On topic sentences

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1. Introduction

1.1. What are topic sentences?

Topic sentences are sentences which are usually the first sentence of a paragraph, and are written in such a way

1. as to project the general idea of a paragraph, but not so general as to be too vague. In other words, they describe the main overall idea of the paragraph which is then developed in more detail in the rest of the paragraph;
2. that the reader will be confident s/he knows what the rest of the paragraph will focus on. In other words, it lets the reader know what the rest of the paragraph will be referring to.

1.2. Examples

We will discuss the aspect of topic sentences in class using the following examples:

- "Much has been written about task design and the features desired in an ideal task or set of tasks. Stein et al. [22] discuss the importance of engaging students in thinking, reasoning, and sense-making. The features of a mathematical task they identify as promoting these activities are its potential for multiple representations, the existence of multiple solution-strategies, and the extent to which the task demands explanations and/or justifications from the students. Swan [23] focuses on promoting conceptual understanding in secondary school students and identifies five types of tasks he deems suitable for this purpose: classifying mathematical objects; interpreting multiple representations; evaluating mathematical statements; creating problems; and analyzing reasoning and solutions." [4].

- "Consider some single activity of the project. We suppose that a preliminary level of effort, θ_0 (dollars, manpower, or other resources) has been determined for this activity, and that a distribution, $F(t) = \Pr\{\text{activity time } \leqq t\}$ is given for this level of effort. The planner must estimate the interval needed for completion of this activity by a decision variable, *z*. Then, using these estimates for each activity, a minimal time schedule is determined for the entire project. This fixes the event times once and for all." [5].

- “As a field of study, machine learning sits at the crossroads of computer science, statistics and a variety of other disciplines concerned with automatic improvement over time, and inference and decision-making under uncertainty. Related disciplines include the psychological study of human learning, the study of evolution, adaptive control theory, the study of educational practices, neuro-science, organizational behavior, and economics.” [10]

- “There are many reasons why one might decide that one measure of central tendency should be considered preferable to another for descriptive purposes. There are also many quantitative criteria that might be used as a basis for choice. One criterion is to select the measure that minimizes the variation around it. This variation is most frequently described by computing either the sum of the squares of the deviations (the numerator of the variance) or the sum of the absolute values of the deviations (the numerator of the average deviation). […].” [1].

- “The clinching is one of the most common metal joining processes in the manufacturing of metal plate-based products, especially when [it is required to assemble parts without adding major joining elements]. This joining technique is indicated for coupling, similar or dissimilar, pre-coated or galvanized, material sheets up to a total thickness of 3 mm. (Nong et al. 2003; Mucha 2007; Mucha et al. 2011; Di Lorenzo and Landolfo 2004; Varis 2003; Borsellino et al. 2004.” (adapted from [11]).

- “Although the ellipsoid method is a powerful tool in proving polynomial solvability, it is not used in practice because of its poor average performance. A primal simplex method starting with constraints (1) and adding the violated constraint detected by the separation algorithm as a cutting plane, is a promising approach in solving LP(k). The size of the simplex tableau can be controlled by removing an added constraint whenever it becomes non-binding.” [3].

So we might say that topic sentences acts as introductions to the rest of the paragraph. We might then have the following definition of topic sentences:

Topic sentence = A sentence describing the main idea of a paragraph in order to orient the reader's attention towards what is to come in the rest of the paragraph.

Caveat: As you read more widely you will find that not all paragraphs start with topic sentences in the way written above. In fact, it might look as if the first sentence of a paragraph is not a topic sentence at all. One might write the topic sentence as the second sentence of the paragraph, or one may write the first sentence of a paragraph in a very different manner. This is ok, but to write like this requires experience. At the end of the day, whatever the style of the first sentence of a paragraph, the first sentence (or first two sentences at most) of a paragraph should be written in a way to best lead the reader *into the greater development* of an idea, opinion, example, theory, discussion literature review, etc.

