



Writing a Scientific Paper in English

Part 2: Improving your Writing

Caitriana Nicholson

Editor, Chinese Physics C

Recap of Lecture 1

- **Why we write scientific papers**
 - Remember why you are doing this!
- **Structure of a typical paper**
 - Remember your goal: clear communication
 - Make sure your paper says:
 - Why you did this work
 - What you did
 - What the results were
 - What the results mean
 - Start from the data
 - Title, abstract and figures – the first things (maybe the only things) a reader will look at

This lecture

- Common problems with academic writing
 - Writing concisely
 - Tenses, articles and voice
 - Punctuation, spelling and vocabulary

Disclaimer:

I can't cover every grammatical or style problem here....

I will highlight some important principles and give suggestions for how to improve your writing

- Lecture 3: submitting your paper to an international journal

A word of encouragement...

Style may be influenced by cultural differences between English and Chinese – but good writing is difficult even for native English speakers!



Writing Concisely

Concise v. complex

It was the best of times, it was the worst of times, it was the age of wisdom, it was the age of foolishness, it was the epoch of belief, it was the epoch of incredulity, it was the season of Light, it was the season of Darkness, it was the spring of hope, it was the winter of despair, we had everything before us, we had nothing before us, we were all going direct to Heaven, we were all going direct the other way—in short, the period was so far like the present period, that some of its noisiest authorities insisted on its being received, for good or for evil, in the superlative degree of comparison only.

1 sentence, 120 words

Opening paragraph, “A Tale of Two Cities”, Charles Dickens

Concise v. complex

- You are not writing a novel!
- Remember your aim: communicate your work as clearly as possible
- Aim for 15-18 words per sentence, maximum 25
 - Sentences with 8 words are understood by 90% of readers first time
 - Sentences with 27 words are understood by 4% of readers first time
 - *From “The Effective Communicator” by John Adair (ISBN: 9788172244286)*
- One idea per sentence

Sentence length

VII. CONCLUSIONS

Although the present experimental data are perfectly consistent with the absolute stability of Standard Model within the experimental and theoretical uncertainties, one should not exclude the possibility that other experiments will be able to establish the metastability of the electroweak vacuum in the future. Should the Higgs inflation idea be abandoned in this case? This paper gives a negative answer to this question.

63 words, 3
sentences,
longest
sentence
44 words

Sentence length

VII. CONCLUSIONS

Although the present experimental data are perfectly consistent with the absolute stability of Standard Model within the experimental and theoretical uncertainties, one should not exclude the possibility that other experiments will be able to establish the metastability of the electroweak vacuum in the future. Should the Higgs inflation idea be abandoned in this case? This paper gives a negative answer to this question.

63 words, 3 sentences,
longest sentence
44 words

Present experimental data are consistent with the Standard Model being absolutely stable. Future experiments, however, could show that the electroweak vacuum is metastable. Our work shows that in that case, Higgs inflation is still possible.

35 words, 3 sentences,
longest sentence 12 words

Sentence length - exercise

- *Try to rewrite the following sentences as several shorter sentences*
- The real electric field in the gas gaps of an MRPC is always calculated by dividing the high voltage applied on the graphite layers by the total gap width, because in a typical MRPC, the bulk resistivity of gas and glass are $10^{15} \Omega \cdot \text{cm}$ and $10^{12} \Omega \cdot \text{cm}$ respectively, which means the voltage drop on the plates is one thousandth of that in the gas gap. (65 words)
- When it comes to those “small” theories of quantum gravity which emerge from superstrings, 4-dimensional Horava theory, proposing a quantum field model including UV completion of the Einstein theory and its relevance to anisotropies between space and time, becomes of great significance. (42 words)

Sentence length - exercise

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Sentence length - exercise

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- Let the the high voltage applied on the graphite layers be V . Let the total gap width be W . The real electric field in the gas gaps of an MRPC is always calculated from V/W . This is because in a typical MRPC, the bulk resistivity of gas is $10^{15} \Omega \cdot \text{cm}$. The bulk resistivity of glass is $10^{12} \Omega \cdot \text{cm}$. This means the voltage drop on the plates is 0.1% of that in the gas gap. (12 + 7 + 16 + 15 + 8 + 16)

