Guide to using references in the sciences

This material is adapted from *English Solutions for Engineering Research Writing* http://www.hanyangowl.org

**Consider using a literature review matrix**

When you are researching a topic, it is difficult to remember what you have read and the similarities and differences between these papers. In order to organize your research, a literature review matrix may be helpful. Simply make an MS EXCEL file with the key points of any paper in your field, such as the author names and title of the article, the date of the paper, the specific aspect of the research problem examined, the type of materials used, the experimental methods used, or the research methods used. The exact categories can be customized to each field of research. Then, fill in the grid with summaries of the papers you have read. This matrix format, especially with the addition of color coding, will help you see the overall picture of your research field and will allow you to see similarities, differences, and patterns in research. This tool is even more useful for theses and dissertations, or other longer more complex multi-paper research projects or proposals done by a whole lab. Each member of a research team could add to this matrix after they have read a paper. The quality or usefulness of an article could also be indicated by using a point or star system. A matrix may also be useful background for a proposal or research grant application for a non-specialist audience.

Download this file to see examples from the fields of health sciences and environmental protection and modify the method according to your own needs.

Also, search “Literature Review Matrix” in quotation marks in an internet search to find further examples. This technique does not seem to be that common in engineering, but it looks very useful.

**TIP**

Since the exact format may differ in different journals, it is a good idea to choose which journal you are sending your paper to before you do the references. This will save you time by not having to reformat your paper.

Many software programs can be used to automatically format and store all your references and/or research notes. Ph.D. students and faculty should consider using research software programs to increase productivity. Most are not free, but the university may have a site license for *Endnote* software. Here are some of the more popular online services or software.

http://www.endnote.com/
http://refworks.com/
http://www.refman.com/

Here are some additional online tools for reference software.

A free online shared reference system from the journal *Nature* http://www.connotea.org/
http://www.library.utoronto.ca/gerstein/subjectguides/personalbib.html
5.6. Why are references required?

A good introduction with a literature review in a thesis or “related works” section of an article is not simply a summary of previous research, but should show that you have made a contribution to a problem or missing area of research in your field. As well as showing where you got the ideas from, references also allow you to show the difference between your work and previous research. Therefore, you make reference to other research when presenting the importance of your own paper. Citations to other similar research also helps the reader to understand the context of your paper. Citation also help to determine the importance and influence of an article by showing the number of references.

TIP

A problem for some graduate students is a lack of references to previous research in the introductions section. Browse the already published articles in the journal you want to publish in and get an idea of the average number of references. Then compare it to the number of references in your paper. If there is a very significant difference in the number of references in your article and many previously published articles, it may indicate a problem. It is only a rough guide, but it is a helpful comparison.

2) Location of references in the paper

It may be obvious that references occur in the introduction and discussion sections of papers, but they may also occur in the methods or results sections as well. For example, if you are using a method that is not commonly known in your field, you may add a reference from another field that has used a similar method successfully. In fact, you can add references to almost any section of the paper except the abstract, where full references are never given except rarely for some conference proposals. In short, do not put references in an abstract unless a journal or conference specifically asks for them.

TIP

You may mention a particular method, research instrument, theory, or author, but you should not give a numbered reference or author-date reference in the abstract itself.

Here is an example of the first line of an abstract. There is no reference. If this sentence were in an introduction, we would normally see references for the methods, theories, specific papers, or procedures, but not in the abstract.

EXAMPLE

The perturbation method is used to construct the general solution of a centrally symmetric quasistatic problem of elasticity under the assumption that all thermomechanical characteristics of a body are functions of temperature.


There are basically three ways to use sources from other papers:
5.7. Direct quotation

Direct quotation is used when you want to use the exact words from a source, term, or an example. Basically, anything between the “quotation marks” should not be changed from the original at all. In this example, the author uses quotation marks to indicate the exact sentences used in searches.