Also, not all paragraphs need a topic sentence. For example if the second paragraph of a section continues, or elaborates on the idea of the first paragraph then no topic sentence is needed.

Comment: At what point during the writing process do you write a topic sentence? Do you write it first before writing the main idea or do you write your main idea first so that you know what the topic sentence needs to be? In my experience, I do both of these:

- If I already have a general idea in my mind then I write my topic sentence first. I then continue elaborating on the details of my idea from my second sentence onwards.
  However, it is possible that as I continue to write the paragraph I find I want to change the focus or emphasis of the paragraph. In that case I will probably need to re-write my topic sentence.
  In this kind of writing process I am writing my topic sentence and paragraph in an iterative manner, refining the topic sentence and paragraph at each pass through my writing.
- On the other hand if a very specific point of detail comes to mind, I write this down, expand upon it, and develop an overall paragraph around it which then leads me to wanting to write a topic sentence.

When I write maths notes for students I also build a table of contents (TOC) for the notes. I then read the TOC as if it was a coherent text, where the headings and subheadings of the TOC act as types of topic sentences. Based on how the TOC reads I then edit the headings and subheadings of the main text to more clearly reflect the flow and development of the major themes of the essay I am writing about. Reading the TOC as a piece of text actually helps me clarify my ideas about what I want to write and how I should organise my ideas and writing. An example of this can be seen below.

1.8 On the geometric construction of numbers and arithmetic

1.8.1 Introduction
1.8.2 On geometric constructability
1.8.3 Constructing natural numbers geometrically
1.8.4 The principle of homogeneity and the unit line segment of arbitrary length
1.8.5 Constructing fractions geometrically
1.8.6 Constructing incommensurable magnitudes (square roots) geometrically
1.8.7 Constructing arithmetic geometrically – Addition and subtraction
1.8.8 Constructing arithmetic geometrically – Multiplication and division
1.8.9 Geometric multiplication and division as inverse processes
1.8.10 Conclusion

Exercises

1) For the example texts above confirm that the topic sentences are topic sentences.

   1) Find the main idea/theme of the topic sentence.

   Confirm that the rest of the paragraph elaborates on, or gives more detail about, the topic sentence.

2) Repeat exercise 1) using a paper of your own choice.

3) If you have started writing your extended essay identify any paragraph where topic sentences are missing, or where these could be improved upon. Then include or improve a topic sentence.

4) Write a topic sentence relating to your own discipline. Keep the sentence simple, and think about how this guides the readers towards the idea you want him/her to pick up on in the rest of the paragraph.

2. Examples from the literature

2.1. Example 1: Mechanical engineering: Vibration analysis

The following is from Liew, Xiang, and Kitipornchai (1995). It is the first paragraph to their introduction

> The study of the free vibration of plates dates back to the 1800s. Chladni [1] studied the free vibration of a square plate with completely free edges and observed the nodal patterns of this plate in 1802. Rayleigh [2] presented his well-known general method of solution for the natural frequencies of vibration of any structure in 1877. Ritz [3] improved the

Analysis

The first sentence of the paragraph is a topic sentence because it is more general than the subsequent sentences. The subsequent sentences provide more detail to the general topic outlined by the first sentence. Note that the subsequent sentences are indeed relevant elaborations of the topic of the first sentences. That is the point of a topic sentence.

2.2. Example 2: Mechanical engineering: Vibration analysis

The following is again from Liew, Xiang, and Kitipornchai (1995), and is actually the follow-on paragraph to the paragraph in 1) above.

