Scientific Writing

Dear reader,

this overview is not to be understood as a generally applicable guide to the perfect academic paper, but serves as an aid for authors when revising the linguistic content of their essays. The following text summarises tips for use and conventions that have proven their worth in leading publications.

The contents are based on one master's and two PhD lectures at the Düsseldorf Institute for Competition Economics but are not directly related to the requirements for seminar papers, project papers or theses there.

The Editorial Board, November 2024

Scientific writing

Writing a scientific paper is not about presenting a particularly extensive vocabulary. Rather, the focus is on aspects of scientific communication. This means that the information should be presented clearly and comprehensibly for the intended readership. A particularly readable work is characterised, among other things, by the structure of the text, the reading flow and the sentence length and structure.

Organization of the text

A paper published by the DSER consists of an introduction in which the topic of the paper is explained in full. Formulas, statistics or technical details are omitted. Below are some questions that a well-written introduction should answer (cf. Lichter & Erhardt, 2024):

- Why is the research question relevant?
- What strategy was used (empirical, theoretical or both)?
- What are the results?
- What contribution does the work make in comparison to existing studies?

In the main part, the methodology, the data, the experimental design and the results are presented. Conclusions should not be drawn in the final section. Rather, this serves to briefly summarise the work, present the conclusions in a bundled form and offer an outlook.

The paragraph (cf. Norman 2024):

Paragraphs are the most important element of a text. A paragraph can be understood as a grouping of sentences that develop a theme or a stringent idea.
The rough structure of the paragraphs follows a kind of modular system. Each paragraph begins with a sentence that introduces and summarises the topic of the paragraph. The introductory sentence can take various forms and (1) tell the reader what to expect in the paragraph, (2) make an assertion that is subsequently supported with evidence, or (3) express a conviction that is further elaborated. Examples from Waylink Language Resources (2024):

- “Survey results show that banks are failing their customers.”
- “Findings indicate that Bronze Age settlers built three types of houses.”
- “Humour is one of the best cures for disease.”

Avoid simple statements of fact or vague expressions of opinion:

- “Paris is the capital of France.”
- “I think the banks in the UK charge too much.”

Now add supporting sentences, theoretical arguments or empirical results to the title sentence. Example from Aguirre, Cowan and Vickers (2010, p. 1):

> “The effect of discrimination on welfare can be divided into a misallocation effect and an output effect. With discrimination output is inefficiently distributed because consumers face different prices in different markets. This negative feature of discrimination may, however, be offset if there is an increase in total output, which is socially valuable since prices exceed marginal costs. Arthur Pigou (1920) proved that if all demand

> functions are linear and all markets are served at the nondiscriminatory price then total output remains at the no-discrimination level, in which case discrimination is bad for welfare. Joan Robinson's (1933) pioneering analysis, taken forward by Richard Schmalensee (1981), showed how the curvature of demands determines the sign of output effect."

The concluding sentence summarises the topic of the paragraph without adding anything new and in different words than in the introduction of the paragraph. In this way, the written text remains coherent and in the expected thematic units, ibid.:

> "Hal R. Varian (1985) proved very generally that a necessary condition for welfare to rise with discrimination is that total output increases (see also Marius Schwartz 1990)."

It is helpful to maintain a logical flow of grammatical topics within the paragraph by

- maintaining a common theme in the paragraph or
- changing the topic according to the narrative.

An example from Hottenrott (2014):

> "To understand human evolution, **genomes from related primates** are necessary. For example, **identification of features** common among primates or unique to humans will require several primate genomes. Fortunately, **scientists** can now do such genome-wide exploration; in the past 5 years, **the community** has released several non-human primate genome sequences."
>
> Becomes:
>
> "To understanding human evolution, **genomes from related primates** are necessary. For example, several **primate genomes** are needed to identify features common to primates or unique to human. Fortunately, such **genome-wide exploration** is now a reality; in the past 5 years, **genome sequences** of several non-human primates have been released."

Paragraphs to each other (cf. Norman 2024):

Based on the classic structure of introduction, main body and conclusion, you should organise your paragraphs in such a way that they logically build on each other thematically. An example from Blanco, Engelmann and Normann (2011, p. 1 f.):

1. Behavioral economists invest a great deal of effort into developing models of other-regarding preferences.
2. As for the empirical validity of the models of other-regarding preferences, the existing literature has relied to a large extent on aggregate-level analyses whereas only a small number of studies provides individual-level tests.
3. Our paper contributes to the growing literature on individual-level analyses of other-regarding preferences with two distinct innovations. Firstly, …
4. The second point our paper makes is methodological as we will analyze the performance of a model of other-regarding preferences both at the aggregate and individual level.

