Scientific Editing, English Editing, Copy Editing

Zuojun Yu , Ph.D.

Writing Well for Science

My story: learning English

My mom

My English teachers in college (SCO, or OUC) and at Zhong Da's graduate school

The secret: memorizing (rote learning, or 机械学习, 死記硬背)

My story: learning how to write well

I was lucky because my Ph.D. adviser was a great writer/teacher.

My adviser was lucky because he had a good journal editor once.

The secret: a detailed outline.

My two "secret" weapons for writing and editing English:

- **Microsoft Word "Thesaurus" (under "Review")**
- **Google with "quotation marks"**

Snapshots of a journal in the UK:

- **Copy editing at Prog. in Oceano. 1991 vs 2013**
- **Equatorial dynamics in a 2 ½-layer model**
- **Dynamics of the Indian-Ocean oxygen minimum zones**

Fax vs. email (three times)

No “The”

Figure vs. Fig.

Snapshots of a journal in the UK:

- **Widows and orphans**

http://en.wikipedia.org/wiki/Orphans_and_widows

1. Introduction

In the tropics, mid-depth oxygen minimum zones (OMZs) are located in poorly ventilated regions (e.g., Wyrtki, 1962; Kamykowski and Zentara, 1990). In the Indian Ocean, they are found in both the Arabian Sea and Bay of Bengal, where the ventilation age is 30 years or longer due to their closed northern boundaries (Fine et al., 2008). In this study, we use a coupled, biophysical model to understand the processes that determine their magnitude and structure.

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1.1. Background

1.1.1. Indian-Ocean OMZs

The Arabian-Sea OMZ (ASOMZ) is the second-most intense OMZ in the world tropical ocean (Kamykowski and Zentara, 1990), with near-total depletion of oxygen at depths from 200 to 1000 m (e.g., Morrison et al., 1998); indeed, suboxic levels ($\lesssim$5 μmol O_2/kg) exist over much of that depth range and denitrification occurs in its upper portion (Naqvi, 1991). Although still strong, the Bay-of-Bengal OMZ (BBOMZ) is weaker than the ASOMZ, with oxygen concentrations everywhere remaining above the denitrification threshold (Naqvi et al., 2006).

Fig. 1 illustrates the ASOMZ structure, showing its horizontal distribution near 200 m (left panel) and a vertical section from cruise TN039 of the Joint Global Ocean Flux Study (JGOFS) Arabian

Snapshots of a journal in the UK:

