Author's Toolkit

Writing Better Technical Papers

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Something happens, and then something else happens as a consequence. The notion of “cause and effect” is at the heart of scientific investigation and the scientific method itself—it’s hard to imagine how a scientific paper could *not* discuss causes and effects.

Cause & Effect, Effect & Cause

Let’s look at a few of the most common problems authors have in writing about causes. First, let’s consider the use of “as” to mean “because,” which strikes me as rather archaic usage. More importantly, it can easily produce an ambiguous expression:

? The color saturation increases as the aperture opens very quickly

In technical writing, the conjunction “as” is usually used in the sense of “when” or “while,” not as “because.” Therefore, it’s safest to write this sentence in one of two explicit ways:

- The color saturation increases because the aperture opens very quickly.
- The color saturation increases during the rapid opening of the aperture.

Another problem is using “So” to begin a sentence that gives the result of the previous sentence. Here, use a conjunctive adverb:

- × So the energy level showed a tendency to...
- Therefore/Consequently/Accordingly, the...

In using “thus” within a sentence, the addition of “and” before it can help readability:

- × ...pits formed, thus the surface regularity...
- ...pits formed, and thus the surface...

Generally, “because” connects a ‘result clause’ to a ‘cause clause’:

- A higher data transmission rate could be achieved [result] because the false positives were removed in the first stage [cause].

Alternatively we can reverse the order of clauses by starting the sentence with “because”:

- Because the false positives were removed in the first stage [cause], a higher data transmission rate could be achieved [result].

However, be careful not to start a *very long* opening clause with “because”:

- × Because a higher...which is also...in addition to being...was reached, we...

By the time the reader gets to the “we” result clause, he or she is likely to forget that the long clause was describing a cause! In such a case, put the transition between the cause and result:

- × A higher...which is also...in addition to being...was reached. Therefore, we...

Above all, the cause-effect relationship should be immediately clear and unmistakable.

“Oh, one more thing...”

Recently, I’ve seen more instances of authors “tacking on” additional ideas in the Conclusions section, that is, adding information that did not appear in the earlier sections of the paper. This may include previous research (belonging in the Introduction) or discounted data (belonging in the Results); in a recent paper, I saw an alternative equation added to the Conclusions (of course belonging in the Methods).

The Conclusions section should not include, in principle, any idea, finding, or technique not introduced earlier in the paper. As an exception, it’s OK to introduce “future work” at the end of the Conclusions, but—as I mentioned in an earlier column—this should be kept short.

Grammar Questions? read@kurdyla.com

Mini Quiz: What’s Wrong?

- 1) This device is to detect low-frequency...
- 2) The threshold is to control the level of...

(Answers: (example revisions) 1) This device is designed to detect low-frequency... 2) The threshold is set to control the level of... [main point: Don’t make “to” infinitive phrases “carry too much weight” in an expression’s meaning!])