Sentence length - exercise

- When it comes to those “small” theories of quantum gravity which emerge from superstrings, 4-dimensional Horava theory, proposing a quantum field model including UV completion of the Einstein theory and its relevance to anisotropies between space and time, becomes of great significance. (42 words)
- 4-dimensional Horava theory proposes a quantum field model which includes UV completion of the Einstein theory and its relevance to anisotropies between space and time. This theory is of great significance for those “small” theories of quantum gravity which emerge from superstrings. (25 + 17 words)

Verbs and nouns

- Use verbs, not nouns, where possible
 - “An empirical numerical model is presented **for the calculation of transmission** through thick objects in high energy proton radiography”
 - “An empirical numerical model is presented **to calculate transmission** through thick objects...”
 - “Manual boundary **modification** is easy to **perform**...”
 - “It is easy to **modify** the boundary manually....”
 - “Peak field **optimization** has been **performed**...”
 - “The peak field has been **optimized**...”
- Using verbs makes your paper easier to read and gives a stronger, more dynamic feel

Verbs and nouns - exercise

- *Try to rewrite these sentences, replacing the nouns in red with their verb form*
- ...the simulated value of drift velocity of ionized electrons had some **deviation** from the experimental value....
- By changing the working gas, the **measurement** of the neutron energy spectra of different energy ranges can be realized.
- For a **measurement** of the photoelectron yield of the prototype detector...
- We can draw a **conclusion** that the photoelectron yield increases by about 30%

Verbs and nouns - exercise

- *Try to rewrite these sentences, replacing the nouns in red with their verb form*
- ...the simulated value of drift velocity of ionized electrons **had some deviation** from the experimental value....
- ...the simulated value of drift velocity of ionized **deviated** from the experimental value....
- By changing the working gas, **the measurement of** the neutron energy spectra of different energy ranges can be **realized**.
- By changing the working gas, the neutron energy spectra of different energy ranges can be **measured**.

Verbs and nouns - exercise

- For a **measurement** of the photoelectron yield of the prototype detector...
- To **measure** the photoelectron yield of the prototype detector...
- We can **draw a conclusion** that the photoelectron yield increases by about 30%
- We can **conclude** that the photoelectron yield increases by about 30%

Redundant phrases & information

- “Ineffectual phrases” are words which don’t add any extra meaning to the sentence – they are useless
- Just cut them out!
 - The data **seem to** show → The data show
 - **In order** to describe → To describe
 - **It should be noted that** this method → This method
 - **It may be said that** there is a strong correlation → There is a strong correlation
 - **In this work, we intend to** study → We study
 - **It is obviously of great value** to search for... → It is important to search for...
- Redundant information is repeating information which has already been given
- When you give specifics, don’t give general information too
 - E.g. “In the month of November” → “In November”
 - “A total of 26 modules” → “26 modules”

An optical trick

- Put important information at the **start** or the **end** of sentences
- When reading, the eye is drawn to white space, so it's easier to notice words at the beginning and end of a sentence
- Another reason to avoid “It should be noted that..” and other ineffectual phrases!
- “Referencing the design concept presented by the RD51 collaboration, the architecture of the prototype SRS is shown in Fig. 1”
- “However when we are asked about the most significant feature of black holes, we definitely bring up the concept of singularities and the cosmic censorship”

An optical trick

- “Referencing the design concept presented by the RD51 collaboration, the **architecture of the prototype SRS** is shown in Fig. 1”
- → The **architecture of the prototype SRS** is shown in Fig. 1. It references the design concept presented by the RD51 collaboration.
- “However when we are asked about the **most significant feature of black holes**, we definitely bring up the concept of **singularities and the cosmic censorship**.”
- → The **most significant features of black holes**, in our opinion, are **singularities and cosmic censorship**.

Adverbs



- Reduce use of adverbs – use only when necessary
- Give specific information when you want to quantify something
 - It is then **quite** interesting → It is then interesting
 - Due to the **relatively** large dispersion → Due to the large dispersion
 - The transparency is **significantly** reduced → The transparency is reduced by XX%
 - It is **perfectly** consistent with XX → It is consistent with XX to within YY%

Exercise

- *Look at the paragraph below and spot as many things as possible to simplify*
- In the analysis of the experimental data, measurement of the energy information (E_p) of the normal protons was achieved by summing the whole energy deposition; the recoil angle (θ) was deduced by fitting the proton tracks on the $x - z$ plane and the $y - z$ plane. Using a combination of the energy and recoil angle of the normal protons, the incident neutron energy (E_n) was derived based on Eq. (1). By fitting the reconstructed neutron spectrum using the Gauss function (see Fig. 7), the charge response of the neutron-TPC to different neutron energies, that is, the energy calibration of the neutron-TPC, was found (see Fig. 8). As can be seen from the figure, there is a relatively good linear relationship between the neutron energy and the charge response of the neutron-TPC.

