which was hitherto not widely considered by researchers.*
 - Halgar's research has introduced a new theory.
- Can I exaggerate the sentence – if yes, is my verb positional? – avoid opinion.
 - *This irresponsible change in agricultural practice has had devastatingly harmful consequences.*
 - This change in agricultural practice has resulted in low crop yields and widespread abandonment of previously arable land.
- Is my verb choice too colourful for academic tastes (journalistic or too similar to sales language)
 - *Crop yields have plummeted*
 - Crop yields have fallen sharply

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Thesauruses

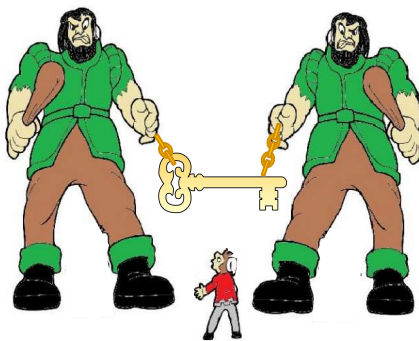
- <https://dictionary.cambridge.org/thesaurus>
- <http://www.wordnik.com/>
- <https://www.thesaurus.com/>

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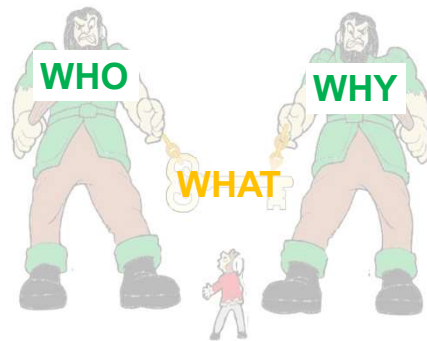


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Passive vs. Active voice

Passive (somewhat dated in style)

2500 candidates were identified from which a cohort of 250 were selected. This cohort was then analysed using an xyz compression algorithm. This was a time-consuming process.

A completely novel algorithm was subsequently developed by the authors that reduced analysis time by 30%.

Active (can sometimes sound repetitious)

We identified 2500 candidates from which we selected a cohort of 250. We then analysed this cohort using an xyz compression algorithm. This was a time-consuming process.

We subsequently developed a completely novel algorithm that reduced analysis time by 30%.

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Passive vs. Active voice

It is OK to mix the active and passive voices.

(but make sure you use 'we' or even 'I' where you wish to emphasise your authorship, or your contribution)

2500 candidates were identified from which we selected a cohort of 250. This cohort was then analysed using an xyz compression algorithm. This was a time-consuming process.

We subsequently developed a completely novel algorithm that reduced analysis time by 30%.

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Switching tenses: Example

The aim of this experiment is to demonstrate a direct link between diet, exercise regime and resulting weight loss.

A group of 200 people attending weight loss motivation exercise classes with dietary advice are compared over a six-month period with a group of television-watching couch potatoes who are supplied with an endless menu of potato-based snacks.

Results

We discovered that for the exercise group there appeared to be a steady decrease in weight.

The second group did not achieve this result and in some cases gained weight.

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What to avoid

■ Uncertain language:

- would, could, should
- might, may,
- What I would like to do, what we hope for is...

- If our experiments are successful, we hope to show a link between exercise, diet and weight loss.

- A successful outcome to our experiment will demonstrate that regular exercise and a healthy diet increases weight loss

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What to avoid

- In recent decades
- In the last two decades
- In the last decades – wrong!
- In the last years – wrong!

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I would advise that you examine your 'thats'.

In all events, it is clear **that** many people claim that quantum physics is a complex subject

Many people claim **that** quantum physics is a complex subject

Quantum physics is a complex subject.

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Be careful of 'they' and 'theirs'

The standard ABC and XYZ methods are not suitable for carbon compounds since they underestimate their rigidity

The standard ABC and XYZ methods are not suitable for carbon compounds, since both of these methods underestimate the rigidity of the compounds.