EXAMPLE
All of the above discussed models, [6], [7], [22], [27], share the following drawbacks. 1) They do not represent time-varying visual features other than direction, for example, a simple query as the following is not supported “find a shot that has an object whose color changes from red to blue”, 2) they do not support rich sets of VST relationships between objects, for example, a simple query as the following is not supported “find a shot that has two objects, where O1 is smaller, darker, and faster than O2,” and 3) their query tools do not allow users to specify the appearance and disappearance of an object trajectory in reference to trajectories of other objects, for example, a simple query as the following is not supported “find a shot that has two objects, where O1 appeared in the shot before, and disappeared after, O2”.

In this example from civil engineering, it is important for the author to show the exact words from the design code, so a direct quotation is used.

EXAMPLE
All connections are assumed to be fully rigid, in agreement with the design code philosophies. In Ref. [4,Chapter 5.2.2.2] (models for global analysis), paragraph 6 states the following: “In general, the connections in bridges should be designed as rigid except for pinned connections or connections of cables which may be considered as nominally pinned, to improve their fatigue life”. In Chapter 5.2.3.5 (truss bridges), paragraph 2 contains this note: “For the fatigue verification secondary moments shall be taken into account.”

However, unlike the social sciences, direct quotation is rarely used in engineering writing. Instead, summary and paraphrase are standard. Direct quotation is used more commonly in business writing in reports, recommendations, or proposals, however. For more information on how to use direct quotation see http://www.engineering.utoronto.ca/English/page-1-2076-1.html#3

Notice that double quotation marks are used in American English, but single quotation marks are used in British English. For further explanation, see Section 10.10.

5.8. Summary

Summary occurs when you only want to refer to the main idea of a paper or a group of papers that share some characteristics. For example, in this article related to coal fuel, the author is summarizing the changes over the years contained in a number of different articles up to the present [2-6].
EXAMPLE
The code has been modified over a number of years to model the flow and combustion processes in bagasse fired boilers [2–4]. Details of a more recent version of the FURNACE code are described elsewhere [5,6].

When making a summary, you cannot just copy and paste a sentence from other papers but must write your own sentence in your own words containing the main idea of the previous article or articles. Summary is common in engineering writing.

5.9. Paraphrase

Paraphrase involves taking a sentence from a part of a paper and rewriting it in your own words. Paraphrasing properly is very difficult, but common in engineering writing. It will be explained in detail in the next section.

Steps to proper paraphrasing:

1. Read and fully understand the sentence you want to use.
2. Identify the key terms in your field that must be used and the words that need to be rewritten.
3. Modify the sentence structure and change the vocabulary words as necessary.
4. Include the reference to the original.

Even if a reference is given (such as [1]), it is not acceptable to copy and paste the entire sentence or even much of a sentence from another paper into your introduction. When you use references from another paper, you must rewrite the original in your own words.

5.9.1 Technical terms in paraphrasing

In order to paraphrase correctly, it is essential to know the difference between the technical terms in your field and the particular general vocabulary words that the author has chosen. In addition, you must be able to distinguish between fixed phrases common in your field, and phrases unique to individual authors based on their own choice of general words.

These are three important points to remember when you are paraphrasing.

1) Do not change technical terms when paraphrasing

Words like “end-to-end delay” in voice communications should not be changed because this term has a specific technical meaning in this field known to everyone. Changing this term would only confuse the reader with an unfamiliar word. Here is the definition of “end-to-end delay.”
http://www.iec.org/online/tutorials/voice_qual/topic05.html

To find the use of technical terms in your field you can use the Google Internet and Acrobat search techniques introduced in Chapter 2 to see how specific words are used in your field.

2) Be able to recognize fixed expressions in your field
One guideline for a computer program that checks sentences for copying is whether six words in a string are the same. See http://www.nature.com/nature/journal/v435/n7040/full/435258a.html

However, I think it is more important to recognize the difference between fixed expressions in your field, and the unique words chosen by the author that can be changed by using other words with a similar meaning. The following are examples of fixed expressions common in engineering that do not have to be rewritten. You can find more useful patterns by using the advanced Adobe search techniques introduced in Chapter 2. Learning these common fixed expressions will help you to write in a style that is appropriate in your field.

