The Languages of the Scientific Writing: A Review

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ABSTRACT

Writing scientific writing is not essay and simple. Many writers often fail to communicate the idea or subject matter to the readers. The failure to communicate and deliver the idea is due to two factors- the lack mastery of the idea or subject matter itself and poor mastery of the language usage in scientific writing. In term of scientific writing, the language usages are typical ones and standard. This paper attempt to sum up and paraphrase the typical language of the scientific writing covering a) subject and action, b) cohesion and coherence, and c) concision and simplicity

I. Introduction

Writing is a very important part in academic life. It becomes a kind of 'businesses' for academicians. The writings you write may range from simple ones to the complex ones like a daily lecture task, a paragraph, an essay, a term paper, article, and even research report. Those types of writing may use different standard of language usages.

Then, those various and typical writing often follow the formats which have been categorized standard, particularly the scienific writing. Scientific writing can take many forms from a lab notebook to a project report, or from a paper in an academic journal to an article in a scientific magazine. The standardization of the writing falls into two domains that is the content and the linguistic features.

In terms of academic writing and or scientific writing of a certain subject matter, language plays important role because it is a vehicle to deliver, to present and or to inform, to study the science, technology, and art to the readers. The scientific writing actually needs a proper and suitable language usage by context. For example, in particular, the language use for social and natural science may slightly different in term of dictions and sentence pattern. However, in general both have many similarities in the usage of the language (Lindsay, 2011).

Scientific writing with segmented and restricted readers need to grasp the idea and content of the writing quickly, effectively, and accurately. Reading scientific writing is not time consuming due the incorrect and improper usage of the language. That is why writing scientific writing is difficult not only due to the mastery of the subject matter being writing but also the languages being used.

This paper attempt to sum up and paraphrase the typical languages of the scientific writing covering a) subject and action, b) cohesion and coherence, and c) concision and simplicity https://cgi.duke.edu/web/sciwriting/index.php?action/lesson.

II. Description and Elaboration

1. Subject and Action

Actually, the subject and action introduces three principle structural patterns that is a) put action in verb, b) put characters in subjects, and c) keep subjects near verbs.

a) **Put action in verb**

Verbs are *action words*: they describe motion, like to *explore*, to *examine*, or to *observe*. Verbs can be turned into nouns, which changes the word from an *action* to a *thing*. For example, the verb *to analyze* can be changed into its noun form *analysis*. A noun that is formed from a verb like this is called a *nominalization*. Nominalizations are nouns that contain a hidden action. Nominalizations can also be words other than nouns, but they're usually nouns in scientific writing such as *to regulate* becomes r*egulation*, *to*

analyze becomes *analysis, to occur* becomes *occurrence, to investigate* becomes *investigation, etc.*

There is nothing inherently wrong with nominalizations, but many scientific writers misuse them by using abstract nouns to convey action. This creates a disconnection between *structure* and *meaning* — the intended action is no longer found in the verb. Most readers expect the main action of a clause to be found in a verb. This is because verbs inherently convey action, and nouns do not. If you fail to put your intended action in a verb, your reader must work to determine where the action is. For example:

Sentence	Action
(1) We performed an **analysis** on the data	nominalization
(2) We **analyzed** the data.	verb

What is going on in this sentence? In the first example, the verb is *to perform*, but the intended action is probably *to analyze* (hidden in the nominalization *analysis*). The point of this sentence probably has nothing to do with *performance*. But a reader of the first example has to consider this possibility (if subconsciously), while the reader of the second clearly understands the action. This is a trivial example, but the point is more important in complex sentences (see examples below).

However, the nominalizations are sometimes useful; for example, when they *summarize the action of the previous sentence*. In such a case, a nominalization is a good way to form a backwards link to something already familiar to the reader. For example "*We* **analyzed** *the data.*" "*This* **analysis** *demonstrated the need for additional experiments.*"

b) Put Characters in Subjects

The character is the actor (the entity performing the action). Readers expect the main character in a clause to be found in the subject. Characters can be (and often are) abstract nouns, like *expression level* or *exon usage*. Here are two examples about '*bacteria*' that use the subjects differently.

> (3) The **movement in the liquid medium** of the bacteria was accomplished by micro flagella.

> (4) The **bacteria** move themselves in the liquid medium with micro flagella

In the sentence (3), there is a disconnection between subject and intended main character. So it can be said sentence (3) is wrong. On the other hand, in sentence (4), the content is the same, but the structure is changed. The main character is now found in the subject. Then, it can be said that sentence (4) is regarded correct. In addition, sentence (4) is clearer because the intended actor (what's the sentence about?) is the same as the grammatical subject (bacteria).

b) Keep Subjects near Verbs

When these two pieces of information are far apart, that usually means one of them isn't arriving until the end of the sentence. This can lead the readers confused because they can't piece together the whole picture without answers to these questions. In science writing, this is often caused by long, complex subjects. Pay attention carefully the following sentences!

