Optimizing the Presentation of Paper

Figures, tables, mathematical notation, *etc.*

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Fig.: Sections 5.

Optimizing the presentation of your paper

We now turn to issues of presentation:

- how to properly make use of **figures**,
- how to properly make use of **tables**,
- how to properly make use of **mathematical notation**,
- as well as **terminology**.

Good presentation reflects a right attitude.

Figures: definite purpose

Each figure should have a **definite purpose**.

- This might be to help **clarify** the text, or **demonstrate** a particular experimental result.
- Pictures included just to look more appealing are **not** appropriate in **scientific writing**.
- Figures should be used for information which is **hard** to explain in **words**.

This could be the results of an image sharpening algorithm, for example, or a graph presenting some relation-ship between inputs and outputs of your method.

The reader will find easier to grasp by means of a picture.

Figures: definite purpose

- Your figures should **add** something to the paper.
- Figures should be **meaningful**.
  - ✗ Vague and suggestive
  - ✗ Fail to give units
  - ✗ No mathematical basis

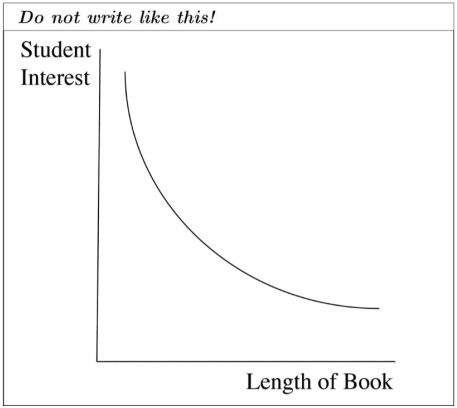


Fig.: The relationship between the student interest and the length of book.

Figures: definite purpose

- Avoid such diagrams which are **not quantitative** relationships based on a mathematical model.
- Qualitative content can be **better** described in **words** than figures.
- Make sure that graphs have properly **labelled** axes which state what each axis represents.
- Make sure that the range of values shown with **units**.

Figures: an example

For example, this shows a relationship between power and voltage:

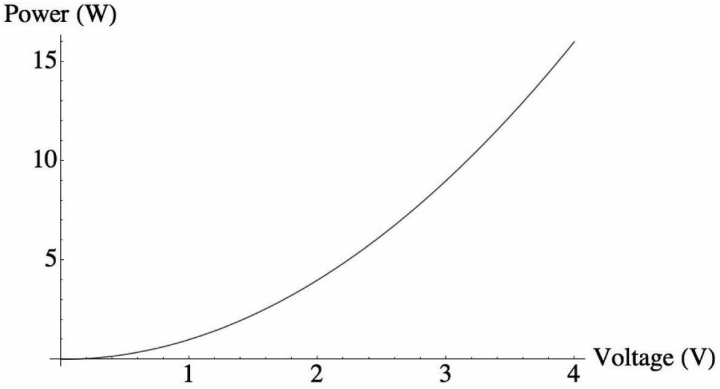


Fig.: A standard-compliant figure.

Figures: an example

Each figure should have a **short** caption.

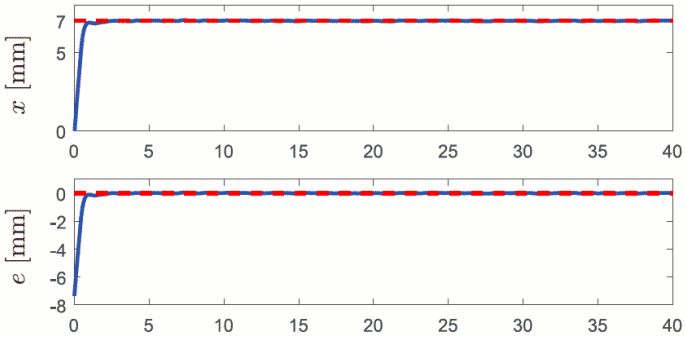


Fig. 7. Results of Experiment 2: Case 1 (*reference trajectories*—red dashed line; *proposed method*—blue solid line).