EXAMPLES
- ... as shown in Figure 1.
- Previous work has mainly focused on improving the tradeoff between ...
- In this paper, we propose a new/novel ...
- This paper is organized as follows. Section II describes the ...
- As illustrated in Fig. 2, we denote the ...

3) Change the structure of the sentence without changing the meaning of the original author’s words

When paraphrasing, we have to keep the original meaning of the sentence. Therefore, be careful not to mix your own ideas together with the paraphrased words in a single sentence. Even if you give the reference at the end, it may be unclear which ideas are being referenced.

5.9.2 Examples of incorrect paraphrase

Imagine that you are writing your introduction on voice communication over IP networks.

You start off the introduction of your own paper with a general statement that introduces the reader to the research problem that will be introduced.

Eliminating excessive end-to-end delay is an essential step in ensuring quality-of-service (QoS) in real-time voice communication over IP networks (VoIP).

In your reading you found an important point from Liang et al. on why voice communication must not be interrupted, which you would like to use in your article. You also like the way the authors have emphasized the “interactivity of human conversation” and want to include it in your paper.

In simple English this sentence just means that voice information unlike other types of packets of information must arrive in the correct order in order for voice to be understood in real-time. Because of this, we cannot just send the information again like other types of information.

The unreliable and stateless nature of today’s Internet protocol (IP) results in a best-effort service, i.e., packets may be delivered with arbitrary delay or may even be lost. This quality-of-service (QoS) limitation is a major challenge for real-time voice communication over IP networks (VoIP). Since excessive end-to-end delay impairs the interactivity of human conversation, active error control techniques such as retransmission cannot be applied. Therefore, any packet loss directly degrades the quality of the reconstructed speech. Furthermore, delay variation (also known as jitter) obstructs the proper reconstruction of the voice packets in their original sequential and periodic pattern.
Simply copying and pasting this sentence without a reference would be totally unacceptable, but this is not usually a problem with students. However, proper paraphrase is often a problem, and it can get quite complex. The following paraphrase is not acceptable because we have just copied and pasted the sentence, even though we have included a reference [1] to indicate that we got this example from Liang et al.

**ORIGINAL EXAMPLE**
Since excessive end-to-end delay impairs the interactivity of human conversation, active error control techniques such as retransmission cannot be applied.


Remember that the first sentence is your own sentence and not the paraphrased one.

> **Incorrect paraphrase 1**
Eliminating excessive end-to-end delay is an essential step in ensuring quality-of-service (QoS) in real-time voice communication over IP networks (VoIP). Since excessive end-to-end delay impairs the interactivity of human conversation, active error control techniques such as retransmission cannot be applied [1]. Therefore, …

We need to rewrite the sentence in our own words. In order to do that, we need to understand the meaning. Basically the sentence means that, unlike other types of data that are sent in packets, voice data cannot be interrupted or resent because it needs to arrive in the proper order and time for people to be able to interact in real-time when talking.

**ORIGINAL EXAMPLE**
Since excessive end-to-end delay impairs the interactivity of human conversation, active error control techniques such as retransmission cannot be applied.


> **Incorrect paraphrase 2**
Eliminating excessive end-to-end delay is an essential step in ensuring quality-of-service (QoS) in real-time voice communication over IP networks (VoIP). Because excessive end-to-end delay impairs the interactivity of human conversation, active error control techniques such as retransmission cannot be used [1]. Therefore, …

The paraphrase above is still not correct because we have only substituted a few key words and have not modified the structure of the sentence. As a result, we have taken too many of the author’s choices of words. There are too many strings of text that are the same, such as “impairs the interactivity of human conversation,” and, therefore, we are stealing the author’s words. The author’s words themselves and not just the ideas cannot be copied. Words and not just ideas are intellectual property, just like company slogans.

**ORIGINAL EXAMPLE**
Since excessive end-to-end delay impairs the interactivity of human conversation, active error control techniques such as retransmission cannot be applied.