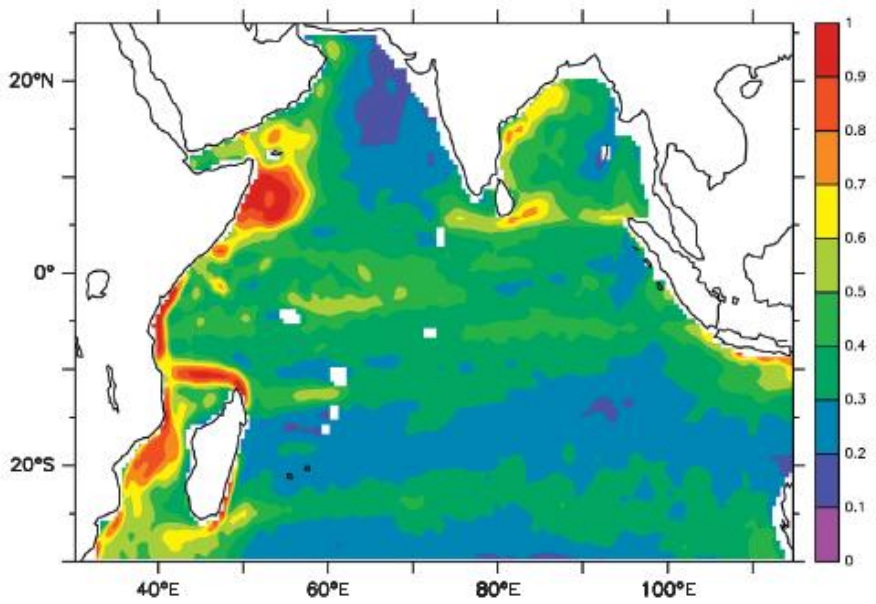
- **Non-breaking space**

http://en.wikipedia.org/wiki/Non-breaking_space

Chl-a/m^3 in the western Arabian Sea and Bay of Bengal, respectively). Even when there is sufficient mixing of nutrients from layer 5, however, N_4 cannot be maintained without a strong MR loop. In a test solution without any nutrient remineralization of small detritus in layer 4 ($e = 0$ in the N_4 equation, Solution noeN_4), N_4 again drops to $\lesssim 10$ µmol N/kg everywhere except near the ITF port, and the ecosystem collapses. In a similar test without large-detritus remineralization ($e' = 0$ in all the nutrient equations, Solution no$e'N$), N_4 still drops but only slightly, an indication that large detritus does not contribute much to the MR loop that retains nutrients in the system.

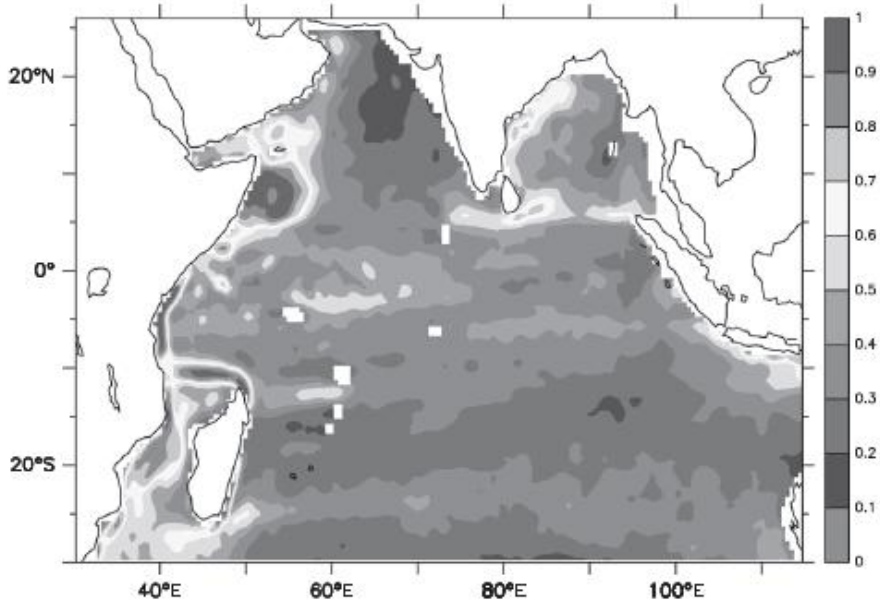
Nutrients are brought into the near-surface ocean (layers 1–3) either by vertical mixing or entrainment across the bottom of layer 3. To test the relative importance of each process, we obtained