Figures: caption length

Caption **length** is a matter of some debate.

- Avoid using **long** explanatory captions under figures.

Do not write like this

Fig. 1. Image enhancement results for our algorithm and Wang's algorithm. Look carefully at the top left, where you can see that Wang's results are still blurred, due to a less successful sharpening operation. Also consider the bottom left, where Wang's method has resulted in un-wanted stripes in the image, due to the regular structure of his operators. Finally, we can also see that Wang's results have lower contrast, as he does not use a contrast boosting scheme.

Figures: caption length

The caption should be as **short** as possible, to **aid** the readers **concentration** on the main ideas in the paper.

- A paper has an essentially **linear** structure–a reader generally reads it **from start to finish**.
- Every time the reader stops to read a caption, they have to **break off** from the **main** flow of ideas to do so.
- The **longer** this break is, the **harder** it becomes to remember the main flow of ideas while reading the caption.

Tips: long footnotes or parenthetical remarks should also be avoided in the text.

Figures: referred & explain

- **Every** figure should be **referred** to in the main text explicitly.
- Do **not** include **figures** without saying what they show.
- **Explain** how it adds to the text, and what the reader is **supposed** to understand.

An example

Fig. 1 shows how power delivered to the battery varies with voltage in our supercharger circuit. As the voltage increases, the power delivered also increases. Thus, for rapid charging, the supercharger should be operated at as high a voltage as possible.

Figures: size

Do **not** make figures **too small**.

- **Try** to avoid shrinking pictures to accommodate **more** text.

An example

Figures which are the size of postage stamps and which *e.g.* claim to show some minor difference in results, will be pointless if at the size shown they look more or less the same.

Figures: size

If you **must** use **small** figures, at least show a **sub-figure** which **zooms in** on the important part to show the difference in detail.

- Make sure that the smallest text in any figure is **no smaller** than the main **font size** used in the paper.

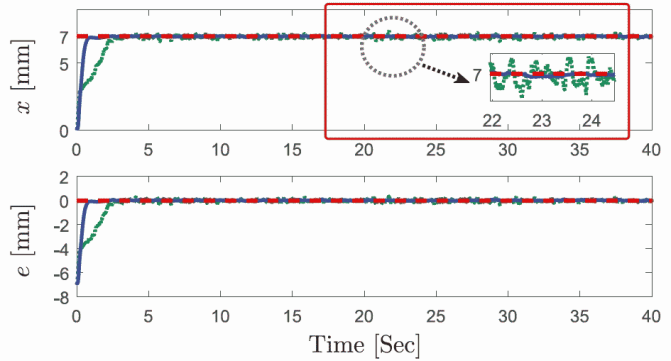


Fig.: A figure zooms in on important part locally.

Figures: consistent

Make sure that text within figures, and the caption, are **consistent** with the main text:

- Any terminology used should **match** that in the main text.
- Symbols should look the **same**, ideally in the same **font**.

Make sure that any **comments** in your figures are **consistent** with any comments in the main **text**.

Figures: an example

Keep the variables in the figure consistent with the text.

Tips: different curves can be distinguished by using different line types and different colors simultaneously.

