

The threads of writing

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Threads run through documents and hold them together. What are the threads? Simply, threads are topics. They are found by compiling, in order, the (grammatical) subjects of neighboring sentences and clauses. For example, if you underline all the subjects within a paragraph, this assemblage will group into topics. Easy-to-follow writing usually has one, two, or, at most, three easy-to-identify threads running through and, possibly, interwoven within the paragraph. Disjointed, hard-to-follow writing has more and, here, more may include isolated threads (i.e., a subject that lacks threading to preceding or proceeding subjects), or no, or very little discernable thread structure. Identifying and unraveling the thread structure of a document and adjusting to make it consistent can be an important editing tool.

Here is an example I adapted from the first paragraph of an article *Physics Today* ("Lorentz invariance on trial," July 2004). To stress my point, I specifically chose a topic that can bring smart people to their knees—Einstein relativity and Lorentz invariance.

Expecting to measure different speeds, in 1887 Michelson and Morley performed an experiment on light in different reference frames that gave null result. In terms of the physics concepts prevalent at that time, it was surprisingly difficult to explain these results; fundamental changes were required in the notions of space and time. Albert Einstein's special theory of relativity, which appeared 20 years later and postulated the Lorentz Transformation, under which all the laws of physics are invariant, was the necessary change. Differences in observations of the same phenomenon made in reference frames moving at different velocities are mathematically related by the Lorentz Transformation, which can be applied to rotating reference frames and reference frames changing velocity. A basic structural element of quantum field theory is Lorentz (transformation) invariance, and general relativity also includes Lorentz invariance through Einstein's equivalence principle: any experiment conducted in a small, freely falling reference frame is invariant.

This paragraph takes a difficult subject and makes it more difficult. This is the type of writing that drives people away from technical documents. It is disjointed and hard to follow or identify any flow; the author (me!) has not created subjects that don't readily group into consistent threads. To demonstrate this, I have underlined the subjects. Because of the mismanaged threads, readers are not sure through which topic, relativity, Lorentz transforms, the equivalence principle, etc., the author is directing them. Now consider a rearrangement of the same information, but with consistent thread management.

The 1887 Michelson-Morley experiment measured the speed of light in different moving reference frames, expecting to see differences. Their result, a null result, was surprising and difficult to explain in terms of physics concepts prevalent at that time. The result required a fundamental change in the notions of space and time. The change, Albert Einstein's special theory of relativity, appeared 20 years later. Special relativity postulated that all laws of physics are invariant under the mathematics of a Lorentz transformation. Consistent with Michelson and Morley's null result, the Lorentz transformation relates the differences in observations of the same phenomenon made in reference frames moving at different velocities. It applies to rotating reference

frames and reference frames changing velocity. Lorentz (transformation) invariance is at the basic structure of quantum field theory. It is also included in general relativity through Einstein's equivalence principle, the invariance noted in any experiment conducted in a small, freely falling reference frame.

Lorentz invariance is not an easy concept; yet, this paragraph flows and can be followed. It maintains consistent threads. I have underlined the subjects with critical modifiers or other clarifying terms. Grouping them into threads shows thread 1: *Michelson-Morley experiment, result, result*; thread 2: *change, Albert Einstein's special theory of relativity, Special relativity, laws (of physics)*; and thread 3: *Lorentz Transformation, It, Lorentz (transformation) invariance, It, invariance*. (The only subject left out of the thread groupings is *differences* and it relates observation to the Lorentz Transformation, which is part of thread 3.) The paragraph shows three threads that readily grouped, are consistent, and flow easily one to the next, even if the reader is not very familiar with relativity theory. Unlike the first example, the second example shows a complex topic presented in a reasonably simplified format.

As another exercise, try plotting the threads of something you found difficult to follow. Most likely, the subjects are all over the globe and they don't readily aggregate to threads. To make sense of this type of writing requires that readers bring a lot of their own information to fill in blanks created by the writer. If you don't have the background to supply the missing information, you will simply be confused and probably stop reading—a fate writer's would rather avoid. Readers supplying the missing information is one reason why colleagues will say a manuscript's fine, but when you submit it to a journal, it comes back with comments about lack of flow, disjointed, poor organization, etc. Your colleagues are familiar with your work and fill in your blanks. The editors and reviewers at journals do not have that familiarity, may not recognize what information is missing, but do recognize something is missing. Remember editors and reviewers are representatives of the readers and have a sense of how typical readers of their journal will be disappointed with the writing.

Creating the first paragraph from the second was easy: Going from good to poor is not a challenge; going from poor to good is. It requires the care to list subjects; to see if they piece together into threads, and to make sure the threads are consistent, especially if they are interwoven. If the threads are all over the globe, then the writer must invoke the editor's rapier and restructure to create consistent, identifiable, flowing threads. This takes time and effort, two commodities that seem to be in short supply once a first draft has been crafted.

So, new writers, established writers, and everyone else, take heed. If you want to be a good technical writer, pay attention to your threads. If you read something and cannot understand or follow something you should understand and expect to follow, take a moment, identify the grammatical subjects, and see if they readily group into threads. I'd wager they don't. The irony of thread analysis is that it frequently shows that the information is in the document, but the author has mismanaged its presentation and flow. **TLE**

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