(5) *Farmers that understand the difference between the soil requirements of plants when they are seedlings and their requirements when they are mature are in high demand.*

The subject **Farmers** is separated from the verb phrase are in high demand by 21 words. Actually sentence (5) can be reduced the distance in order to provide more understandable sentence as shown in sentence (6) below!

(6) *Farmers are in high demand if they can understand the difference between the soil requirements of plants when they are seedlings and their requirements when they are mature.*

A similar problem happens with long lists. Authors provide a long list of stuff with no context, and the verb doesn't show up until the end of the sentence as shown in sentence (7) below.

(7)*Peanuts, shrimp, almonds, milk or anything else with lactose, and wheat or anything with gluten all **represent** things that people are commonly allergic to **(Wrong).***

To have a good sentence, the sentence (7) can be revised as shown by sentence (8) below.

(8) *People are commonly allergic to things like peanuts, shrimp....*

Sentence (9) below is also similar to sentence (5) and (7) which are not effective and the subject are not near the verb.

(9) *The ABC database has been subject to different improvements, modifications, and extensions in structure and content over the years **(wrong).***

The sentence (9) relies on nominalizations to convey action. The awkward verb of the sentence ("has been subject to") is basically meaningless. By converting these into verbs, the sentence (9) above can be clear and effective as shown by sentence (10) below.

(10) *The ABC database has been improved, modified, and extended in both structure and content over the years*.

2. Cohesion and coherence

The way to make the sentence and paragraph flow smoothly is very important any writing genre. Cohesion is the degree to which sentences "glue." Coherence is the logical division of the writing into internally consistent units (usually paragraph units). Actually, the word 'coherence' is the Latin verb 'cohere' means 'hold together' (Oshima and Hogue, 1999). Then, the adjective form of 'coherence' is 'coherent.' It is textually defined as 'logical interconnection 'or 'sticking together' or 'consistent and orderly' or 'logical and well-organized, or' harmonious.' In terms of coherence and cohesion, there

are three principles relating one another that is a) put new information last, b) use passive voice judiciously, c) First and Last Sentences of the Paragraph Match

a) Put New Information Last

Conceptually, ideas or characters that have not yet appeared in your manuscript are called *new information*. *New* means *unfamiliar*. "Old information" is something familiar to the reader, either because it's background knowledge or because you've already introduced it. It is a fact that the sentences generally will contain both new and old information. Most readers will find your writing clearer if you consistently begin sentences with familiar (old) information and conclude sentences with unfamiliar (new) information.

So what happens when you begin a sentence with new information? Your reader gets a new idea without any context. He or she may try (incorrectly) to link this information to the previous sentence. After reading the rest of the sentence, the reader may have to revise his or her understanding. If you do this too much, it makes your writing confusing because it lacks cohesion.

Beginning sentences with old information makes writing cohesive. It also allows you to put new, important information in the position of emphasis at the end of the sentence. Paragraph (1) below is categorized ineffective or in term of the position of the new information.

1. *Farmers try to provide optimal growing conditions for crops by using soil additives to adjust soil ph. Garden lime, or agricultural limestone, is made from pulverized chalk, and can be used to raise the pH of the soil. Clay soil, which is naturally acidic, often requires addition of agricultural lime.*

It is a fact that it is difficult to see at first, but the second and third sentences have the same problem. They begin with new information. If we separate the sentences and **bold** the **old information** and the **new information** it becomes easier to notice as shown by sentences a, b, and c.

a. ***Farmers try to provide optimal growing conditions*** *for crops by using* **soil additives to adjust soil pH.**

b. ***Garden lime, or agricultural limestone****, is made from pulverized chalk, and can be used to* **raise the pH of the soil.**

c. ***Clay soil****, which is naturally acidic, often requires addition of* **agricultural lime.**

Now, let's follow the reader through this paragraph. When the reader begins sentence (b), reading "*Garden lime...*" there is little context; the reader may guess "*limes*" are a crop we will now discuss, or that it is a "*soil additive*". There are at least two possible connections to the previous sentence, and readers will be split. At the end of the sentence,

we are given the context and the connection: *"raise the pH"*. This backward-glance at the end of the sentence causes the reader to backtrack, costing concentration.