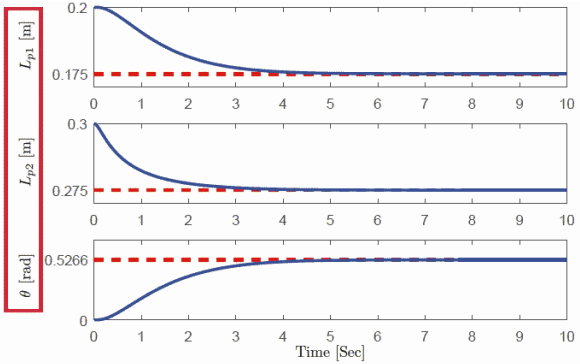
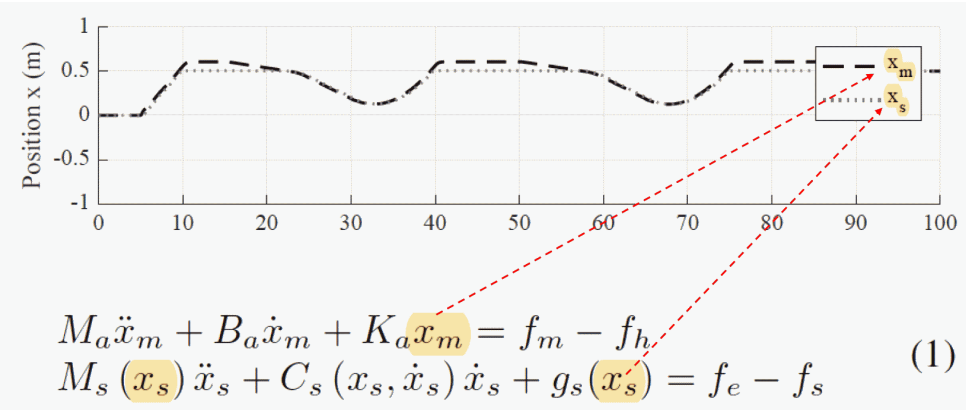


Fig. 2. Simulation results of $\theta(t)$, $L_{p1}(t)$, $L_{p2}(t)$ of the dual-PAM system (reference values–red dashed line; simulation results–blue solid line).

Figures: an example

Do **not** use **Matlab** font to **directly** generate coordinate variables.



Such coordinate variable format is **inconsistent** with the text.

Figures: an example

Use **overpic** to add text if necessary.

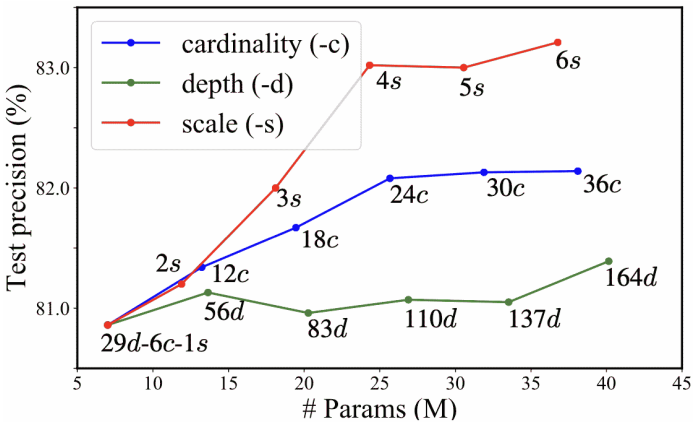


Fig.: Full LaTeX example: `http://mmcheng.net/res2net/`

Figures: place nearby

Place figures as **near** as possible to where they are **first** mentioned in the text, **ideally** on the **same page**, or at least the next page.

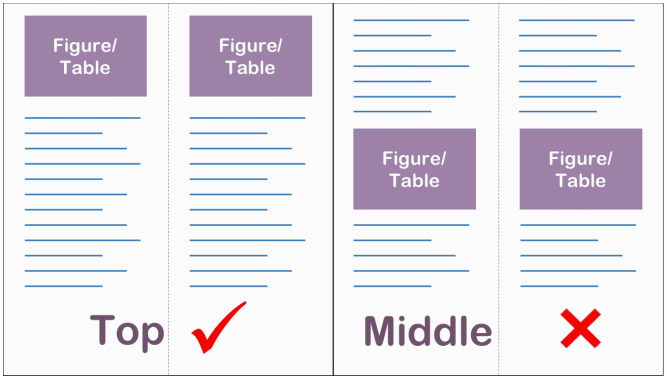
- It is **distracting** to readers to have to **skip** forwards and backwards between the text and figures.
- The linear flow of ideas should **not** be **disrupted**.
- Ensure that figures are **numbered** in the **same** order that they **appear** in the paper.

e.g.

Figure 6 does not come before Figure 5.