> Since then, there have been extensive investigations of the vibration of plates of various shapes, support and loading conditions as reported in standard texts (see, e.g., references [4, 5]), theses (see, e.g., references [6–8]) and papers (see, e.g., references [9–11]). Most of these publications deal with thin plates for which the effect of shear deformation is neglected, as shown in Leissa's series of reviews [12–17], Bert's series of reviews for composite and sandwich plates [18–23] and other review papers [24, 25]. This effect is significant, however, in thicker plates [26, 27]. When the shear effect is ignored, the

Analysis

Again, the first sentence of the paragraph is a topic sentence because it is more general than the subsequent sentences. And, again, the subsequent sentences provide more detail to the general topic outlined by the first sentence. Note that the subsequent sentences are indeed relevant elaborations of the topic of the first sentences.

2.3. Example 3: Education

The following is from Ozmen (2004). This text is the second paragraph of the author's introduction. So even the second (and subsequent) paragraphs start with topic sentences.

> Students preexisting beliefs influence how students learn new scientific knowledge and play an essential role in subsequent learning (Arnaudin and Mintez, 1985; Boujaoude, 1991; Driver and Oldham, 1986; Shuell, 1987; Tsai, 1996). Hunt and Minstrell (1997) stated that children's difficulties in science occur because students' conceptions before teaching are not taken into account and therefore communication barriers between teachers and learners can not be overcome. These ideas are logical, sensible, and valuable from the students' point of view, strongly held by the students, but may be significantly different from accepted scientific viewpoints and may not be in conformity with the true or the scientific explanation (Osborne, 1982; Schoon and Boone, 1998).

Question: Do the second and subsequent sentences elaborate on the topic sentence (the second sentence starts "Hunt and Minstrell (1997) …")?

2.4. Example 4: Geophysics – Earthquakes

The following comes from Keefer (2002). This is a long text but remember that, for the moment, we are only interested in the topic sentences.

> 2.2. RETROSPECTIVE STUDIES
>
> Some other early earthquakes have been the subjects of retrospective studies conducted decades after the events that have sought to reconstruct the landslide occurrence. Even field investigations conducted soon after an earthquake may encounter problems separating out landslides triggered by the earthquake from, for example, landslides triggered by recent rainstorms. Retrospective studies face the additional challenges of separating earthquake-induced landslides from landslides possibly triggered by other, unrelated events. The confidence in identifying landslides caused by an earthquake several decades in the past can be increased if even incomplete reports or eyewitness accounts recorded soon after the event are available; these can be used to calibrate landslide identification by establishing apparent geomorphic ages and degrees of surface alteration for landslides triggered by that earthquake.

Early retrospective studies include the investigation of a 1935 earthquake in New Guinea ($M = 7.9$), for which Simonett (1967) pioneered a statistical method to differentiate presumed earthquake-induced landslides from landslides presumably triggered by other events, such as rainstorms. He concluded that a distribution in which the concentration of landslides decreases away from a central point or zone indicates earthquake triggering, and this conclusion is confirmed by typical landslide distributions associated with recent earthquakes. Other retrospective studies were used to identify landslides caused by several earthquakes in northern California (Youd and Hoose, 1978), landslides in British Columbia caused by an M_s 7.2 earthquake in 1946 (Matthews, 1979; Rogers, 1980), and landslides caused by earthquakes in 1929 and 1968 in New Zealand (Adams, 1980; Pearce and O'Loughlin, 1985; Hancox et al., 2002).

The retrospective approach has been applied most extensively to the 1811–1812 New Madrid, Missouri, earthquake sequence ($M_I \approx 8.1$, 7.8, and 8 for the three main shocks; Johnston, 1996). Contemporary accounts, such as those in Mitchill (1815) and Penick (1981), indicate that many landslides occurred on riverbanks and bluffs of the Mississippi River during the earthquake. Fuller (1912) synthesized information from the available contemporary accounts and carried out field studies in the affected region in 1904 and 1905. He found abundant evidence of relatively recent landslides along a 56-km-long stretch of the bluffs. Noting that upright trees on landslide surfaces were also of a fairly uniform age of "a little less than 100 years", he concluded that the landslides had occurred during the 1811–1812 earthquake sequence.

Analysis

To be done in class.