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Exercise

- *Look at the paragraph below and spot as many things as possible to simplify*
- **Analysing** the experimental data, the energy information (E_p) of the normal protons **was measured** by summing the whole energy deposition. **The** recoil angle (θ) was deduced by fitting the proton tracks on the $x - z$ plane and the $y - z$ plane. **By combining** the energy and recoil angle of the normal protons, the incident neutron energy (E_n) was derived based on Eq. (1). By fitting the reconstructed neutron spectrum using the Gauss function (see Fig. 7), **the charge response of the neutron-TPC to different neutron energies** was found (see Fig. 8). **From** the figure, there is a **good** linear relationship between the neutron energy and the charge response of the neutron-TPC.

Reading comprehension

- You may write clearly, but there are still a lot of authors who don't!
- If a scientific paper is difficult to understand because of the language, it's badly written
- If you have a difficult piece of text to read, try:
 - Skim reading to pick out the important paragraphs / sentence, then focus on understanding these
 - Breaking long sentences into shorter pieces
 - Cutting out unnecessary words, so you can see the important parts of the sentence
- Keep practising by reading as widely as you can

Writing concisely - summary

- Learning to write concisely will:
 - Make your writing clearer
 - Reduce grammatical mistakes
 - Allow the reader to focus on the important part – your research
- Keep sentences short
- Use more verbs
- Cut out useless words and information



Tenses, Articles and Voice

Tenses and Articles

- I know these are especially difficult for Chinese speakers...
- No time for details today, just some quick reminders
- No 'magic trick' to help, just hard work! 😊

Verb tenses



- Past tense: completed actions
 - We **have studied** the spatial distribution features...
 - We **built** a cosmic ray telescope
 - Two time-of-flight detectors **were** installed
 - The emittance growth **was** below 10%
- Present tense: things which are still true
 - Figure 2 **shows** that...
 - The theoretical value **is** smaller than the experimental result
 - The magnetic form factor **decreases** monotonically

Verb tenses

- Introduction – mostly present tense
- Methods – mostly past tense
- Results – mixture of past and present
- Discussion – mostly present tense

Articles

- “a / an” – the **indefinite** article
- “the” – the **definite** article

a / an	the
General	Specific
Introducing something for first time	Referring to something which has already been introduced

- “**A** particle detector usually consists of several different components. **The** BESIII detector has seven major components.”
- “The BESIII detector includes **an** electromagnetic (EM) calorimeter and **a** muon detector. **The** EM calorimeter consists of CsI crystals...”

Articles

- No article - general use of uncountable nouns or countable plurals
 - “Gravity is the only force for which we have not yet discovered a force carrier” – uncountable noun, general use
 - “The gravitational pull from the black hole tore the spaceship apart” – uncountable noun, specific use
 - “This gives a strong support to the argument...”
 - “Neutrinos are the lightest subatomic particles” – countable plural, general use
 - “The neutrinos detected by IceCube showed...” – countable plural, specific use
- A tutorial on articles: <http://www.englishpage.com/articles/>

Commas

- Commas have lots of uses, which can be confusing
 - Separating different clauses in a sentence
 - Separating items in a list
 - For a full explanation, see e.g. <https://owl.english.purdue.edu/owl/resource/607/01/>
- In a list:
 - “The detector system is composed of a LAr dewar, purification system, cooling system, and a vacuum pump.”
 - The last comma is often known as the “serial comma” or “Oxford comma” and is **optional**
 - Depends on the author’s or publisher’s style
 - Can help make meaning clearer if the list includes things that are not single words, e.g.
“The detector system is composed of a LAr dewar, purification and cooling system, and a vacuum pump.”

Active and passive voice

- Passive voice:
 - “A single light sterile neutrino **is assumed**”
 - “the full energy peaks of Ca, Mn and Fe **are chosen to be fitted** with a Gaussian”
- Active voice:
 - “**We assume** a single light sterile neutrino”
 - “**We choose to fit** the full energy peaks of Ca, Mn and Fe with a Gaussian”
- Passive voice used to be standard for scientific writing
 - Can lead to awkward sentence construction
- Many journals now prefer active voice where possible
 - Active voice is usually more direct and clear
 - Passive voice can be useful
- Use whichever voice makes the meaning and logical flow most clear

Exercise

- *Look at this paragraph of text and spot as many mistakes as possible*
- In comparison with proton beams, the electron beams can easily give better quality because of less impact from a space charge effect. Thus high energy electron radiography (eRad) could have better performance at medium scale, with the advantages of less emittance and energy spread. The eRad cannot replace pRad at macro scale because of a poor penetrating power, as Fig. 1 showed.