Figures: place at the top

For ease of reading, figures (and tables) should **normally** be **placed** at the **top** of the page (or column), rather than in the **middle** of it, **except** for small figures which fit into the flow of the text.



Figures: not misleading

Make sure figures are **not misleading**.

- What you claim a figure shows should be the **same** as the impression a typical reader will get by **quickly** looking.
- Make sure that the **viewpoint**, or **units** used, or other aspects of the figure, are those that a reader would **naturally** assume, or are **normally** used in your field.
- Ensure that figures are **numbered** in the **same** order that they **appear** in the paper.

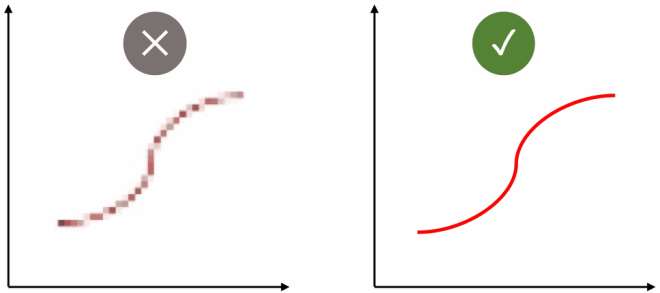
Do not write like this!

Fig 4. shows the distances of various planets to the sun, in cm.

Figures: quality

Finally, make sure figures are of an adequate **quality**.

- They should not be **low resolution** bitmaps,
- Unless you are particularly skillful, they should **not** be **hand-drawn**.



Try to use vector figure (.pdf or .eps).

Tables: special figures

Most of the above comments about figures **equally apply** to **tables**.

- They are really a **particular kind** of figure containing **textual** information.
- They conventionally **numbered** separately as '**Table** *n*' rather than '**Figure** *m*'.
- Algorithm pseudocode listings can also be presented as another **special** kind of figure, again with their **own** numbering sequence.

Tables: examples

TABLE I

DUAL-PAM'S PARAMETERS

Symbols	Physical Meaning	Unit
$L_1,\ L_2$	lengths of arm bones of upper/lower arms	m
$\theta_1,\ \theta_2$	shoulder/elbow joint angles	rad
$L_{s1},\ L_{s2}$	lengths of the first/second springs	m
$L_{p1},\ L_{p2}$	lengths of the first/second muscles	m
$F_{p1},\ F_{p2}$	input forces of the first/second muscles	N
$F'_{p1},\ F'_{p2}$	generalized forces	N
$m_1,\ m_2$	masses of upper/lower arms	kg
$\alpha_1,\ \alpha_2$	auxiliary angles	rad
r	distance between muscles (or springs) and arm bones	m
g	gravity coefficient	m/s^2

Algorithm 1. Seed-segment detection

Require: $\boldsymbol{N}_p, \epsilon, \delta, \boldsymbol{S}_{num}, \boldsymbol{P}_{min}$
Initialization: $flag = ture$
for $i = 1 \rightarrow (\boldsymbol{N}_p - \boldsymbol{P}_{min})$ **do**
  $j \leftarrow i + \boldsymbol{S}_{num}$
  fit $\boldsymbol{Seed}(i, j)$
  for $k = i \rightarrow j$ **do**
    obtain the predicted point P'_k
    $d_1 \leftarrow distance\ from\ P_k\ to\ P'_k$
    if $d_1 > \delta$ **then**
      $flag = false$
      break
    end if
  end for
  return $\boldsymbol{Seed}(i, j)$
end for

Fig.: The table and the algorithm pseudocode have their own numbers.

Tables: presentation of the information

The typical use of tables is to present **numerical results**, or other numerical information. To **aid** readers attention should be paid to **presentation of the information**.

- Make sure **each** row and column has appropriate **headers** to explain **what** that row of column contains.
- Columns of numbers should be **right-justified**, and all numbers in the same column should be given to the **same number** of decimal places.

Tables: units

- If numbers are **physical** quantities, the table should **state** the units with **each** number, *e.g.* . write '**10 s**' to indicate ten seconds.
- This is a **better** approach than putting the units in brackets in the table **headings** (although sometimes this can be the **only** approach which works, especially in **multi-column** page formats).
- Much worse is to **only** give the units in the text of the paper.