Actually, the sentence (c) is also problematic. It begins with "*Clay soil...*", similarly without context. The reader may then think "*clay soil*" as another additive, perhaps one that lowers the pH? At the end of the sentence (*requires...lime*), you finally get the connection back to the previous sentence and the context for "*clay soil,*" but this causes the reader to backtrack. To solve the problem, we can try swapping the new and old information as shown by paragraph (2) below.

> 2. *Farmers try to provide optimal growing conditions for crops by using soil additives to adjust soil pH. One way to raise the pH of the soil is an additive made from pulverized chalk called garden lime or agricultural limestone. Agricultural limestone is often added to naturally acidic soils, such as clay soil.*

When your sentences "glue", your writing is said to be *cohesive*. If your sentences are regularly beginning with unfamiliar concepts, your writing won't be very cohesive. Putting new information last also helps with emphasis: readers naturally emphasize the ideas at the end of the sentence. Putting the new, important information at the end will help inform the readers of what you intend to emphasize.

b) **Use Passive Voice Judiciously**

Passive voice isn't inherently bad. It can actually be quite useful. The problem is that some writers incorrectly think *passive voice is inherently scientific*. In fact, some students are taught that *passive voice is more objective*. Really, the way you write doesn't make your experiments any more objective; instead, your results should speak for themselves. For whatever reason, many scientists rely on passive voice excessively. But scientific journals would rather you use active voice. Actually, here are some possible consequences of relying on passive voice can be classified into three important points.

First, ambiguous characters - a consequence of passive voice is that the actor can be omitted, which is common in scientific writing. Sometimes this makes sense, other times is causes confusion. For example, passive voice can be effectively used in a methods section to focus the reader on the method (instead of on the actor). It is not OK to omit the actor if there are multiple possibilities, leaving your reader to guess as shown by sentence (11) below.

(11) The DNA was sequenced using the n-terminus method (Smith et al. 2004).

In this example, who sequenced the DNA? Is the paper being cited because Smith et al. did the sequencing, or because they invented *the n-terminus* method? Any time you leave multiple possibilities, you divide your readers. Some readers will misinterpret your intent.

Second, dangling **modifiers-w**hen you write passive sentences, be careful not to dangle your modifiers! Our chief objection to the passive voice is that it sometimes

seems to make authors forget to watch for dangling modifiers. A dangling modifier is a modifying phrase whose implicit subject does not match the explicit subject of the clause it modifies. Dangling modifiers are common errors in scientific writing.

Third, w**ordiness- all** else being equal, shorter writing is better: it takes less time to read and it uses less space. These are important things to consider in scientific writing. Readers benefit from less reading (it takes less time), and scientists are also regularly subject to journal space constraints. Whatever else is true of passive voice, it is a fact that passive voice tends to increase length (however slightly). When every word counts, active voice can help keep writing concise.

On the other hand, the pasive voice also has its own advantages when writing scientific papars. Actually, the key use of passive voice is that it switches the order of a sentence. This is hugely important in light of principle 1 in this lesson. Use passive voice when it moves the old information to the front and new information to the back as stated previously. Guide your writing with the rule "Put new information last" instead of the rule "Always use passive voice." Use the passive as needed to keep the flow, and *always provide the actors if there is a possibility of confusion*.

The point of this principle is not to eliminate passive voice, but to increase your awareness. Choose passive voice for a reason, not because you think it "sounds scientific." There's a lot more to be said about passive voice. If you're interested in a more in-depth treatment of the active/passive voice discussion.

However, currently, the active voice is preferred in most scientific fields, even when it necessitates the use of "I" or "we." It's perfectly reasonable (and more simple) to say *"We performed a two-tailed t-test"* rather than to say *"a two-tailed t-test was performed,"* or *"in this paper we present results"* rather than *"results are presented in this paper."* Nearly every current edition of scientific style guides recommends the active voice, but different instructors (or journal editors) may have different opinions on this topic.

c) **First and Last Sentences of the Paragraph Match**

This principle is called *coherence*. Usually, when readers refer to the "flow" of writing, they are referring either to coherence, or to cohesion. When writing is *coherent*, it stays on topic in expected units. **Readers usually expect thoughts to be expressed in paragraph units**. A single paragraph corresponds to a single thought. Each sentence in the paragraph should support that main point.