> **Incorrect paraphrase 3**
Excessive end-to-end delay is an essential step in ensuring quality-of-service (QoS) in real-time voice communication over IP networks (VoIP). Because excessive end-to-end delay interrupts the interaction
necessary for human speech, retransmission or other active error control techniques cannot be used [1]. Therefore, …

In this example we have changed some words and included the reference, but it is still not acceptable because the structure is entirely the same as the original. This is a writing strategy often called “patchwriting” among English teachers. It can be useful for learning to write, but it is not acceptable for school assignments or for international SCI publication.

5.9.3 Acceptable paraphrase

Here is our original sentence that has been improperly paraphrased so far.

Eliminating excessive end-to-end delay is an essential step in ensuring quality-of-service (QoS) in real-time voice communication over IP networks (VoIP). Since excessive end-to-end delay impairs the interactivity of human conversation, active error control techniques such as retransmission cannot be applied [1]. Therefore, …

Here is an acceptable paraphrase of that sentence.

Eliminating excessive end-to-end delay is an essential step in ensuring quality-of-service (QoS) in real-time voice communication over IP networks (VoIP). However, retransmission or other error control techniques are not feasible for real-time voice data because excessive end-to-end delay interrupts the real-time interaction necessary for human speech [1]. Therefore, …

Then, at the end of our paper in the references section, we would give the complete citation information, along with the other papers we have referenced. This example is in IEEE format. The exact format would be different in different fields and journals.


Why is this an acceptable paraphrase?

1. The meaning of the original sentence has not been changed.
2. The original words of the author have been rewritten, but the key technical terms have been kept.
3. The sentence structure has been changed.
4. Reference to the original is included at the end of the paraphrase.

Links
A discussion of how to paraphrase correctly and what is considered plagiarism (copying) http://www.engineering.utoronto.ca/English/page-1-2076-1.html

For a useful discussion on what and why sources should be documented, read http://www.engineering.utoronto.ca/English/page-1-2053-1.html

An excellent article from the journal Nature on the common and complex problem of plagiarism (copying) in scientific journals. http://www.nature.com/nature/journal/v435/n7040/full/435258a.html
5.10. BEST PRACTICES for using references

Using references properly is very complex. Here is a guide to best practices. The key words that illustrate the best practices are underlined.

**BEST PRACTICES 5.10.1** Summarize the important points of previous research

Good introductions don’t just list previous research, but explain how the results of what was found are related to the author’s paper. In the following example, the previous study is not only listed, but the important conclusions are also described.

**EXAMPLE**
Colucci and Viskanta [21] studied experimentally the effects of nozzle geometry on the local heat transfer coefficients of confined impinging jets. Low nozzle-to-plate gaps were considered in the Reynolds number range of 10,000–50,000. The results were compared with similar experiments for unconfined jets.

An important conclusion was that the local heat transfer coefficients for confined jets are more sensitive to Reynolds number and nozzle-to-plate gaps than those for unconfined jets.


**BEST PRACTICES 5.10.2** Balance references to general trends in research with explanations of specific papers

In some papers there is just a long list of previous studies without a clear indication of why these studies are important or relevant to the author’s work. However, in the following example, a general overview of research on heat transfer rate is given. Specific papers on fin design are then mentioned. The author concludes the paragraph by indicating that the previous research has not been adequate. There is a good balance of types of references from a summary of general trends to analysis of specific papers here.

**EXAMPLE**
To make the heat exchanger more compact and practical, many investigators [11–13] showed that a higher heat transfer rate may be achieved by applying a prescribed thickness of insulation to a smaller fin at high operating temperatures. As for the optimization of fins, Haley and Westwater [5] proposed a turnip-shape fin with minimum volume for boiling heat transfer. Later, Cash et al. [14] modified the complex shape fin by using a two-cone assembly attached to a small cylindrical neck. Due to the impermanence of the insulation material and the difficulty in manufacture of these fins, lots of efforts were still needed in the improvement of the fin designs.