Tables: examples

Table 3
Parameters of the studied model.

Parameter	Description	Value
g	Gravity acceleration	981 (cm/s^2)
L_0	Original length of the PAM	16.4 (cm)
n	Number of turns of the thread	1.04
b	Thread length	17.9 (cm)
P_{atm}	Atmospheric pressure	1.01 (bar)
P_s	Supply pressure	7 (bar)
k	Stiffness of the spring	21.33 (N/cm)
l_{s0}	Pre-strained distance of the spring	2.8 (cm)
γ	Ratio of specific heats	1.4
R	Universal gas constant	286.7059 [kJ/(kgK)]
C_f	Discharge coefficient	0.63
C_r	Pressure ratio	0.528
T	Gas temperature	288 (K)
K_v	Valve proportional coefficient	0.05024 (cm^2/V)
D_0	Initial diameter of the muscle	1 (cm)
θ_0	Initial braiding angle	0.382 (rad)
μ	Friction coefficient	0.11 (Ns/cm)
t_k	Thickness of the rubber sleeve	0.16 (cm)
E	Elastic modulus of the rubber	0.39 (bar)
M	Active mass of the system	2.1 (kg)

TABLE II
IDENTIFIED VALUES OF $F(P)$ AND $K_i(P)$ WITH RESPECT TO DIFFERENT P

P (bar)	3.1	3.4	3.7	4.0
$F(P)$ (N)	741	779	820	867
$K_1(P)$ (N/mm)	14.92	13.45	12.21	11.44
$K_2(P)$ (N/mm^2)	− 0.072	− 0.050	− 0.031	− 0.018

save space

better

Tables: decimal places

Do **not** give numbers to **more** significant digits than are necessary to make your point.

For example

If comparing the success rate of alternative approaches, and these numbers vary from 40% to 95%, you do not need to give any decimal places at all. On the other hand, if they vary between 98% to 99% you may need one or even two decimal places.

	Hu's Method	Our Mechod
Time taken	10 s	4 s
Successful	85.2%	84.8%
Unsuccessful	6.3%	15.0%

Mathematical Notation: follow the standard

If your field conventionally uses **standard** notation for various mathematical values, make sure you follow it.

For example

It is standard practice to call the principal curvatures in differential geometry k_1 and k_2, and it would be unhelpful and confusing to refer to them as c_a and c_b.

- If previous papers have all used the **same** symbols for some quantities you **also** need, use the same symbols.
- Readers often **consider** and compare several papers on the **same topic**.

Please pay attention the repetition rate and avoid complete consistency.

Mathematical Notation: follow the standard

Using **standard** notation also means **following** convention on the use of **typographical style** for different kinds of quantities.

Example 1

Vectors are represented by lowercase bold letters: $\boldsymbol{v}$.

Example 2

Matrices are represented by italic uppercase letters: M. Most mathematical variables and functions are written in italics.

Example 3

Angles are usually written using Greek letters: θ.

Mathematical Notation: tips

- Make sure that **all** mathematical symbols used are **defined**, apart from commonly understood ones like π and i.
- The definition should come as **close** as possible to the place where the symbol is **first** used in your paper.
- Putting definitions where they are needed helps to **keep** the structure **linear**.

Mathematical Notation: single meaning

Make sure that each symbol is used with only a **single meaning** in a given paper.

For example

Do not use n to mean the number of patients in a medical trial at one point, and then n to mean the number of days on which a drug was taken at another point.

Mathematical Notation: single meaning

When you are defining your own symbols, use **easily remembered** names as much as possible.

For example

Use P for a point and L for a line, rather than, say A for the point and B for the line.

If you have several **related** items, give them related **names**.

For example

If you have several related points, use **subscripts**, and call them P_1, P_2 and P_3, or failing that, call them P, Q and R.