Figures: online vs. paper version

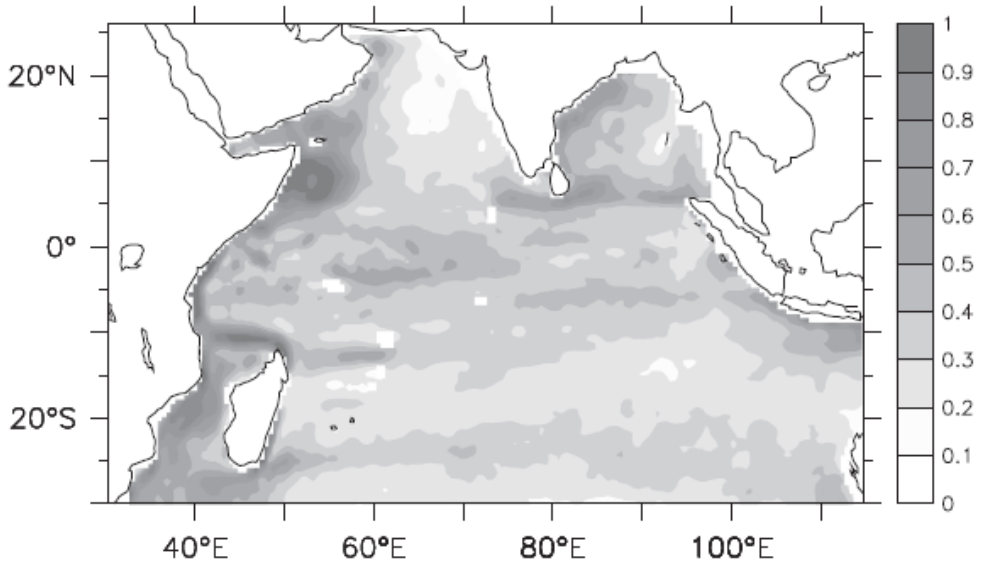


. 2. A map of normalized eddy kinetic energy, $\mathcal{E}'(x,y)$, based on AVISO data, normalized by $\mathcal{E}_{max} = 3.0 \times 10^{-3}$ m^2/s^2.

J.P. McCreary Jr. et al. / Progress in Oceanography xxx (2013) xxx–xxx



nap of normalized eddy kinetic energy, $\mathcal{E}'(x,y)$, based on AVISO data, normalized by $\mathcal{E}_{max} = 3.0 \times 10$



Snapshots of some journals in the US: copy editing

- **JPO--yes**
- **JGR/GRL--no**
- **Other journals in Earth Sciences--mixed**

Part I: scientific writing basics

The basic structure of a research paper

How to design illustrations for a paper

How to prepare an outline

The craft of scientific writing. **Michael Alley.**

Writing Well for Science

Part II: how to write better

More on structure: Providing transition, depth, and emphasis

How to write with precision and clarity

How to write concisely

How to write smoothly

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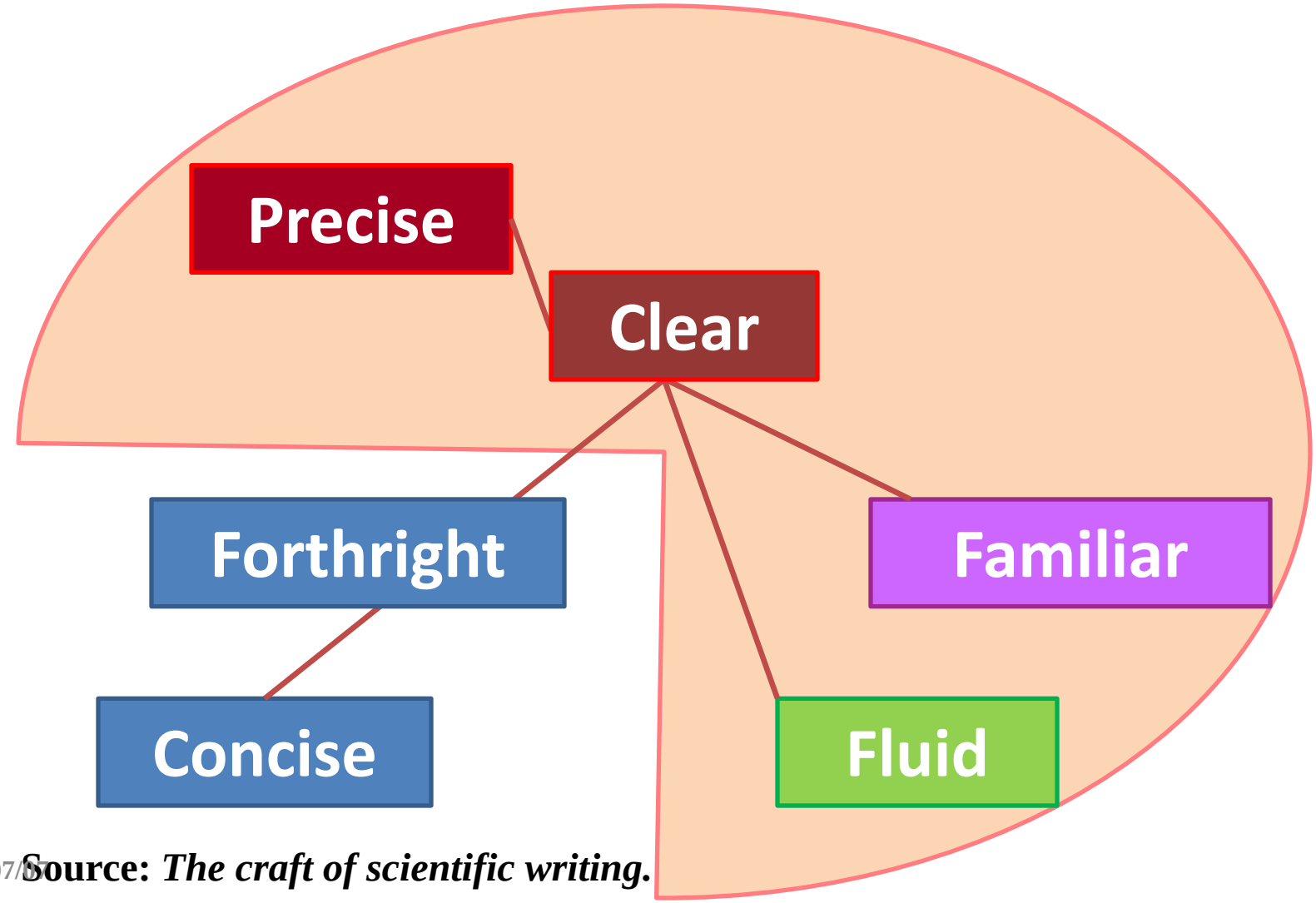
Writing Well for Science