Exercise

- *Look at this paragraph of text and spot as many mistakes as possible*
- In comparison with proton beams, **the** electron beams can easily give better quality because of less impact from **the** space charge effect. Thus high energy electron radiography (eRad) could have better performance at medium scale, with the advantages of less emittance and energy spread. **The** eRad cannot replace pRad at macro scale because of **its** poor penetrating power, as Fig. 1 **shows**.

Tenses, articles and voice - summary

- This is a difficult part of English writing
- Use active voice as much as possible

- Practice, practice, practice!
- Proofread, proofread, proofread!



Punctuation, Spelling and Vocabulary

Punctuation

- Capital letters:
 - **Only** at the start of a new sentence, or for proper names or abbreviations
 - Do not use after a colon (:) or semi-colon (;)
- Spaces:
 - **Always** leave a space between any punctuation mark (.,!?:;]) and the following word
 - Always leave a space between values and units
 - 100 ps, NOT 100ps
 - 125 GeV, NOT 125GeV

Contractions

- Isn't, won't, can't, don't, doesn't, etc
- Use for **oral** and **informal** English
- For formal writing, in most situations better to use full expression

Spelling

- Use a spellchecker!

uranium warheads refer to the uclear warheads whose fission cores are made of weapon-grade uranium (WgU). Some studies have shown that passive detection technique is ineffective to detection of uranium warheads. After the “Black Sea Experiment” [4] was done in 1989, Steve Fetter et al. proposed four typical nuclear warhead models in 1990[5]. With a preliminary study on the feasibility of detecting nuclear warheads by neutron and γ passive methods, they thought that the uranium

- Proofread your work several times before submitting!

Spelling – American or British?



- Colour or color? Realise or realize?
- It doesn't usually matter!
- Just keep it **consistent** within your paper
- Check the style guide for the journal – some may request British or American spelling depending on their country of publication
 - E.g. Phys. Rev. journals ask for American spelling
- A well-written paper showing good work is unlikely to be rejected just for using the “wrong” spelling

Vocabulary

- Use simple words where possible:
 - Utilize → Use
 - Adopt → Use
 - Methodology → Method
 - the glass has better planarity → the glass is flatter
- Remember your aim: communicate your work as clearly as possible
- If you don't know what a word means, don't use it

Vocabulary

- Watch out for “cousins”
 - Monotonous v. monotonic
 - Diagnosis v. diagnostics
- And for words that spellchecker won't catch
 - Angel v. angle
- Words / phrases that are too colloquial / in the wrong **register**
 - “Figure out”
 - “The fly in the ointment is that...”

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Spelling, punctuation and vocabulary - summary

- Read widely
- Don't use a big word when you can use a simple one
- Practice, practice, practice!
- Proofread, proofread, proofread!



Some common pitfalls

“On the other hand...”

- Used only when discussing **2 sides of an argument**
- “**On the one hand**, Beijing is China’s capital, so there’s always lots to see and do. **On the other hand**, it takes ages to get anywhere.”
- “On the one hand, accelerator research is needed for particle physics. On the other hand, it is also useful for developing new medical treatments.”

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- “On the one hand, acceleration research is needed for particle physics. On the other hand, it is also useful for developing new medical treatments.”
- It is a little informal, so better to avoid it and use “however”, “whereas” or some other word instead



“Meanwhile...”

- Used to talk about time – something which is happening at the same time as something else
 - “John started making dinner. Meanwhile, Jane finished writing her paper. “
 - “The system was tested as the temperature was lowered from 20 degrees to -40 degrees. Meanwhile, the PMTs were monitored to ensure there was no loss of light output during the test.”
- Does not mean the same as “also” or “however”
- “The working gas acts as the neutron reaction medium meanwhile”
- “LAr is highly transparent to visible light, so the depletion of visible light is negligible during transmission. Meanwhile, because the reflectivity of Teflon is not strictly equal to 100%, loss of photons occurs in the process of reflection.”