Mathematical Notation: advice

- Computer scientists are usually **advised** that variables and functions in programs should be given **long names**.
- However, in mathematics, the convention is to (usually) use **single letter** names for such **quantities**, and for **subscripts**.
- Do **not** express ideas **entirely** through **mathematical notation**.
- Trying to put the ideas into **words**.
- Explain ideas informally in English **first**, further giving more **precise** details in mathematical notation.

Units: Système International (SI)

The main rules for writing **metric** (SI) units can be summarised as follows:

- If metric units are written out in full, they should always start with a **lowercase** letter (except **Celsius**).

Thus,

write 47 ohm resistor, not 47 Ohm resistor.

- **Symbols** for metre units are written in **lower case**, except for those that are named after **persons**.

For example,

m for meter but W for watt, named after James Watt.

Units: Système International (SI)

- **Prefixes** indicating **multiples** are written **next** to the unit symbol, *without* a space.

Thus:

cm for centimetre = 1/100 metre, and ms for millisecond.

- **Prefixes** meaning a **million** or more are written in **uppercase**, and for **smaller** quantities, in **lowercase**.

Note carefully the difference between

m for milli- and M for mega-.

Units: Système International (SI)

- Leave **a space** between a number and any **unit** symbols which follow.

For example,

10 s not 10s.

- **Never** put a final **s** to indicate **plural** units.

Thus,

write 10 cm not 10 cms.

Units: Système International (SI)

- Do not put a **full stop '.'** after a symbol (except at the **end** of a sentence).

For example,

10 cm. wide should properly be 10 cm wide.

- **Avoid** using **standard** symbols for **non-standard** meanings.

So,

m means metres, and it should not be used to mean minutes, or millions.

Units: Système International (SI)

- Use '/' to mean **per**.

For example,

write 80 m/s for 80 metres per second.

- More complicated cases are most clearly written with **negative** powers.

For example,

write 10 m/s^{-2} for an acceleration measured in metres per second squared.

Units: Système International (SI)

- Symbols should be written in **upright (Roman)** letters, not **slanted (italic)** letters, to avoid confusion with mathematical variables.

For example,

write 100 m not 100 m.

- Use the **internationally agreed standard** symbols, and do not invent your own.

Thus, for example

write s for seconds, not sec.

Units: Système International (SI)

- This applies especially to symbols which are written with characters that do **not belong to** the Latin alphabet.

Like

μ for mico- and Ω for Ohm.

- In computing,

note

the difference between b for bit and B for byte;
the prefix k means kilo, i.e., 1000, while K conventionally means $2^{10} = 1024$.

Numbering: sections, figures, tables, *etc.*

Sections and subsections should be **hierarchically** numbered throughout the paper.

- The first section of the paper, **Section 1**, should have subsections numbered **1.1**, **1.2** and so on.
- **All** figures should be sequentially numbered using a **single sequence** throughout the paper, rather than a hierarchical approach.
- Tables should have **their own** separate sequential numbering sequence, as should any other type of special item such as **algorithms**, **theorems**, *etc.*

Numbering: equations, references

- The numbering convention used for **equations and references** depends on the **house style** used by a particular publisher.
- Numbering **all** equations is a reasonable default if **not given** specific guidance.
- **Suggest** numbering only the **important** equations, or equations you **refer to** elsewhere in the text.

Follow the requirements of journals and reviewers!

Numbering: examples of figures/tables

When **cross-referring** to sections, figures, tables and equations, refer to them **precisely** by number, rather than more **vaguely**.

For example,

‘Figure 7 shows ...’ rather than ‘The **above** figure shows ...’
‘The **above** equations’ could refer to **any** number of previous equations.

However, refer to *e.g.* ‘The **next** section’ in cases where the meaning is **unambiguous**.

Numbering: examples of figures/tables

The **exat** format used to refer to figures, tables and equations is **determined** by the **publisher's** house style.

For example

it might be as in '**Figure 2**', '**Fig. 2**', or '**Figure (2)**'.

Please read carefully the format of the journal you want to submit.