Six Goals of Language in Scientific Writing:



Source: ***The craft of scientific writing.***

Basic structure of a research paper:

A research paper has a beginning, middle, and ending.

The beginning of a paper includes the title, abstract, and introduction.

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How to find a strong title for a paper (1)

A strong title offers two things:

1) the topic of the research;
2) its unique identity that is different from all other papers in the field.

Test: Does it stand out from a "google" search?

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How to find a strong title for a paper (2)

- **Being precise** (using the right words and appropriate level of accuracy);
- Using no more than three or four details;
- Avoiding being too long;
- Avoiding unfamiliar abbreviations.

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About “the”:

In addition to “solid” rules, some of us also have a “soft” rule, that is, to delete it (“the”) if it does not cause any confusion.

See “How to use articles” at
http://owl.english.purdue.edu/owl/resource/540/01/

How to Express Numbers:

Avoid beginning a sentence with a numeral.

Example:

64.1 milligrams of copper corroded during the tests.

During the tests, 64.1 milligrams of copper corroded.

Rules:

Use one to nine, but 10 (and up).

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What is the abstract for:

The abstract is to help readers to decide whether or not they need to read this paper.

"Please be good enough to put your conclusions and recommendations on one sheet at the very beginning of your report, so that I can even consider reading it."

---Winston Churchill

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About the abstract

When you cannot find a concise title to separate your work from everyone else's work, you can use the abstract to do so.

Note: If you need an abbreviation, define it first.

Note also: You should not define an abbreviation, if you use it less than three times.

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About “but” and “and”:

In scientific writing, one should avoid starting a sentence with “but” or “and.”

Copy editing: units & spacing

A space is needed before all but temperature units.

How to write an introduction:

An introduction should answer the following questions:

1. What exactly is the study about?
2. Why is the study important?
3. What is needed to understand the work?
4. How will the work be presented?

Note: If you need an abbreviation, define it first. (The one defined in the abstract does not count.)

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Copy editing: Figure vs Fig.

Ex:

A new flow chart of … is shown in Fig. 2.

Figure 2 shows a new flow chart of …

Middle of a research paper:

1) Choose an appropriate strategy to describe your research;

2) Create sections and subsections.