Just because your sentences stick together by including appropriate backwards links, it doesn't mean your writing is coherent. Paragraph (3) below is cohesive, but lacks coherence:

3. *My favorite animal is the domestic cat. Cats were domesticated almost 10,000 years ago in ancient Mesopotamia. Mesopotamia is a name that literally means "the land between two rivers," taken from Greek. The Greek language is one of the oldest written languages, and its alphabet forms the basis of many other writing systems, including Latin.*

3. The Concision and Simplicity

Theoritically and practically, the scientific writing must be precise, effective, and simple. Also it uses concrete language that is easy to understand and to grap. In terms of language use, (Lindsay, 2011) states that the words should be precious so that the scientific writing can inform other scientists of new work and ideas. The right words need to be in the right places for the right reasons if they to do their job properly

As a matter of fact, in many cases, the length and complexity of the language use can make idea or content difficult to understand but long sentences are sometimes perfectly understandable, and specialized terms may be necessary to explain complex problems. Otherwise, sometimes short sentences with simple words are more difficult to follow because of the way they are written. It follows that structure of the sentence may be more important than length or complexity. In term of concision and simplicity, there are four points in order to keep your writing brief, concise, and effective such as a) omit needless words, b) prefer using simple words, c) use simple subjects, and d) use adjective or adverb frugally.

a) Omit Needless Words

It is generally known that many writers tend to write the scientific writing long and complex ones. This happens because the writer would like to show his or her writing is good and truly scientific. In the same time, psychologically, the writer also wants to show that he or she is a good and reputable writer. However, when he or she examines his or her writing and consider what each word adds, he or she may be surprised at how many are unnecessary. In section, you will focus on two points that is an inffectual pharses and wordy phrases.

i) **Ineffectual Phrases**

The biggest category of needless words comes from *ineffectual phrases* (phrases that add no meaning). Robert Hartwell Fiske writes in *The Dimwit's Dictionary* "*The intent of those who use ineffectual phrases is to make it appear as though their sentences are more substantial than they actually are, but not one sentence is made more meaningful by their inclusion* (p. 17)."

If you start to pay attention, you may be amazed at how often you read the words "*it should be noted that….,* " or "*It is important to realize,*" or "*It is generally know that,*" etc. Think carefully about what they mean: nothing. Those ineffectual phrases should be omitted.

ii) Wordy Phrases

Another source of needless words are multi-word phrases that mean nothing more than a simple word. For example, I routinely read "*a large number of*" instead of "*many,*" or "*due to the fact that*" instead of "*because,*" or "the *question as to whether*" instead of "*whether.",* etc.

In addition, the terms of wordy words is also sometimes called word formality level. In scientific writing, you have to avoid informal or spoken language in scientific texts. Instead, use formal alternatives such *"a lot"* for *"many or much"*, *"do"* for *"perform"* or *"carry out"* or *"like"* for *"such as* or *example*, etc.

b) Prefer Simple Words

Using complex word is commonly used by the writer when he or she writes his or her scientific writing. Generally they assume that using complex words shows the the paper is regarded good and excellent or even shopisticated one. In addition, for the writer, the use of the complex word will rate the writer good, qualified and experienced in his or he field.

However, in many cases, many scientists generally tend to avoid using complex word when a simple word will do. Also, the writers consider long words more impressive than short one like the use of *"usage"* instead of *"use"* or *"methodologies"* instead of *"methods, etc. "* **without** knowing what they mean.

Another example is the use of *utilize* vs *use*. Many writer often use the word *utilize* instead of *use.* It happens because the writer assumes that the use of *utilize* is better because it sound more important. If the words mean the same thing, we should prefer *use* for the sake of simplicity. But the words are slightly different. The word *utilize* can carry a sense of *employing something not designed for the purpose*. It can also mean *use to full potential*. For example: "*The family ran out of wood for the fire, so they utilized old cardboard boxes instead*." It seems that the word *use* does not carry these nuances.

In addition, the simple word also means word choice. Word choice determines the quality the writing itself. This happen because often several words may convey similar meaning, but usually only one word is most appropriate in a given context as shown by sentences (12) and (13) below.

*(12) Population density is positively **correlated** with disease transmission rate"*

*(13) Population density is positively **related** to disease transmission rate."*

Slightly, the sentences (12) and (13) are '*correct*' because it is generally known that the word '*correlated*' and the word 'related' are similar that is why writer often interchanges the use of '*correlated'* and *'related.'* Or it is also a fact that in some contexts, "*correlated*" and "*related*" have similar meanings.

However, in scientific writing, the word 'c*orrelated*' and the word '*related*' are different. In scientific writing, the *"correlated"* conveys a precise statistical relationship between two variables. In scientific writing, it is typically not enough to simply point out that two variables are related: the reader will expect you to explain the precise nature of the relationship (note: when using "*correlation*," you must explain somewhere in the paper how the correlation was estimated). If you mean "*correlated*," then use the

word *"correlated"*; avoid substituting a less precise term when a more precise term is available

c) Use Simple Subjects

Scientific writing abounds with complex subjects. The biggest problem this creates is increased distance between subject and verb as mentioned in previous section. Often, science writers want to accomplish too much in a single sentence. The writer usually defines a complex abstract entity (the subject), and then describe something that it does as shown by sentence (14 below).