2.5. Example 5: Applied physics

The following comes from Lee (2018). These paragraphs are at the start of a new section called "Introductions to ICPs".

> RF ICPs have been widely studied for over 130 years. The basic concept for generating an ICP stems from Faraday's law, $\nabla \times \mathbf{E} = -\partial \mathbf{B}/\partial t$. An RF current flowing into an antenna coil induces a time-varying magnetic field. This magnetic field produces an induction field, which generates and sustains the plasma. This system can be thought of as a transformer circuit in which the antenna coil acts as the primary circuit, while the plasma forms the secondary circuit with a single circular loop, as shown in Fig. 2 (Piejak *et al.*, 1992).
>
> Hittorf (1884) first proposed that plasma lamp could be produced by wireless inductive coupling to an antenna coil surrounding the tube. The plasma was then named an "electrodeless RF lamp," and it overcame the drawbacks of conventional fluorescent and discharge lamps with electrodes (Godyak, 2002). Since the filing of patents for the ICP lamp by Hewitt (1907) [Fig. 3(a)] and by Bethenod and Claude (1936) [Fig. 3(b)], much effort has sought to improve the ICP lamp design (Anderson, 1970; Shinomiya *et al.*, 1991; Coaton and Marsden, 1997; and Lister *et al.*, 2004).
>
> In the 1970s, applications of ICPs were extended to new fields such as plasma torches in material processing and plasma sources used in semiconductor/display processes. Plasma torches were operated in the high- or atmospheric-pressure regime (Eckert, 1974), whereas plasma sources for semiconductor and display processing were used at low pressures below a few hundred millitorr (mTorr) due to the need of clean environment. The use of plasmas in semiconductor processing stems from their novel characteristics, namely, the directional motion of ions and synergetic effects between the ions and radicals (Coburn and Winters, 1979). In particular, ICPs were actively developed and applied to semiconductor processes because high-density plasma generation over a large area is possible without the need to insert an electrode. In early semiconductor processes, ICPs were used

<u>*Analysis*</u>

- The first sentence of the first paragraph is clearly a topic sentence. Why?
- The first sentence of the third paragraph is also a topic sentence. However, because we are now onto the third paragraph the topic sentence can be more detailed. Here the author can use the topic sentence of the third paragraph to extend the idea of the topic

sentence of the first paragraph. This is what s/he is doing by focusing on extending the application of ICPs. If this is the case then all well and good. If not, the author will have led us astray by the topic sentence of the third paragraph.

- The first sentence of the second paragraph is also a topic sentence (note that there is a spelling error in this topic sentence). A question to ask now is, does this topic sentence continue something of the first paragraph or is it designed to introduce a new idea which will be developed during the second paragraph? To answer this one would have to know whether or not plasma lamps worked according to the physics described in paragraph 1.

One final note: Never start a sentence with abbreviations (or symbols or numbers or equations) as in the first sentence of the first paragraph above. Always start with at least one complete word. Why? Remember what the aim of writing is.

3. Exercises

3.1. A general mathematics text

Consider the texts below, taken from "The concept of function", J. F. Wampler, *The Mathematics Teacher*, Vol. 53, No. 7 (NOVEMBER 1960), pp. 581-583, then answer the questions below:

> "It has become evident that most of the current college texts which attempt to integrate the traditional topics of first year mathematics are using as their unifying concept that of function. Because of the great importance of this concept in mathematics and because of the recent emphasis upon it as a unifying principle, I feel that we should be particularly careful in our presentation of this idea to students. I believe that there is a serious need for agreement on the part of mathematics teachers concerning the definition, notation, and language used in working with functions.
>
> Eves and Newsom give a concise account of the development of the function concept from Descartes to the present day. The early part of this account reads as follows:
>
> The concept of function . . . has undergone a marked evolution, and every student of mathematics encounters various refinements of this evolution as his

studies progress from the elementary courses of high school into the more advanced and sophisticated courses of the graduate college level."