Considering parallelism

Example:

3.1 Relationship between currents and wind

3.2 SST and surface wind interaction

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Ending of a research paper:

1) Conclusions

Conclusions generally include a list of the key results from the paper's middle, a discussion and a future perspective on the work.

2) Back matter

It includes appendices and a bibliography.

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Ending of a research paper (cont'd):

1) Conclusions

- Do not bring in new results or new ideas;
- Do not end the paper with a negative statement about the work;
- Do not define abbreviations again;
- Avoid being too long (about 5%-10% of the length of the main text).

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Ending of a research paper (cont'd):

2) Appendices

An appendix is a good place to show detailed information for a more technical audience.

Examples:

Equations parameterizations for a numerical model;

Solving solutions for an 1-D model.

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Step 1: Designing and refining figures

- Design each figure by highlighting the features you want to share with your readers;
- Keep only what's necessary (panels, shadings, contours, labels, and writings);
- Arrange all the figures in a logic way.

Test: You should be able to give a 15-min talk using these figures alone.

Four Goals of Illustration:

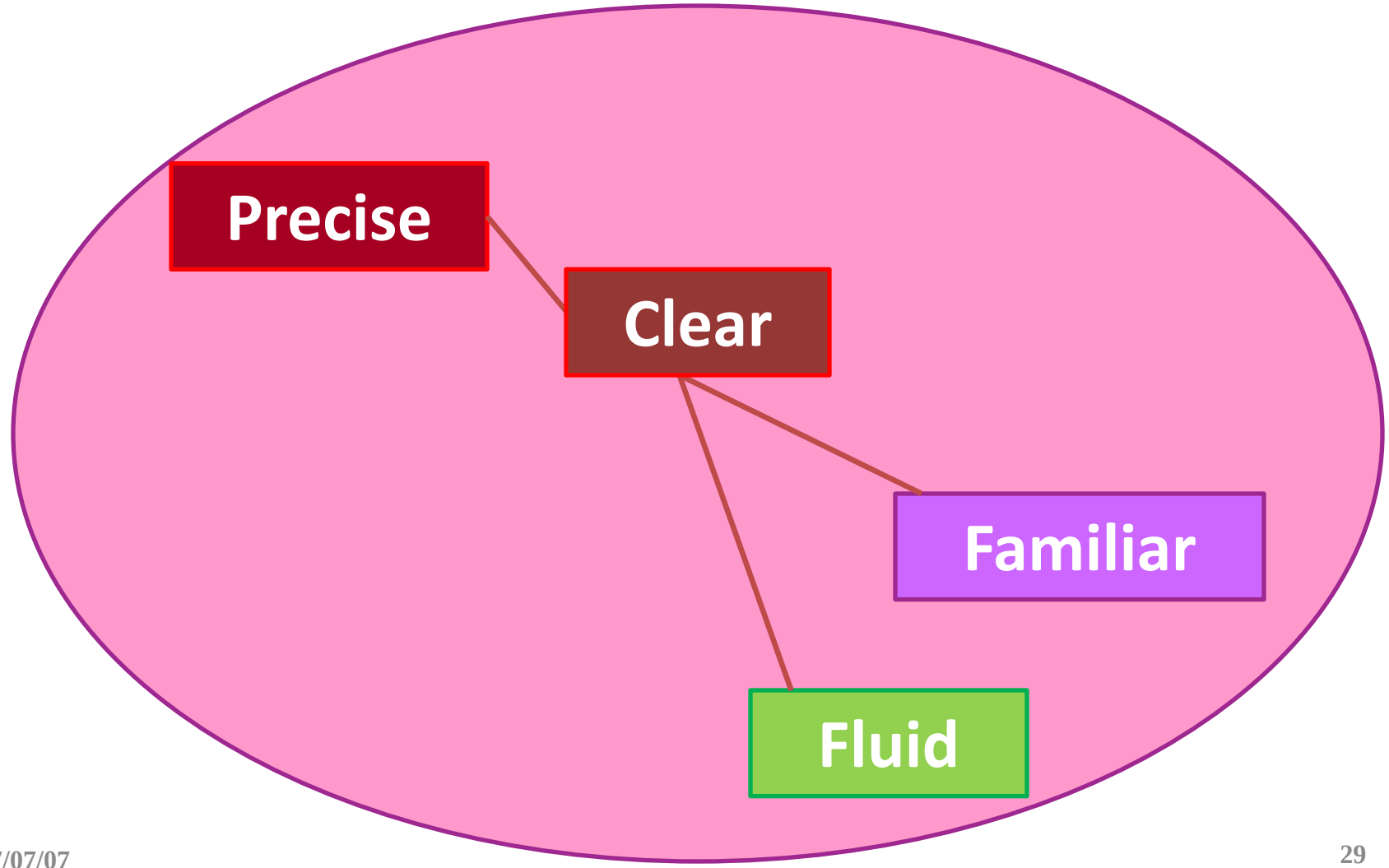

Illustration: Being Precise

Common mistake: a figure is much more complex than the text.

"Everything should be as simple as it can be, yet no simpler."

---Albert Einstein

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Illustration: Being Clear

A good figure has a well-written caption, which begins with a title phrase.

Test: A well-written caption should provide enough information to stand alone.

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Illustration: Being Fluid and Familiar

- **Match the information in the text with that in the illustration;**
- **Use familiar units;**
- **Use consistent layout.**

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Step 2: Using an outline

I. Introduction

II. Methodology

III. Results

IV. Summary and discussion

Step 2: Using an outline (cont'd)

I. Introduction

1.0 Opening paragraph

1.1 Background (pubs)

1.2 Present research

Note: Do not "mix" your own (published) results with other people's results, which can really upset some reviewers.

Step 2: Using an outline (cont'd)