In addition to clearly indicating the weaknesses of previous approaches or methods, you can also critically evaluate the research done in individual papers. In this example, there is a direct reference to the problems with a single paper. However, it is best not too criticize too aggressively. See section 6.3.5. for more polite ways to evaluate previous research.

**EXAMPLE**
You and Chang [15] experimentally obtained the porous flow characteristics for air flow through uniformly distributed square pin-fins. They did not provide systematic results for the permeability or inertial coefficient of fin arrays.

Understand reporting verbs

Be aware of the type of verbs used to present research. The verb shows the opinion of the writer about the research; it is not just a random choice. Verbs like the following: suggests / considered/ presented / obtained / investigated/ examined / provided / evaluated / proposed / all have slightly different meanings.

Notice the word choice and variety in the verbs chosen below to indicate the status of the research.

EXAMPLE

Other methods are using POCS [37], or bayesian approaches [36]. Kokaram suggests a detection method in [26] and a spatial interpolation method in [27] for missing data. In [14], a local analysis of spatio–temporal anisotropic gray-level continuity for film blotch removal is proposed, and in [30] a method for blotch and scratch detection in image sequences is developed.


For example, “proposed” means that a method has been published, but it has not been widely accepted in the field yet; the method is still under consideration.

Words like “investigated” imply that research was done to solve a specific problem. If you study how verbs are used to introduce research in your field, you will have a more sophisticated writing style. Types of reporting verbs chosen may also differ by field, however.

Position references carefully

1) Whenever possible, put references next to what they refer to in the sentence.

EXAMPLE

“Other methods are using POCS [37], or bayesian approaches [36]. Kokaram suggests a detection method in [26] and a spatial interpolation method in [27] for missing data. In [14], a local analysis of spatio–temporal anisotropic gray-level continuity for film blotch removal is proposed, and in [30] a method for blotch and scratch detection in image sequences is developed.”


In the example above, it is clear exactly what each reference is referring to. Now imagine that the paragraph only had the references at the end of the sentence.

EXAMPLE [MODIFIED]

Other methods are using POCS or bayesian approaches [37], [36]. Kokaram suggests a detection method and a spatial interpolation method for missing data. [26], [27]. A local analysis of spatio–temporal anisotropic gray-level continuity for film blotch removal is proposed, and a method for blotch and scratch detection in image sequences is developed [14], [30].

In this revision, it is not clear whether references [26] and [27] refer to both the detection method and the spatial interpolation method, or whether each reference refers to one of these methods, respectively. We can guess but we cannot be certain. When giving references, you should make it as easy as possible for the reader to find the information they need for further study without guessing.
This sentence is from a published paper, and although it is not a serious mistake, there is a lot of ambiguity here.

EXAMPLE
Accordingly, there have been many PAR reduction schemes proposed, including clipping, coding, tone reservation, tone injection, partial transmit sequence, selected mapping, compounding approaches and various combinations of the above; see [1], [2], [3], [4], [5], [6], [7] and references therein.

It is really not clear which references refer to “selected mapping,” for example. In order to find the combinations of schemes, the reader would have to consult most of the references to find the papers that are relevant, but they shouldn’t have to.

2) If you have a number of points joined by AND in a sentence, it can be unclear what is being referred to if you put the references at the end of the sentence away from the words they refer to.

EXAMPLE
Future 4G wireless systems, based on the combination of multi-carrier (OFDM) and spread spectrum (CDMA) technologies, popularly known as OFDM-CDMA (or MC-CDMA), applied to a wide-area environment, can achieve very large average user throughputs by using adaptive modulation and coding (AMC), instead of fixed modulation methods, and power control [2,3].

It is hard to decide whether references [2] and [3] refer to the use of adaptive modulation and coding (AMC) in future designs or if they refer to the old models of “fixed modulation methods” and “power control.” Or do the references refer to “fixed modulation methods” [2] and “power control” [3] respectively? Or could [2] refer to MC-CDMA and [3] refer to fixed modulation methods and power control? In short, the reader should not have difficulty understanding what the references refer to.