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Tips on writing

- Start early – (writing can also be part of the exploration process)
- Form a clear argument
 - Research as widely as possible. Internet: not just google. Academic databases. Don't forget the library! Quote from many sources.
 - Analyse: Define claims, sift evidence, challenge logic
 - Allow the idea to form: Question yourself; write; meditate; go for walks; go into unusual environments. Allow time for gestation. Tolerate the uncertainty.
 - Thesis: Clear argument, assertion. Claim, then 3 reasons why.
 - Challenge your thesis: Is an alternative explanation possible? What assumptions are there? Is the logic sound? Is there enough evidence?
 - Avoid: Generalising from small samples; exaggeration; either/or thinking; over-reliance on 'authorities'; all forms of assumption.

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Tips on writing: the introduction

- Grab the attention:
 - An interesting fact
 - A relevant quotation
 - A surprising statistic
- Set up the issue, lead into the thesis
- Give an overview of the structure:
 - What is being tested? What is the question?
 - Why is this interesting, important or relevant?
 - What was the approach used?
 - Briefly – what is the conclusion?
- Title & introduction together are critically important.

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Story-telling – titles – Everyday English

nature

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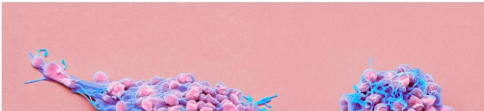
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nature research highlights article

RESEARCH HIGHLIGHT | 04 November 2021

Dressed-up tumour cells make up a personalized cancer vaccine

A dose of silica-coated cancer cells helps to rally the immune system against malignancies in mice.



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'Sexy' Titles – contemporary references

Use, or distort, a well-known phrase, saying or title:

Tea for Two Hundred Million

A study of the economic impact of recent changes in agricultural practices in the tea plantations of Ceylon

The Lord of the Carbon Rings

A biography of August Kekulé's work on the structure of Benzene

Make the main title snappy or memorable, and ensure you include as many of the hot key-words for your subject in the subtitle as feasible.

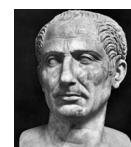
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'Sexy' Titles – some very old techniques

- Alliteration: Key words begin with the same sound
e.g. 'The Justification for Geo-Engineering'
- Repetition: Repetition reinforces meaning and adds rhythm
e.g. 'Open to change and open to the future'
- The rule of three: Groupings of 3 aid memorability
e.g. 'Tea, Sympathy and Tear-gas'
- Rhyme (either explicit or internal)
e.g. 'Techniques from the Greeks'
- Assonance: Use of similar vowel sounds
e.g. 'An Unusual Route to Union'



'Veni, Vidi, Vici'

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Story –telling...

Developing story-telling skills – unfinished sentences

E.g. Working in this university has become a dream experience since we started...



Collaborative online whiteboard: <https://miro.com>

- My discoveries are significant because...
- My work is relevant to you because...
- It is a good idea for you to understand what I am working on because...
- ...which means that...

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Story telling : the phrase that just keeps on giving....

My work on the biota in the gut of the *Drosophila melanogaster* fruit fly may reveal why the populations are falling rapidly...

...which means that...

By changing the formulation of our most common pesticide, we may be able to reverse this trend...

...which means that...

Higher populations of this fruit fly have been shown to have a beneficial effect on the reproduction rates of the *Euterpe inventadalis* precatia palm tree

...which means that...

Rainforest re-planting programmes in Australia, Borneo and Peru will see faster rates of re-forestation

...which means that...

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Story telling : the phrase that just keeps on giving....

The rainforest will start to absorb more carbon from the atmosphere, more quickly

...which means that...

CO2 levels will fall faster than current predictions...

...which means that...

My work is crucial to the future of our planet!