I. Introduction

1.0 Opening paragraph

1.1 Background (publications)

1.1.1 Observational background

1.1.2 Theoretical background

1.1.3 Modeling background (pubs)

Step 2: Using an outline (cont'd)

II. Methodology

2.1 Data

2.1.1 Atmos. data

2.1.2 Air-sea flux data

2.1.3 Ocean data

2.1.3.1 Data used for assimilation

2.1.3.2 Data used for validation

2.2 Models (cont')

Step 2: Using an outline (cont'd)

II. Methodology

2.1 Data

2.2 Models

2.2.1 Model basics (equations, etc.)

2.2.2 Forcing field

2.2.3 Basin, resolution, and boundary conditions

2.2.4 Initial conditions

2.2.5 Output sampling and averaging

Step 2: Using an outline (cont'd)

III. Results

3.1 Main run

3.1.1 Mean state

3.1.2 Seasonal variability

3.1.3 Interannual variability

3.2 Sensitivity to winds

3.3 Sensitivity to mixing

…

Step 2: Using an outline (cont'd)

IV. Summary and discussion

4.1 Summary

4.2 Discussion

4.2.1 Unresolved issues

4.2.2 Future work

Note: Avoid ending a paper with a list of weaknesses of the research.

Step 3: Revising, revising, revising…

Note: Revising is the key to strong scientific writing.

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Structure: Providing Transition, Depth, and Emphasis

"Science is built up with facts,
as a house is with stones.
But a collection of facts is no more
science than a heap of stones
is a house."

---J. H. Poincare

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Transitions Between Details

1. Between sections:

- **Map the sections**

  Using a list at the end of introduction.

- **Smooth the entrance into each section**

  Avoiding three common beginnings:

  an "empty" beginning,

  a "too specific" beginning,

  or a "too general" beginning.

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Transitions Between Details (cont'd)

2. Between paragraphs:

Do not waste the first sentence to repeat what is said in the previous paragraph.

3. Between sentences:

Finish one thing before starting another. Do not go back and forth.

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Depth of Details

1. Limited by the length of the article
   GRL versus JGR

2. Indicated by the lengths of paragraphs and sections

3. Shown by repetition, wording, illustration, and placement

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Emphasis of Details

3. Shown by repetition, wording, illustration, and placement

Repetition: mentioning a particular result in the abstract, result section, and conclusion.