Numbering: examples of equations

When you are referring back to equations, you should **summarise** what they mean, rather than **simply** referring to them by **number**.

Do not write like this!

We substitute Eqn. (2) into Eqn. (6) to obtain the following equation.

instead, write

We substitute the locality constraint in Eqn. (2) into the similarity function in Eqn. (6) to give the neighbourhood similarity, as follows.

Numbering: examples of references

Different publisher will demand **different** styles of **referencing** and **citing**.

A simple approach is

to place the references in alphabetical order of first author's surname at the end of the paper, and number them sequentially as [1], [2], ...

- Alphabetical ordering helps the reader to **quickly** find a reference if he can remember who the first author is.
- Schemes such as numbering each reference according to **where** it **first appears** in the paper do not have this advantage.

Numbering: examples of references

An alternative and more informative style is to refer to them by **combining** the first author's **name** and the paper's **year** of publication. If there are clashes, you can:

- adding a **letter** after the **date** to distinguish papers by the same author in the same year,
- adding **initials** after the **name** to distinguish authors with the **same surname.**

An example

Major advances can be found in [Angus1999], [Angus2001a], [Angus2001b], [ChenXY1995], [ChenZ1994].

Numbering: examples of references

In many scientific publications, citations to references are given in **square brackets**, preceded by a **space**.

This method is explained in [Chen2000].

Some journals use **brackets** to cite references.

It is worthwhile to mention that, the method proposed in (Raffo, Madero, and Ortega (2010)) is still focused on SBRs working on the horizontal plane.

Other referencing styles use **superscript** numbers.

This problem is known to be intractable[17].

Terminology: use consistently

Much of the advice given earlier concerning mathematical notation also applies to **terminology**.

- You should use names of concepts **consistently**, and particular always use the **same** name for the same idea.

For example,

if you define a graph in which nodes represent cities, and edges represent rail connections between them, you should *always* refer to the graph's nodes as 'nodes', and not 'points', or 'vertices'. You should always refer to its edges as 'edges', and not 'links' or 'connections'.

Terminology: use consistently

- When writing novels and other literature, it is considered good practice to avoid **repeating** words–variation adds to the reader's **interest**.
- However, in scientific writing, **clarity** is more important.
- If you always use the **same** word for the **same** concept, the reader will know you mean the same concept.

An example

If sometimes you write 'edges' and sometimes you write 'links', this can lead to confusion, as the reader may be uncertain if the difference in terminology indicates some subtly different idea.

Terminology: use precisely

Use words **precisely** with their **correct** sense, especially technical words.

Example 1

You may be tempted to say that you have ‘made an incredible discovery’ but the word incredible means ‘unbelievable’. It is unlikely that you want to tell readers that they should not believe your findings.

Example 2

In the example ‘it is vital that you save all data to disk before shutting the computer down’, the word ‘vital’ literally means ‘necessary for life’. However, the author probably does not mean that the computer user will die if this is not done!

Terminology: use precisely

A different kind of **mistake** is made by an author who **misuses** technical language.

For example,

an author may write ‘power’ when they mean ‘energy’: power is energy per unit time.

Terminology: use precisely

Do not use **slang or colloquial** language.

Do not write like this!

3D TV is a hot topic.

Instead, use more formal language

3D television has recently attracted widespread research interest.

Terminology: use precisely

Do not use **unfamiliar sophisticated** words needlessly. If available, a simple word with the same meaning is **preferable**.

For example,

the word ‘paradigm’ is often used where ‘approach’ or ‘idea’ would do.

Do not use **spoken abbreviations** in formal writing.

Like

‘can’t’ always spell them out in full as ‘cannot’.

Terminology: use precisely

While tehnical abbreviations **are acceptable** the concept should be given in **full** the **first time** the abbreviation is used, followed by the abbreviation in **parentheses**.

An example

Genetic algorithms (GAs) can solve optimisation problems. GAs have been applied in many problem domains.

★ If you only use an abbreviation **once**, at the place where you define it, it is **unnecessary** and should be **omitted**.

Q & A?