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# Use of Proper Grammar in Research Paper Writing



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# Use of Proper Grammar in Research Paper Writing

Capitalization is one of the big problems in academic writing. Random usage of capital letters to highlight everything important is a common among writers, eventually making reading hard. This paper is an attempt to help researchers and authors write better quality research papers.

## Upper Case and Lower Case Letters

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## I. Proper Nouns

### I. (a) General Rule

As a general rule, the first letter of a proper noun is capitalized. Also, in the case that a proper noun consists of more than one word, the first letter of each word (other than articles, prepositions and conjunctions) is capitalized. With regard to this rule, a point that warrants particular consideration is that, as illustrated by the terms below, proper nouns often include ordinary words:

Pacific Ocean, United Nations, Lake Superior, Black Forest, Kyoto University, Center for Advanced Study, National Institute of Health.

\*Note that these proper nouns all include ordinary words (that is, words that by themselves are not proper nouns), but these words too are capitalized.

Proper nouns can also include hyphens. For such nouns, there are two cases regarding capitalization. First, if those things connected by the hyphen are themselves words, then both of these should be capitalized (for example, *Cedars-Sinai Medical Center*, *Three-Fifths Compromise*). Second, if one of the things connected by the hyphen is not by itself a word, then the first letter after the hyphen should not be capitalized (for example, *Institute for Non-invasive Surgery*, *Society for Promotion of Eco-friendly Sustainable Development*).

## I. (b) Criterion for Proper Nouns

In most cases, determining whether a noun should be regarded as “proper” is not difficult. For example, people’s names and geographical names are always proper nouns. However, there are cases in which the situation is less clear. Below, we consider such cases and clarify the rule used in making this determination.

The necessary and sufficient condition that a given noun be a proper noun is that it was created for the purpose of referring to a particular thing. The following examples elucidate this rule.

- (1a) The University of Tokyo was established in 1877.
- (1b) I will be visiting your university in the fall.
- (2a) The field of mathematics is very old.
- (2b) The mathematics department in our university is quite large.
- (2c) The Department of Mathematics is headed by a Fields Medal recipient.
- (3a) Jacques Chirac was the President of France during the period 1995–2007.
- (3b) Someday, I would like to be president.
- (4a) Our galaxy has a diameter of approximately 100 kly.
- (4b) We live in the Milky Way Galaxy.

### I. (c) **Biological Classification**

The use of upper case and lower case letters in biological classification is a special case, and thus we consider it separately. In the Linnaean taxonomic system (with ranks of domain, kingdom, phylum, class, order, family, genus, species and subspecies), the name of a particular group within any rank above species (e.g., a particular phylum or a particular order) is capitalized, while the name of a species or a subspecies is not capitalized. Also, it should be noted that all such names (for any rank) are written in italics.

## II. Proper Adjectives

Proper adjectives are adjectives derived from proper nouns. There are two types of proper adjectives, those that are obtained as modifications of proper nouns (for example, *Irish*, *African*, *Westernized*, *Newtonian*) and those that are themselves proper nouns being used as adjectives (for example, “Schrödinger,” “Bernoulli’s” and “Turing” in *the Schrödinger equation*, *Bernoulli’s principle* and *the Turing test*). Like proper nouns, proper adjectives are always capitalized.

### III. Nouns Derived from Proper Nouns

There are many nouns that are derived from proper nouns. Such nouns are particularly common in scientific and mathematical fields. For example, each of the following has a person's name as its origin:

*algorithm* (Al-Khwarizmi), *Hamiltonian* (William Hamilton), *bel* (Alexander Graham Bell), *pasteurization* (Louis Pasteur), *Celsius* (Anders Celsius), *Lagrangian* (Joseph Louis Lagrange), *fermion* (Enrico Fermi)

As seen from these examples, in the case of nouns derived from proper nouns, there is no strict rule regarding capitalization. Instead, this is determined largely by convention.



## IV. Titles

Titles (for example, of papers, books, etc.) are types of proper nouns, and hence, as a rule, they are capitalized. However, recently, particularly in academic journals, it has become increasingly common to capitalize only the first word in the title of a paper or section within a paper. Presently, both styles are quite common, and thus, as long as consistency is maintained, either style can be used without problem. In the case of a work written for publication, the publisher will make adjustments necessary to realize conformity with their particular style.