Wording: using dependent clauses and infinitive phrases.

because, since, as, although, when…

to filter out the high-frequency signal…

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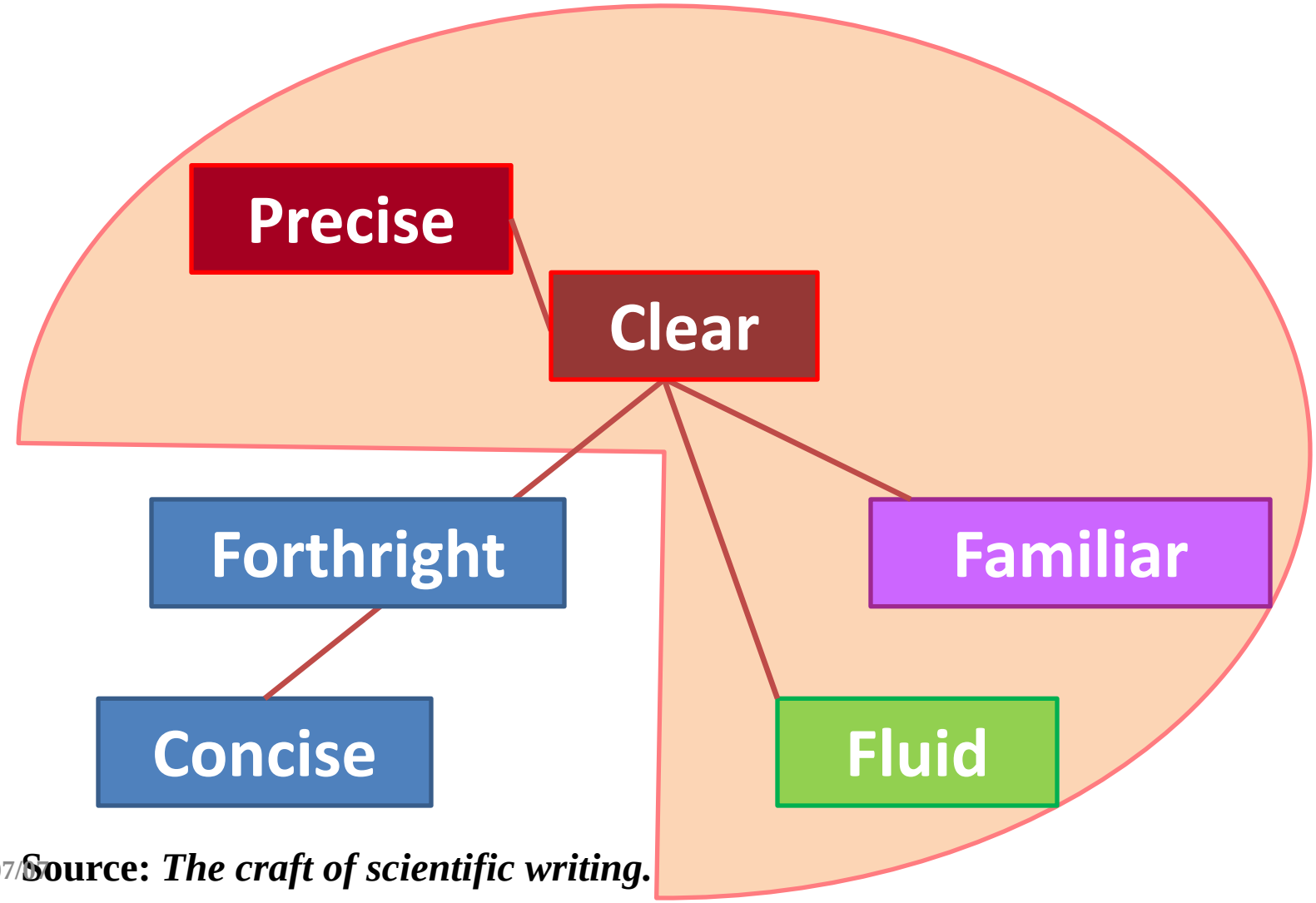
Six Goals of Language in Scientific Writing:



Source: ***The craft of scientific writing.***

Language: Being Precise

1. **Choose the Right Word**
   - affect/effect
   - farther/further
   - fewer/less
   - its/it's
2. **Choose the Right Level of Detail**

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Denotation and connotation of words

A word's connotation is its associated meanings, which may go against its dictionary meaning (denotation).

