

Improving the readability of your technical paper



Mik Fanguy

Readability



- Referees in scientific journals often complain about problems with the readability of submitted papers.
- Your writing must be clear in order to convey the result of your research effectively.

Topics



- This presentation will cover the following issues related to the readability of your writing:
 1. Proper word choice
 2. Verb tenses
 3. Flow
 4. Paragraphing
 5. Complexity

1. Word choice



- Writers sometimes tend to use simple words that prevent them from fully or completely expressing their ideas.
- Problem words:
 - Good
 - Bad
 - Big
 - Very, quite
 - A lot of, many
 - Thing, stuff

Word choice: good



- Can you think of a more appropriate word choice for this example?
- A and B showed **good** adhesion...

Alternative



- A and B showed **strong** adhesion...
- Other alternatives: excellent, remarkable, etc.

Word choice: good



- Unfortunately, the off line calculation for determining **a good** subspace dimension, as well as the principal eigenimages themselves, is computationally expensive.

Alternative



- Unfortunately, the off line calculation for determining **the appropriate** subspace dimension, as well as the principal eigenimages themselves, is computationally expensive.

Word choice: good



- As can be seen from all three measures, quantitatively, the estimated left singular vectors for the proposed algorithm are **very good** estimates of the true left singular vectors as computed by the direct SVD.

Alternative



- As can be seen from all three measures, quantitatively, the estimated left singular vectors for the proposed algorithm are **highly accurate** estimates of the true left singular vectors as computed by the direct SVD.

Word choice: good



- We thank A. Hochwagen, G. Ruby, and H. Guo for **good** discussions.



Alternative



- We thank A. Hochwagen, G. Ruby, and H. Guo for **helpful** discussions.



Word choice: very/quite



- At P2, at the start of REC outgrowth, EC-MC interactions are already **quite** aberrant in Fz4/retinas, indicating an initial failure of EC-MC recognition or adhesion (Figure 3E).
- Can you think of an alternative that would indicate that the aberrance was immediately evident to anyone examining the evidence?

Alternatives



- At P2, at the start of REC outgrowth, EC-MC interactions are already **strikingly** aberrant in Fz4/retinas, indicating an initial failure of EC-MC recognition or adhesion (Figure 3E).
- Other possibilities: noticeably, conspicuously, significant, considerable, remarkable.

Word choice: a lot of



- Can you think of a better alternative below?
- Ndp retinal vascular transcriptomes were highly correlated and showed **a lot of** differences versus WT.

Alternatives



- Ndp retinal vascular transcriptomes were highly correlated and showed **numerous** differences versus WT.
- Other possibilities: a number of, multiple, a variety of, etc.

Word choice: bad



- Exposure to light was **bad** for performance.

Alternatives



- Exposure to light **negatively affected** performance.

Alternatives for “bad”



- Disadvantageous
- Unsubstantial
- Negative
- Weak
- Undesirable
- Unacceptable
- Unethical

Word Choice: Big



- Can you think of an alternative to the red word below?
- New research could lead to **big** advancements in this area.

Alternative



- New research could lead to **substantial** advancements in this area.



Alternatives for “big”



- Considerable
- Expansive
- Massive
- Vast
- Dynamic
- Visible
- Enormous
- Impressive

Topics



- This presentation will cover the following issues related to the readability of your writing:
 1. Proper word choice
 2. Verb tenses
 3. Flow
 4. Paragraphing
 5. Complexity

2. Verb tense: introduction



- The first rule of thumb is to word your sentences in such a way that verb tenses are simple and consistent.
- Use present tense when possible because it is automatically reader-friendly and readily understood.

Present tense



- An accepted practice is that scientific truths, facts, and things happening during the reading of a paper can be treated best in present tense.

Examples:

- The major drawback in using eigendecomposition **is** the off line computational expense incurred by computing the desired subspace.
- This paper **presents** a method for extending this technique to data correlated on S^2 as well as $SQ(3)$ by sampling the sphere appropriately.

Past tense



- Used for your own findings or experimental procedures, the actual experimental procedures and results of others, and physically past events.

Examples:

- The proposed algorithm detailed in Section IV **was implemented**.
- To illustrate qualitatively the accuracy of the estimated eigenspace, the first seven eigenimages of object 8 from Fig. 6 **were plotted and depicted** in Fig. 8 as an example.

Future tense



- Future tense (using “will” or “shall” with a verb) is usually reserved for those things not yet completed. This tense is most useful when you want to talk about future events.

Example:

- The virtual-reality system developed here **will enable** new experimental approaches to study the neural circuits underlying navigation.

Perfect tense



- Finally, the perfect tense is useful when you need to stress that one thing happened before another, or that something began in the past and was continued thereafter.

Examples:

- Once the principal eigenimages of an image data set **have been** determined, using these eigenimages is very computationally efficient for the online classification of 3-D objects.
- Extensive simulation **has shown** that for fully general pose estimation, a subspace that can recover between 60–70% of the energy is typically more than sufficient.

Changing tense



- Contrary to what some writers think, you may switch verb tense within a paragraph (even within a sentence).
- You simply must be certain that the context implied by the verb tense matches the intended meaning.