3) It is also a good idea to make sure that your references refer not only to general background research in the field, but also include papers containing research on the exact same or most similar research problem you are writing about.

If you claim that the conventional approach is not adequate then the reader should be able to easily find examples of this approach in order to evaluate your paper. This seems obvious, but many papers fail to give an adequate amount of background information to help their reader evaluate the paper in the context of the research in the field.

5.11. Common errors using references

5.11.1 Be careful of the “borrowed literature review.”

Don’t put a long series of sentences each with a reference for a whole paragraph. It makes it look like you just copied and pasted the sentences and “borrowed” the literature review. References should be mixed with your own sentences of analysis and classification. Even if another paper has already written out a literature review or related works, resist the temptation to use too many of the same references. As well as being more ethical, depending on the
research of previous authors may cause you to have references that are not up to date, and by writing your own literature review, you will better understand the relationship between your paper and the rest of the field.

5.11.2 Avoid Self-Plagiarism

You can even cheat from yourself! If you reuse sections of one of your own papers that you or your professor co-authored, you must acknowledge the original source. You cannot reuse most of the text of an introduction section from your previous paper on the same topic, and you must acknowledge if you reuse figures and tables from previous papers in published conference proceedings. Here are the actual IEEE guidelines from electronic engineering:

“C. When an author reuses text, charts, photographs, or other graphics from his/her own previously published material, the author shall
1. Clearly indicate all reused material and provide a full reference to the original publication of the material and
2. If the previously published or submitted material is used as a basis for a new submission, clearly indicate how the new submission differs from the previously published work(s).”
Source: http://a957.g.akamai.net/i/957/3680/1h/www.ieee.org/organizations/pubs/pab/opsmanual.pdf

There is also a danger of reusing too much of the introduction from a professor’s or a senior’s already published paper from the same lab, especially when working on the same research problem.

5.11.3 A method for professors to check improper paraphrase

I suggest that professors ask their students to put all the PDF files in their reference list onto a CD with their article or dissertation. Then, when a professor wants to check if proper paraphrase is being done, they can use the Adobe advanced search techniques from Chapter 2.0 of this guide to compare suspicious sentences with the original papers.

Here are some useful tips for the format of references.

5.11.4 Using et al.

The words “et al.” are used to save space by not having to mention the name of every author in the text. The word “et” simply means AND in Latin so it is not an abbreviation and does not require a period. The word “al.” is an abbreviation of “alia” meaning “and others”, so it requires a period. Impress your friends with this knowledge! Because this term is now common, et al. does not require italics, although you will see the italics in many published papers. Follow the same style used in other published papers from the same journal to which you are sending your paper.

TIP

If there are many authors, you can use the family name of the first author followed by “et al.” in the body of the text. However, do not to use “et al.” in the list of references at the end of the paper. Only use it to save space in the body of the text. No matter how small, everyone likes to have credit for their contribution to a paper by having their name listed. Would you like to be called “et al.”? Some styles recommend only using “et al.” in the list of references if there are more than five names.
5.11.5 Using names in references correctly

Western names are in the opposite order of Korean names: Adam Jonathan Turner. Turner is my family name. Make sure that the references in the text only use the family name.

I sometimes see Korean students incorrectly use both names or incorrectly use the given name rather than the family name for western names in references. In the references at the end of the paper, family name plus initials is used (Turner, A.J.) The second initial in a western name is called the middle name. For example, my full name is Adam Jonathan Turner. I almost never use my middle name in everyday English, except for some government documents. Koreans do not have middle names, but a first name often written with initials, for example, D.J. Kim. In references in the text, I would be referred to as Turner. In the reference list at the end of the paper, initials of the first and middle name are often used. For Korean names, it is advisable to treat the first name as two initials, Lee C.H., for Lee Chun-Soo, for example. Interestingly, when I write my name in Hangul for Korean government documents, it should be written in the Korean order: 터너아담 Turner Adam.

Links

Using LaTeX with tips on storing references
http://www.eng.cam.ac.uk/help/tpl/textprocessing/reports.html

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