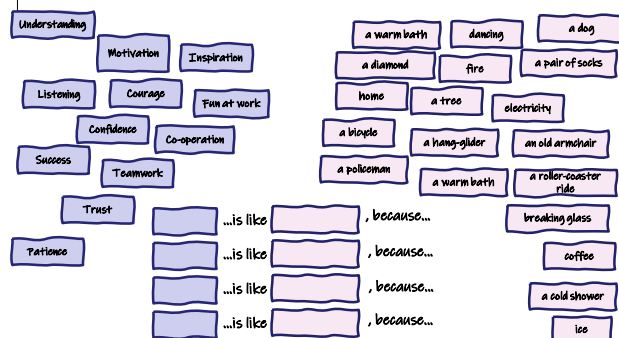
What does your work mean?

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Story telling : Practice with metaphors....



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Tips on writing: the main passage

- Check each paragraph for a central focus.
 - Consider each paragraph in isolation, and then together
 - Develop ideas fully:
 - give examples;
 - use quotations;
 - anticipate responses,
 - give more evidence.
- Discuss Materials & Methods
- Results – Start each paragraph with what was being tested
- Discussion – (Explain, interpret, compare to expectations, next steps)

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Tips on writing: the conclusion

- Find a powerful ending:
 - A memorable quotation;
 - A strong image;
 - discuss consequences & relevance;
 - end as you began;
 - recap your main idea and summarise in new words, or,
 - expand out from your detailed area to the 'wider picture'.
- Re-write the introduction
- Citations & references

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Lastly:

- Write the abstract
- Edit...Edit ... Edit.
 - Revise extensively. Do not let your work become 'sacred'.
 - Circulate widely, and listen to and accept feedback and criticism with grace. Do not become defensive.
 - Look for ways to improve formality, style, flow, economy and appearance.
 - Proof-read thoroughly.

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Abstract: structural checklist

Topic/ main problem that is addressed
Background – (Scholarly style – not too much detail)
Objective of the study
Definitions (Consider target audience)
Hypothesis
Methods/ Equipment
Results (Only the most relevant)
Conclusion
Keywords

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Keeping track of larger, complex writing projects

- Identify the 'strands' (mind-mapping?)
- Break each strand into smaller and smaller chunks
- Schedule important writing milestones into your calendar
- Create 'Project lists'
 - Create an 'Active Projects' folder / Step-by-step lists for each project in reverse order with the next step at the bottom. Delete as completed
 - Weekly review and strategy session. Diarise and schedule following week.
 - Keep a separate 'maybe' list and also a 'someday' list and a 'waiting for' list
- Book recommendation: 'Getting things done' – David Allen

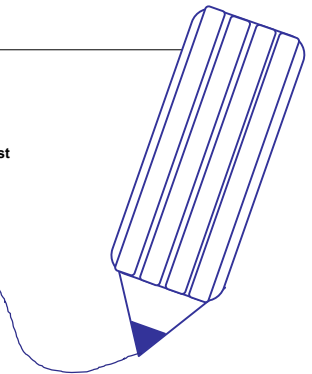
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Editing Filters

- Audience – Who am I talking to?
- Purpose – Why am I telling them?
- Key message – What exactly is the most important thing I am saying?
- Avoid informal language
- Check for careful word choice
- Flow
- Brevity –remove redundant words
- Clarity
- Plain English
- Grammar, punctuation and spelling



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Flow

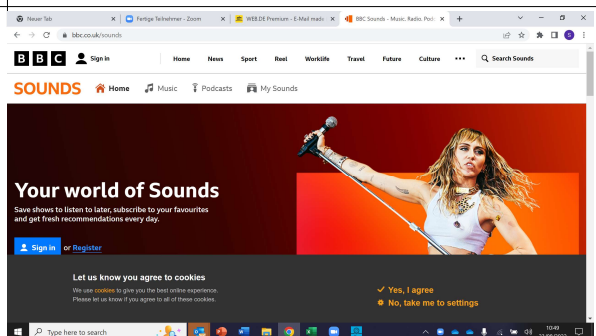
- Narrative and dialogue – consider your paper as a story – beginning, middle and end.
- Does it flow smoothly and logically from point to point?
- Using linking words and phrases will enhance clarity and emphasise logical connections.
- Natural-sounding English

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Developing Fluency: bbc.co.uk/sounds or bbc.co.uk/radio4



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Flow - Analysis

Edward Teach (c. 1680 – 22 November 1718), **better known** as Blackbeard, was a notorious English pirate **who** operated around the West Indies and the Eastern coast of the American colonies.