## V. Reference to Particular Parts of a Paper

Within a paper, it is common to refer to sections, equations, figures and other parts of the same or some other paper. This can be done in two ways, using a proper noun (i.e. a noun created to refer to the particular thing in question) and using an ordinary noun. These are demonstrated below.

- (5a) Let us consider Eq. (3.2).
- (5b) Let us consider the above equation.
  
- (6a) The results are listed in Table 1.
- (6b) The results are listed in the following table.
  
- (7a) Each of these functions is plotted in Fig. 3.
- (7b) Each of these functions is plotted in the figure.
  
- (8a) In Section 4, we discuss the present political situation in Chile.
- (8b) In the following section, we discuss the present political situation in Chile.
  
- (9) It is interesting to compare this with Eq. (4.5) of Ref. [4].

## VI. Beginning of a Sentence

As a rule, the first letter of a sentence is capitalized. For this reason, an expression or symbol for which capitalization is not possible (e.g., a mathematical expression, a number, a symbol) should not be placed at the beginning of a sentence.

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## VII. Name of a Species

In Section 1.3, we discussed the special rules regarding capitalization in the context of biological classification. Here, is a related discussion.

In zoological nomenclature, the name of a species is written in what is called the “binomen” form [generic name + specific name], where the generic name is the name of the genus, and the specific name refers to the species. In such terminology, it is conventional to capitalize the generic name but not the specific name. This is true even in the case that the generic name is shortened to just its first letter. (For example, *Escherichia coli* becomes *E. coli*.) Furthermore, if the subspecies is also specified, the binomen remains the same, and the name of the subspecies is added without capitalization. For example, we have *Puma concolor cougar*, which is abbreviated as *P. c. cougar*.

## VIII. Acronyms

Acronyms (abbreviated expressions usually obtained by taking the first letter of each word in the original expression) are almost always capitalized. This is true both when the original expression is a proper noun, e.g., APEC (Asia Pacific Economic Cooperation), UN (United Nations), and when it is not, e.g., RG (renormalization group), CD (compact disc). However, there are a few exceptions, e.g., radar (radio detection and ranging), laser (light amplification by stimulated emission of radiation).

## IX. Sentences within Sentences

The examples below illustrate the special construction consisting of a sentence within a sentence.

(10) The girl said, "You should not come here again."

(11) The most important question is Does this divergence represent actual physical behavior?

Example (10) demonstrates the typical use of direct quotations. There, "You" is the first word of the quoted statement, and for this reason it is capitalized. The construction in (11) is somewhat rare. There, "Does...behavior" is a complete sentence that within the main sentence "The most...behavior" acts as the complement of the subject "question." In such a situation, in accordance with the general rule that the first word of a sentence be capitalized, the first word of the internal sentence is capitalized. Using a more common type of sentence structure, (11) can be rewritten as follows.

(11') The most important question is the following: Does this divergence represent actual physical behavior?

## X. Data

The noun *data* is the plural form of *datum*, and thus, in strict accordance with grammar, when *data* acts as a subject, its verb should be in plural form.

- (1) This data is useful for generating enhanced images.
- (1) These data are useful for generating enhanced images.

However, in recent years, perhaps because use of the singular *datum* is quite rare, the perception of *data* as the plural form of *datum* has faded. For this reason, such expressions as *one datum*, *ten data*, *many data* and *fewer data* sound somewhat unnatural, and in their place, expressions like *one data point*, *one piece of data*, *ten data points*, *ten pieces of data*, *much data* and *less data* have become standard. In this sense, there is a growing trend to regard *data* as an uncountable noun, similar in meaning and usage to *information*. As a result, because in general uncountable nouns can be used only in singular form, the use of *data* as a singular noun has become fairly common, and even in scholarly written work, this usage is now widely regarded as acceptable.

### Note

Illustrations show sentences demonstrating common types of mistakes, are numbered with red numerals.

Sentences demonstrating proper usage are numbered with black numerals.

Despite this point of qualification, however, it is still advisable as a general rule to use *data* as a plural noun in formal written work. Hence, grammatically, *data* is of a very rare type – a noun that is used as both plural and uncountable.

Below, are some examples demonstrating the incorrect and correct use of *data*.

- (2) We have acquired a large number of data using the technique described above.
- (2) We have acquired a large amount of data using the technique described above.
- (2') We have acquired a large quantity of data using the technique described above.
- (3) Several data have been eliminated from consideration.
- (3) Several data points have been eliminated from consideration.

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