Questions:

1. Can you identify relevant topic sentence(s)?
2. Does the topic sentence focus on a single point? Paragraphs always work better when they explore a single idea and your topic sentence should reflect that.
3. Does the rest of the paragraph elaborate on the topic sentence?

The following questions are also added here for completeness, although they do not apply to the example above because i) the example above consists only of one paragraph, ii) we have not yet talked about the idea of a thesis:

4. Is the topic sentence linked to the previous paragraph? If the topic sentence creates an abrupt change in the idea or theme of the previous text, then you'll need to add in appropriate transitions (either on this topic sentence or the previous paragraph) to maintain the flow;
5. Is the topic sentence relevant to the main thesis? The relevance of your topic sentence to the bigger picture in the text should be clear to the reader. If it isn't, rewrite the topic sentence.

3.2. A statistics text

Consider the text below taken from "Mean Streets: The Median of a Size-Biased Sample and the Population Mean", Woollcott Smith and Milton Parnes, *The American Statistician*, Vol. 48, No. 2 (May, 1994), pp. 106-110, then answer the questions below:

> "Many statistical ideas can be simply presented by stressing the close relationship between the population distribution and the distribution of the sample data; for example, the sample median can be thought of as an analog of the population median. Although this approach is useful, it ignores a large class of interesting real-world problems in which this simple analogy breaks down. Exposing students to these kinds of problems stresses the importance and richness of underlying sampling mechanisms. In this article, we humorously describe a problem of this type that was inadvertently placed on an elementary statistics exam."

Questions:

1. Can you identify relevant topic sentence(s)?
2. Does the topic sentence focus on a single point? Paragraphs always work better when they explore a single idea and your topic sentence should reflect that.
3. Does the rest of the paragraph elaborate on the topic sentence?

The following questions are also added here for completeness, although they do not apply to the example above because i) it consists only of one paragraph, ii) we have not yet talked about the idea of a thesis:

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5. Is the topic sentence relevant to the main thesis? The relevance of your topic sentence to the bigger picture in the text should be clear to the reader. If it isn't, rewrite the topic sentence.

3.3. An operational research text

Consider the texts below, taken from "Linear Programming", W. Allen Spivey, *Science*, Jan. 5, 1962, New Series, Vol. 135, No. 3497 (Jan. 5, 1962), pp. 23-27, then answer the questions below:

> The goal of maximizing or minimizing an objective [function] (say profits or costs), where the choice of means is not unrestricted but must be made under one or more constraints, is common to many different problems in the physical and social sciences, in industry, in agriculture, and in national defence. When the objective can be approximated satisfactorily by a linear function and the constraints can be expressed as linear qualities or inequalities, the problem can then be treated mathematically as a problem in linear programming. Linear programming techniques, largely because of their relative simplicity and flexibility, have found increasingly wide application since systematic development of the theory began in 1948 with the work of George Dantzig and his associates, […]

By 1955 there had been a remarkable development of the underlying mathematical theory (the work of A. W. Tucker, of Princeton University, in particular, and of a host of other brilliant mathematicians). Moreover, with the parallel development of data-processing and computer machines, it became possible to quickly solve large- scale linear programming problems, so that by 1960 – only 12 years after the initial work – linear programming techniques had been successfully applied to the study of such diverse problems as production smoothing, traffic control at toll booths, investment scheduling in an electric-power industry, job assignment, transportation and warehousing of commodities, railway freight movements, blending of aviation gasoline, optimal crop rotation, Air Force contract bidding and the scheduling of aircraft maintenance, plastic limit analysis of structures, chemical composition at equilibrium, and many others."

Questions:

1. Can you identify relevant topic sentence(s)?
2. Does the topic sentence focus on a single point? Paragraphs always work better when they explore a single idea and your topic sentence should reflect that.
3. Does the rest of the paragraph elaborate on the topic sentence?