Although little is known about his early life, he was probably born in Bristol, England. He may have been a sailor on privateer ships during Queen Anne's War **before** settling on the Caribbean island of New Providence, a base for Captain Benjamin Hornigold, whose crew Teach joined at some point in 1716.

A shrewd and calculating leader, Teach spurned the use of force, **relying** instead on his fearsome image to elicit the response he desired from those he robbed. **Contrary to** the modern-day picture of the traditional tyrannical pirate, he commanded his vessels with the permission of their crews **and** there is no known account of his ever having harmed or murdered those he held captive.

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Short or Long Sentences?



Gary Provost



"This sentence has five words. Here are five more words. Five-word sentences are fine. But several together become monotonous. Listen to what is happening. The writing is getting boring. The sound of it drones. It's like a stuck record. The ear demands some variety. Now listen. I vary the sentence length, and I create music. Music. The writing sings. It has a pleasant rhythm, a lilt, a harmony. I use short sentences. And I use sentences of medium length. And sometimes, when I am certain the reader is rested, I will engage him with a sentence of considerable length, a sentence that burns with energy and builds with all the impetus of a crescendo, the roll of the drums, the crash of the cymbals—sounds that say listen to this, it is important."

— Gary Provost

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Appearance

- Well-presented documents are taken more seriously;
- Clear paragraphs;
- Line spacings;
- Standard fonts and sizes;
- PROOF-READ thoroughly – do not rely on a simple spell-checker – use AI or another person!

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Editing for brevity

Only the development and fostering of a close collaborative multidisciplinary cooperation of government bodies, industry, public and private architects, planning regulators, those public and private bodies responsible for strategic development, lobbyists and public opinion leaders will ensure cleaner air in Europe and reduced negative and harmful effects on human health and well-being for future generations to come by the development and promulgation of smart cities, efficient management of green buildings at low CO₂ emissions, and sustainable economic development practices. The stated objective of this Action is to create a multidisciplinary cooperation to establish a cooperative network to explore and experiment with new sensing technologies for low-cost air-pollution control through intensive research, field studies and laboratory experiments and subsequent analysis, documentation and dissemination of final reports in digestible form to ensure the subsequent transfer of the results into preventive real-time control practises, if necessary enacted into legislation and prescriptive local planning regulations. This Action will encourage and ensure an approach designed to create a stronger focus on global sustainability for the ongoing monitoring of climate changes and outdoor/indoor energy efficiency. (179 words)

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Editing for brevity

Only the development and fostering of a close collaborative multidisciplinary cooperation of government bodies, industry, public and private architects, planning regulators, those public and private bodies responsible for strategic development, lobbyists and public opinion leaders will ensure cleaner air in Europe and reduced negative and harmful effects on human health and well-being for future generations to come by the development and promulgation of smart cities, efficient management of green buildings at low CO₂ emissions, and sustainable economic development practices. The stated objective of this Action is to create a multidisciplinary cooperation to establish a cooperative network to explore and experiment with new sensing technologies for low-cost air-pollution control through intensive research, field studies and laboratory experiments and subsequent analysis, documentation and dissemination of final reports in digestible form to ensure the subsequent transfer of the results into preventive real-time control practises, if necessary enacted into legislation and prescriptive local planning regulations. This Action will encourage and ensure an approach designed to create a stronger focus on global sustainability for the ongoing monitoring of climate changes and outdoor/indoor energy efficiency. (179 words)

Only close multidisciplinary collaboration will ensure cleaner air in Europe and reduced negative effects on human health for future generations by the construction of smart cities, efficient management of green buildings at low CO₂ emissions, and sustainable economic development. The objective of this Action is to create a cooperative network to explore new sensing technologies for low-cost air-pollution control through field studies and laboratory experiments and to transfer the results into preventive real-time control practices. This Action will support global sustainability for monitoring climate changes and outdoor/indoor energy efficiency. (88 Words)