Example of tense shift



Once the principal eigenimages of an image data set have been determined, using these eigenimages is very computationally efficient for the online classification of 3-D objects. Unfortunately, the off line calculation for determining the appropriate subspace dimension, as well as the principal eigenimages themselves, is computationally expensive. This drawback has been addressed using several different approaches based on either iterative power methods, conjugate gradient algorithms, or eigenspace updating [23]–[25]. A fundamentally different approach was proposed by Chang *et al.* [16], where the authors show that the fast Fourier transform (FFT) may be used to estimate the desired subspace dimension, as well as the principal eigenimages if the image data set is correlated in one dimension.

Topics



- This presentation will cover the following issues related to the readability of your writing:
 1. Proper word choice
 2. Verb tenses
 - 3. Flow**
 4. Paragraphing
 5. Complexity

3. Flow



- A common complaint from referees is that writing does not “flow.”
- We can improve the flow of writing by varying sentence openers, causing natural transitions from sentence to sentence.

When sentence openers do not vary, the sentences do not seem to connect



Z

Z

Z

The quality measures outlined in Section II were used to validate the quality of the estimated eigenimages. **Fig. 7 shows** all three of the quality measures averaged across all objects in Fig. 6. **The top plot** shows the energy recovery ratio for the first 50 true eigenimages as well as the first 50 estimated eigenimages. **The two curves** are nearly indistinguishable. **The second plot** shows the residue of the first 50 estimated eigenimages compared to the first 50 true eigenimages. **The residue is** normalized by resulting in a worst case bound of one. **The third plot** shows that based on the subspace criterion, the first 50 estimated eigenimages nearly span the same space spanned by the first 50 true eigenimages. Quantitatively, the estimated left singular vectors for the proposed algorithm are very good estimates of the true left singular vectors as computed by the direct SVD.

Varying sentence openers allows for more kinds of transitions between sentences



Topic of Sentence



Subject

Time of action Phrase



Prepositional

Location of action Phrase



Prepositional

Manner of action



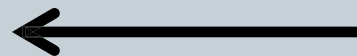
Adverb

Subordinate action



Dependent Clause

Reason for action



Infinitive Phrase

Vary sentence openers to vary rhythm



subject-verb

The top plot shows the energy recovery ratio...

prepositional phrase

As can be seen from the plot,...

adverb

Recently, interest has increased in...

dependent clause

Although the exact time of the eruption surprised scientists, evidence had been collected...

infinitive phrase

To validate the quality of the estimated eigenimages, the quality measures outlined...

Varying sentence openers enlivens the writing and allows connections



To validate the quality of the estimated eigenimages, the quality measures outlined in Section II were used. Fig. 7 shows all three of the quality measures averaged across all objects in Fig. 6. The top plot shows the energy recovery ratio for the first 50 true eigenimages as well as the first 50 estimated eigenimages. As can be seen from the plot, the two curves are nearly indistinguishable. The second plot shows the residue of the first 50 estimated eigenimages compared to the first 50 true eigenimages. The residue is normalized by resulting in a worst case bound of one. The third plot shows that based on the subspace criterion, the first 50 estimated eigenimages nearly span the same space spanned by the first 50 true eigenimages.

As can be seen from all three measures, quantitatively, the estimated left singular vectors for the proposed algorithm are very good estimates of the true left singular vectors as computed by the direct SVD.

Topics



- This presentation will cover the following issues related to the readability of your writing:
 1. Proper word choice
 2. Verb tenses
 3. Flow
 - 4. Paragraphing**
 5. Complexity

4. Paragraphing



- Usually range from three to five sentences.
- One sentence standing alone does not qualify as a paragraph.
- Must be unified under one main idea or theme.

Attitudes towards paragraph length



- Research shows that people generally have more positive attitudes towards technical writing with paragraphs of 100 words or less.
- Shorter paragraphs look more organized.
- White space is increased.
- Extremely long paragraphs may intimidate the reader.

Topics



- This presentation will cover the following issues related to the readability of your writing:
 1. Proper word choice
 2. Verb tenses
 3. Flow
 4. Paragraphing
 5. Complexity

5. Complexity



- Avoid making papers unnecessarily complex.
- Replace technical terms with simple words whenever possible.

Gunning Fog Index



In the index, the complexity of the writing depends on

- (1) the lengths of sentences
- (2) the lengths of words

Desired index values for scientific writing are 10-12:
New York Times (11)
Scientific American (12)

$$F_i = 0.4 \left(\left(N_w / N_s \right) + P_{lw} \right)$$

N_w = number of words in a typical paragraph

N_s = number of sentences in the paragraph

P_{lw} = percentage of long words in the paragraph

Try it



Try copying and pasting a paragraph of your own writing into this Gunning Fog Index calculator:

<http://simbon.madpage.com/Fog/>

An ideal score would be between 9-13.

References



- Alley, Michael. Writing Guidelines for Engineering and Science Students. Retrieved on Nov. 8, 2009 at <http://www.writing.engr.psu.edu/>
- Schall, Joe. Effective Technical Writing in the Information Age. Chapter 1: Improving Your Style. Retrieved on Nov. 8, 2009 at https://www.e-education.psu.edu/styleforstudents/c1_p8.html