5. In the main part of the paper, we will test the model of inequality aversion by Fehr and Schmidt (1999, henceforth F&S).
6. We run an experiment involving four different games with the same sample of experimental subjects.
7. Our data show that results from the within-subject analyses can differ markedly from results from aggregate-level tests.

Generally, two or three lines seem too short and a full page too long for a paragraph. A page with less than two full paragraphs is unusual.

Reading flow (cf. Hottenrott, 2014)

If your sentences regularly begin with unfamiliar concepts, your sentences will not "stick together" and increase the reading effort. The section in question is then not cohesive. The reading flow of a section is facilitated if the sentences begin with a suitable back-reference and end with the new concept. An example:

> "Farmers try to create optimal growing conditions for their plants by using additives to adjust the pH of the soil. Garden lime or agricultural limestone is made from powdered chalk and can be used to raise the pH of the soil. Clayey soils, which are naturally acidic, often require the addition of lime."

Most readers will find your text clearer if the sentences consistently begin with known (old) information and end with unknown (new) information.

> "Farmers try to create optimal growing conditions for their plants by using soil additives to adjust the pH of the soil. One way to raise the pH of the soil is an additive made from powdered chalk called garden lime or agricultural limestone. Agricultural limestone is often added to naturally acidic soils such as clay soils."

To a certain extent, it makes sense to use passive language to maintain the old-new information structure.

> "Scientists have developed an innovative recycling process to process plastic waste more efficiently. In this process, plastic waste is broken down into its basic chemical building blocks. Companies then use the basic building blocks obtained to manufacture new, high-quality products."
>
> Can be paraphrased as:
>
> "Scientists have developed an innovative recycling process to process plastic waste more efficiently. In this process, plastic waste is broken down into its basic chemical building blocks. The basic building blocks obtained can then be used by companies to manufacture new, high-quality products.".

However, make sure that you do not remain in the passive voice throughout the text. The auxiliary verb added in the passive voice lengthens the sentence and shifts the focus away from the subject, so that this reference must be explicitly resumed. By default, you should maintain an active voice.

Sentence structure (cf. Hottenrott, 2014)

The information that can be obtained from the individual sentences is essentially limited to the subject and the verb, i.e.: "Who did what?". To convey this information as simply as possible, two principles can be established:

1. Put the action in the verb.
2. Keep your subject close to the verbs.

An example:

> "The possibility that some companies have a different customer composition than others simply because they are located closer to certain resource facilities can be tested by comparing the experimental results with the results expected from the survey data."

In the word "comparison" we find a nominalisation (1). Nominalisations are not wrong in principle but, like the passive voice, should only be used to a limited extent. As with the passive voice, a separation between sentence structure and sentence meaning occurs when the intended action no longer takes place in the verb.

The subject "possibility" is separated from its verb "to be tested" by an entire sentence (2), which increases the reading effort required to understand the context of the sentence.

> "If we compare the experimental results with those from the survey data, we can examine the possibility that some companies have a different customer composition than others, simply because they are located near certain resource facilities."

Always try to simplify your sentences and avoid run-on sentences. For example, sentences that are too long can be simplified by splitting them up or avoiding unnecessary nominalisations.

> "The observations in our final sample that had passed our filtering, pruning and matching with Method X were analysed for causal effects between innovation and firm performance using GMM'
>
> Better is:
>
> "The observations were pruned, filtered and matched with Method X. Based on the final sample, we analysed the causal effects between innovation and company performance using GMM."

However, when used in moderation, nominalisations offer a good opportunity to create a link back to the previous sentence (see reading flow).

> "We have analysed the data. This analysis has shown that additional experiments are necessary."

Another example of (2):

> “Peanuts, shrimps, almonds, milk or other lactose-containing products and wheat or gluten-containing products are things that people are often allergic to.”
>
> “People are often allergic to things like peanuts, shrimp, ...”

Final tips (cf. Hottenrott, 2014)

Avoid unnecessarily inflating the length and complexity of your text to sound “scientific”. Unnecessary platitudes and wordy phrases can be easily deleted or shortened, e.g. “It should be noted that ...” or “There is no doubt that ...”.

Be careful with pejorative words such as “obviously”, “clearly” or “beyond doubt”. What is obvious to you does not have to be to the reader of your article.

Use adjectives and adverbs sparingly. In most cases, they can be omitted without negative consequences.

References:

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