Examples:

adequate ←→ adequate safety record (insufficient)

cheap (negative connotation) / inexpensive

simplistic (negative connotation) / simple

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Language: Being Clear

Avoid Needless Complexity:

1) Needlessly Complex **Words**
2) Needlessly Complex **Phrases**
   (avoiding stringing modifiers)
3) Needlessly Complex **Sentences**
   (avoiding run-on sentences)

In scientific writing,
beauty lies in clarity and simplicity.

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Needlessly Complex Words

Category	Example	Possible Substitute
nouns	familiarization	**familiarity**
	utilization	**use**
verbs	facilitate	**cause**
	utilize	**use**
adjective	aforementioned	**mentioned**
	discretized	**discrete**
adverbs	firstly, secondly	**first, second**

Hint: Opting for the simpler word choice makes your ideas more clear to your readers.

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Avoiding Ambiguity

1) Ambiguity in Syntax

Example:

During 1990-2000,we used in situ data for our anomaly maps.

We used in situ data during 1990-2000 for our anomaly maps.

2) Ambiguity in Pronouns

"it" and "this"

3) Ambiguity in Punctuation

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Avoiding Ambiguity (cont'd)

3) Ambiguity in Punctuation

Example:

We tested neat methanol, neat ethanol, methanol and 10% water and ethanol and 10% water.

We tested four fuels: neat methanol, neat ethanol, methanol with 10% water, and ethanol with 10% water.

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Language: Being Forthright

Avoid the following phrases:

As is well known, …

The results clearly demonstrate…

It is obvious …

Our results prove …

Use instead:

The results show…

Our results support …

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Avoiding Weak Verb Phrases

In general, the smaller the verb phrase, the stronger the verb phrase.

is beginning	→	**begins**
is used to detect	→	**detects**
made the decision	→	**decided**
made the measurement of	→	**measured**

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Language: Being Concise

1. Eliminate Redundancies
2. Minimize "Writing Zeroes"
3. Reduce Passive Voices
4. Reduce Sentences to Simplest Forms

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Eliminating Redundancies

A redundancy is a needless repetition of words within a sentence.

(already) **existing**
(alternative) **choices**
at (the) **present** (time)
(completely) **eliminate**
(currently) **underway**
first (began)

introduced (a new)
mix (together)
(most) **critical**
never (before)
(still) **persists**
(very) **unique**

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Minimizing “Writing Zeroes”

It is interesting to note that …

It should be pointed out that …

It is noteworthy that …

Use: Note that …

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Simplifying Phrases

Fat Phrase	Reduction
has the ability to	can
in light of the fact that	because
in the event that	if
in the vicinity of	near
owing to the fact that	because

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Reducing Adjectives and Adverbs

detailed **understanding of …**

somewhat **unique**

somewhat **perfect**

very **important**

very **heavily depending on …**

Note: Avoid adverbs "always" and "never."

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Language: Being Familiar

1. Avoid Unfamiliar Terms

2. Define Unfamiliar Terms

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Language: Being Fluid

1. Vary **Sentence Rhythm**
2. Vary **Sentence Lengths**
3. Vary **Sentence Structure**
4. Vary **Paragraph Lengths**

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Eliminating Discontinuities

1) Make Transitions Between Ideas by Using Transitional Words.

Continuation: also, moreover, first…second…

Pause: for instance, for example, in other words

Reversal: however, on the other hand, conversely, nevertheless

2) Avoid gaps in logic.

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- My Blog is at

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