The following questions are also added here for completeness, although they do not apply to the example above because i) it consists only of one paragraph, ii) we have not yet talked about the idea of a thesis:

4. Is the topic sentence linked to the previous paragraph? If the topic sentence creates an abrupt change in the idea or theme of the previous text, then you'll need to add in appropriate transitions (either on this topic sentence or the previous paragraph) to maintain the flow;
5. Is the topic sentence relevant to the main thesis? The relevance of your topic sentence to the bigger picture in the text should be clear to the reader. If it isn't, rewrite the topic sentence.

4. The language and discourse of topic sentences

The examples above on topic sentences involved a certain style of writing or phrasing which distinguished them from the rest of the paragraph. The main factor which distinguishes a topic sentence from the rest of the paragraph is the level of generality in projecting the idea of the paragraph. Particular phrasing is needed in order to achieve this generality

The aim of the examples in the table below is to show you the *underlying principle* of what makes a topic sentence style of writing. This underlying principle is what you should aim to learn and understand. Then you will know how to write topic sentences in your own way. These examples are taken/adapted from https://www.ref-n-write.com/trial/academic-phrasebank/. Note how these phrases or sentences focus on the general not the specific.

The past decade has seen an increase in the use of …	Recent years have seen a rise in the number of …
The arrival of … has highlighted the need for improvements in …	There have been a large number of improvements achieved in the last few years relating to …
A number of - - - - - alternative technologies have appeared in - - - -the last few years.	These findings are only a few years old, but they suggest that … even though ….
Research in these areas are usually carried out using …	This is often chosen as the default approach since …
Typical strategies currently used to achieve this are …	The usual way of performing … is …
There is a long history of … in a number of disciplines.	In recent years, there has been significant advances in …

5. Focusing topic sentences in particular ways

There are some specific ways in which you can start your paragraphs. For example, you can

1) *Present a statistic*: "In 2001-2002 the leading causes of death in the USA were heart disease, cancer, and stroke (Jackson, Kubansky, & Wright, 2006)."

2) *Identify the scope of the research*: "The idea that there are "critical" or sensitive periods in neural, cognitive, and behavioral development has a long history."

3) *Use common knowledge for the general audience*: "The ability of humans to accurately recognize thousands of faces is remarkable considering that all faces have roughly the same configuration."

4) *Use of common knowledge for the expert audience*: "Marine organisms have proven to be rich sources of unique alkaloids."

5) *Start with a definition*: "Creativity is typically *defined* as the ability to generate novel associations that are adaptive in some way."

   "Creativity *typically means* ....

6) *Indicate the lack of previous research*: "Despite the fact that almost everyone uses Likert-type scales, little is known about how variability in their format can affect the data that we obtain."

7) *Start with a lit review*

8) *Expand on a previous study*: "In a previous article (Duncan, Emslie, Williams, Johnson, & Freer, 1996), we introduced the term goal neglect to describe a striking form of performance failure."

9) *Give an overview*: "This study considers age-related differences in collision avoidance behavior in traffic accidents."

(all example above taken from "Writing an introduction to the introduction", J. Hartley, *Journal of technical writing and communication*, Vol. 39(3), p321-329, 2009).

6. References

Keefer, D. K. (2002): "investigating landslides caused by earthquakes – A Historical review", *Surveys in Geophysics*, **23**: 473–510, 2002.

Lee, Hyo-Chang (2018): "Review of inductively coupled plasmas: Nano-applications and bistable hysteresis physics", *Appl. Phys. Rev*. **5**, 011108 (2018).

Liew, K. M., Xiang, Y., Kitipornchai, S. (1995): "Research on thick plate vibration: A literature survey", *Journal of Sound and Vibration* (1995) 180(1), 163–176

Ozmen, H. (2004): "Some Student Misconceptions in Chemistry: A Literature Review of Chemical Bonding", *Journal of Science Education and Technology*, Vol. 13, No. 2, June 2004 (2004)