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“Have”, “possess” and “own”

- “all the systems possess the same thickness of 2 mm”

“Have”, “possess” and “own”

- “all the systems **have** the same thickness of 2 mm”
- “possess” and “own” used only for people (or institutions composed of people, e.g. school, government, country...) with physical things
 - Implies legal or moral rights
 - E.g. “John owns a house”
- For everything else, use “has” / “have”

“can not” v. “cannot”

- “I can not go to the cinema tonight”
- “I cannot go to the cinema tonight”

“can not” v. “cannot”

- “I can not go to the cinema tonight” = “I don’t have to go to the cinema tonight – if I want to, I can do something else”
- “I cannot go to the cinema tonight” = “I can’t go to the cinema tonight, I have to do something else”
- Usually, you mean “cannot” ;-)

“event numbers”

- “Quantum state number” v. “number of quantum states”
- “Event number” v. “number of events”



“interested”

- “... can be amplified by a long undulator resonant at the interested harmonic...”
- “the interested events are plotted in Fig. 1”

“interested”

- “... can be amplified by a long undulator resonant at the interested harmonic...”
- “the interested events are plotted in Fig. 1”
- “interested” is an adjective which describes a person (or animal)
 - I am interested in going to the cinema tonight
 - The dog is interested in the ball
- The object of interest is “interesting” or “of interest”
 - The ball is interesting to the dog
 - This book may be of interest to you
- In a scientific paper, usually means “the range I want to focus on”
- The “of interest” form is used
 - The harmonic of interest
 - The region of interest
 - The events of interest

Data set v. dataset

- Similar words (at different stages of evolution):
 - Motor bicycle → motor-bicycle → motorbike
 - Beam pipe → beam-pipe → beampipe
 - Log-in → login
 - Electronic mail → e-mail → email
- Started as two separate words, then frequent use led to them being combined
- Doesn't matter which form you use, as long as it's still up-to-date
 - Both “data set” and “dataset” are ok, but maybe “dataset” is becoming more common
 - But “motor bicycle” is definitely not ok ;-)

Summary



- Remember your goal: clear communication
- Keep it as concise as possible:
 - Short sentences
 - Simplest possible words that still keep precise meaning
 - Cut out useless phrases
- Proofread your paper, and use a spellchecker!
 - Verb tenses
 - Articles (a / the)
 - Punctuation and spelling
- Read widely
- Don't be afraid to look for help

Lecture 3: Submitting your paper to an international journal

- Now you've written your paper... what happens to it?
- Lecture 3 will look at the process of publication in an international journal
 - What do editors look for in a paper?
 - What happens in the review process?
 - How can I improve my chances of acceptance?

Useful resources

- Elsevier.com – How to Prepare a Manuscript for International Journals
 - <https://www.elsevier.com/connect/six-things-to-do-before-writing-your-manuscript>
 - <https://www.elsevier.com/connect/11-steps-to-structuring-a-science-paper-editors-will-take-seriously>
 - <https://www.elsevier.com/connect/writing-a-science-paper-some-dos-and-donts>
- Duke University Graduate School Scientific Writing Resource
 - <https://cgi.duke.edu/web/sciwriting/index.php?action=lesson3>
- *Clinical Chemistry* Guide to Scientific Writing (has Chinese translations)
 - <https://www.aacc.org/publications/clinical-chemistry/clinical-chemistry%C2%A0guide-to-scientific-writing>

Useful resources

- Editage Insights <http://www.editage.com/insights/>
 - Editage provides English editing services (for a fee), but also has this useful website with tips for good writing (free)
- *Nature* English Communication for Scientists, free online course
 - <http://www.nature.com/scitable/ebooks/english-communication-for-scientists-14053993/writing-scientific-papers-14239285>
- Hemingway app – online tool to help make your writing clearer
 - <http://www.hemingwayapp.com/>

Acknowledgements

- I have referred to the following resources in preparing today's material:
 - Elsevier.com – How to Prepare a Manuscript for International Journals
 - <https://www.elsevier.com/connect/11-steps-to-structuring-a-science-paper-editors-will-take-seriously>
 - Duke University Graduate School Scientific Writing Resource
 - <https://cgi.duke.edu/web/sciwriting/index.php?action=lesson3>
 - Stanford University online course “Writing in the Sciences”, Kristin Sainani
 - <http://online.stanford.edu/course/writing-in-the-sciences>
 - <http://www.englishpage.com/articles/a-an-vs-the.htm>



Question Time