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Editing Skills - Reduce the wordiness

- Hoosits' hypothesis is an attempt at the provision of a replacement for traditional, mainstream quantum physics theory. A good example of his extremely thorough analysis is demonstrated in how often he cites the extensive data in Wilderson's seminal work. (39 words)
- The process of galendialis in the preparatory analysis for and provision of reliable results is widely perceived as a reliable methodology. This is borne out by a review of the analysis methods utilised in all of the major research papers published on this topic in the last five years, which plainly demonstrates that 9 out of 10 studies published in the 5 most widely-read journals in our discipline use this as their chosen analysis method. (75 Words)
- Objective considerations of contemporary phenomena compel the conclusion that success or failure in competitive activities exhibits no tendency to be commensurate with innate capacity, but that a considerable element of the unpredictable must invariably be taken into account. (38 words)

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Wordiness – suggested improvements

- Hoosit's hypothesis is an attempt at the provision of a replacement for traditional, mainstream quantum physics theory. A good example of his extremely thorough analysis is demonstrated in how often he cites the extensive data in Wilderson's seminal work. (39 words)
- Hoosit offers a replacement to current quantum theory with his own hypothesis. Hoosit's citing of Wilderson's extensive data exemplifies his thorough analysis. (21 words – 53%)

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Wordiness – suggested improvements

- The process of galendialis in the preparatory analysis for and provision of reliable results is widely perceived as a reliable methodology. This is borne out by a review of the analysis methods utilised in all of the major research papers published on this topic in the last five years, which plainly demonstrates that 9 out of 10 studies published in the 5 most widely-read journals in our discipline use this as their chosen analysis method. (75 Words)
- Most researchers consider galendialis the most reliable method. 90% of the research papers in our references use this process. (19 words – 25%)

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Wordiness – suggested improvements

- Objective considerations of contemporary phenomena compel the conclusion that success or failure in competitive activities exhibits no tendency to be commensurate with innate capacity, but that a considerable element of the unpredictable must invariably be taken into account. (38 words)
- Success and failure do not come in proportion to talent or ability, but are the result of many random factors. (20 words - 52%)
- Luck matters more than talent (5 words – 13%)

I returned, and saw under the sun, that the race is not to the swift, nor the battle to the strong, neither yet bread to the wise, nor yet riches to men of understanding, nor yet favour to men of skill; but time and chance happeneth to them all. -- Ecclesiastes 9:11

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Data commentary – strength of claim

a) have contributed to	
b) have caused	
c) May have contributed to	
d) May have been a small factor in causing	
e) Were probably a major cause of	
f) Were two of the causes of	
g) Have certainly resulted in	

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Describing procedures

- Firstly, secondly, thirdly.....finally/lastly
- Listings
 - a) Step 1:
 - b) Step 2:
 - c) Step 3:
- The first step is to.....and then..... Next,.....and finally,.....
- To start the process,.....after that....following this....the next stage is....the process is completed by....

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Supplementary 1 – formal language

A super-important question in immunology is to work out which factors make it that an immune response can efficiently clear or control a viral infection, and when it is that we observe persistent viral replication and pathology. Here I have brought together how mathematical models help us find out new things about these questions, and I look into the relationship between antiviral therapy and long-term immunological control in human immunodeficiency virus (HIV) infection.

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Supplementary 1 – formal language (result)

A vital question in immunology is to identify which factors determine whether an immune response can efficiently clear or control a viral infection, and under what circumstances persistent viral replication and pathology can be observed. This paper summarises how mathematical models help us gain new insights into these questions, and explores the relationship between antiviral therapy and long-term immunological control in human immunodeficiency virus (HIV) infection.

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Supplementary 1 – formal language (result)

Mathematical models and experimental data suggest that HIV persistence and pathology are caused by the absence of sufficient CTL memory. We show how mathematical models can be instrumental in devising therapy regimens that can normalise the CTL memory in HIV patients and result in long-term immunological control of the virus without the need for life-long treatment.

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