(14) *The sequences that had passed our filtering, trimming, and alignment with Clustal X, were scanned for conserved elements across mammals.*

This underlined subject in sentence (14) above also includes several actions that aren't verbs in the sentence. To convey these actions in verbs, we can divide this sentence into two; this also enables us to use an appropriate nominalization to summarize the actions of the first sentence, creating a simple subject (alignment) that links backwards. This opens the way for the complex subject (now turned simple) to perform additional actions in an understandable way as shown by sentence (15) and (16) below.

(15) *The sequences were trimmed, filterred, and aligned with Clustal X.*

(16) **The resulting alignments** *were scanned for conserved elements across mammals.*

d) Use Adjective or Adverb Frugally

One of the most overused adverbs is "*very*." Somehow, every experiment is "*very innovative*," every result "*very interesting*," and every conclusion "*very important*." When "*very*" isn't enough, you'll find "***extremely.***" Often, these words can be omitted without effect. Look at sentence (17) below.

(17) *This method illustrates the frequency of **very** high-energy collisions.*

The word "*very*" here is only meaningful if the sentence is making a distinction between *high-energy* and *very-high-energy*. The word *high* implicitly connotes a relative comparison to *low*. If you use "*very*" in a way that doesn't convey additional information to the reader, you're just wasting space. Actually, there are some other words like "*very*" — adverbs or adjectives that don't add anything like repetition problem, excessive hedging, demeaning adverb, etc.

In term of repetition problem, adjectives and adverb are particularly prone to the **repetition** problem. The problem is that writers use two words where one suffices. The words could be synonyms, or one could imply another. For example, "*completely and utterly alone*" means the same thing as "*completely alone*," which means the same thing as "*alone*." These constructions have stylistic use in some forms of writing, but scientific writing is better off stating the facts. Examples more likely in a science paper might be an

"*interesting* and *intriguing*" finding, an "*improved* and *modified*" protocol, or a "*new* and *novel*" drug.

Along similar lines, you'll often find a single adjective or adverb modifying a word that implies the meaning of the modifier. For example, in the phrase "new invention," the modifier "new" is superfluous — "invention" implies novelty.

Another category of superfluous adjectives is excessive hedging. It's good to be humble, but it's easy to go too far. A single hedge should satisfy your urge to cushion your claims as shown by sentence (18) below.

(18) *These results* **suggest** *that our method* **may possibly** *identify* **putative** *enhancer elements.*

Referring to sentence (18) above, the words *suggest*, *may*, *possibly*, and *putative* are all hedges. If you don't want to come right out and say "our method identifies enhancers," use a single hedge. You aren't adding anything by including them all.

As a good writer, be careful of demeaning words like "*obviously*", "*clearly*", or "*undoubtedly*." Something that is obvious to you but they may not be obvious to the reader. There is nothing more frustrating than reading a paper that alludes to something "*obvious*" that you are completely confused about. Too often they're used when something is unclear and doubtful, but the author simply doesn't know how to make the point convincingly. Clumsy writers want to make an argument but they don't know how to bridge some conceptual gap. Instead of painstakingly working out the logic, they simply state their conclusion with an obviously (when it's not at all obvious.

In addtion, to provide concise and simple language use, the writer also must avoid the use of figurative language. Figurative language can make for interesting and engaging casual reading but is by definition imprecise. Writing "*experimental subjects were assaulted with a wall of sound*" does not convey the precise meaning of "*experimental subjects were presented with 20 second pulses of conspecific mating calls.*"

Finally, the use quantify is also advisble. Whenever possible, use quantitative rather than qualitative descriptions. A phrase that uses definite quantities such as "*development rate in the 30°C temperature treatment was ten percent faster than development rate in the 20°C temperature treatment*" is much more precise than the more qualitative phrase "*development rate was fastest in the higher temperature treatment.*"

III. Conclusion

To write the scientific writing actually is not essay in terms of language usage. The language usage of scientific writing is different from any other genre writing. The scientific writing with the segmented readers, the information presented should be clear, direct, concise, simple, condensed. Also, the scientific writing must avoid the vague and ambiguous sentences. The vague and ambiguous sentences may tend to provide different

interpretation. Consequently, the massage grasped by the readers may be deviated information. In short, the language usages of scientific writing is typical ones and they must be implemented properly so that the information in scientific writing can be grasped correctly and quickly.

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