The Two Main Writing Problems in Science: How They Afflict Readers, and How They Can Be Cured

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In the medical field, there are ailments that defy our abilities to treat, ailments that can be somewhat managed, and yet others that can actually be cured. Inadequate scientific writing – ubiquitous and woefully unattended to -- is an ailment that can be cured. I will describe for you here the two major flaws found throughout scientific writing. The great surprise is that almost every scientist suffers from the first of these problems; and, judging from my more than 40 years of analyzing professional prose, absolutely everyone suffers from the second. And yet, no one to date seems to have become aware of either. I shall not only describe and exemplify these ailments for you, but I shall also demonstrate how they can be cured.

How often do you arrive at the end of reading a scientific article or grant application and feel devastated that it had not been longer? How often do you jump up from your desk and rush to find colleagues to share with them this

uplifting document so they might also share your joy? I imagine you would have to answer "not often." Instead, do we as readers not tend to feel relief at arriving at the document's end? We are usually more tired than we were when we began. But that fatigue is not only a problem in itself: It signifies a great probability that, on a sentence by sentence basis, we have failed to perceive the writer's intended meaning clearly and with as little effort as possible. It is the writer's job to convey meaning; it is the reader's job to perceive meaning. If the writer has not performed this job adequately, the reader may well be unaware of it. If the reader arrives at the end of the sentence having received *something*, even a muddy, loosely defined something, the reader has every reason to believe the reading job has been adequately accomplished. In parallel fashion, since the writer knew what the sentence was intended to mean, and the sentence seemed *capable* of meaning that, containing all the correct and pertinent information, the writer may also be well satisfied that the writing job has been accomplished. So there you have it: The writer thinks the writing was well enough done; and the reader thinks the reading was well enough done; but the thought may somehow have failed to be conveyed clearly from the mind of one to the mind of another. You may think I am talking about something that happens only once in a while. As this article will try to demonstrate, it happens

in a shockingly large percentage of scientific sentences. We can do better. We can do much better.

The principles I use here to describe and solve our two major, constant writing problems come from a comprehensive new understanding of how scientific and other professional prose works for its readers. I call it the Reader Expectation Approach to the English Language (REA). It has already helped tens of thousands of scientific researchers across the country and around the world. Many who had previously failed, even consistently failed, to secure funding, once armed with REA, have found they could consistently succeed. If you want to know about my background and learn more about REA, you can find much information at my website, www.GeorgeGopen.com. My 1990 article on REA for *American Scientist, "The Science of Scientific Writing,"* leads that journal's citation index.

Because these two major problems have not been identified nor attended to by others, they are likely to sound strange to you initially.

The first I call "the Stress Position" problem. I have identified places in the structure of the English sentence where readers tend to want to exert extra emphasis. We all know this instinctively as readers; my job here is to make

you conscious of it as writers. If you regularly deposit the material you want stressed in a Stress Position, your readers are far more likely to stress the right words and thus correctly perceive your meaning.

The second I call “the main clause first problem.” In the 10 years I have been on the lookout for it in one-on-one sessions with thousands of scientists, I have yet to find a single person who does not suffer from it. This the first time the problem has been explored in print for the scientific community. It has to do with creating a main clause that has no Stress Position. That will make more sense when we get to it.

By the end of this article, you should not only be able to recognize both of these problems at sight in your own prose, but you will also know how to overcome them. No matter how well you write already, this will increase the quality of your prose substantially. It will also (eventually) reduce the time you need to spend in writing. If you are in the business of submitting articles for publication and applications for funding, it will improve both your curriculum vitae and your cash flow.

We turn to the first of our two problems, that of the Stress Position.

At the beginning of our reading of any sentence, we take a mental breath to summon what I will call the *reader energy* necessary to do interpretational battle with most normal-sized professional sentences. That energy having been summoned, we attempt to proceed without hindrance through the sentence until, at its end, we can affect closure for that sentence; only then can we summon a new breath to move on to the next one. When we get to any sentence's end, two things occur that produce what I am calling the Stress Position: (1) We gratefully exhale whatever reader energy we have yet to use on this sentence; and (2) we perform the all-important act of intellectual *closure*. Both of these produce a substantial feeling of emphasis.

The moment we are made aware that closure is about to take place, it becomes crucially important for us to achieve it. To exemplify this, try singing the following words and stopping when you get to that last word:

> My country, 'tis of
> thee, Sweet land of
> liberty, Of thee I . . .

(Or substitute "God Save the Queen," leaving out the last "Queen.")

You are left there, hanging. Despite my instructions, did you find yourself moving forward to include the last word/note? Did you feel something of a *need* to do so? What you wanted was closure – not only for the moment in the song, but for your task in the singing of it. That is what a Stress Position is – any moment of full syntactic closure. Or, to put it only slightly less technically, a Stress Position occurs whenever the grammatical structure of a sentence comes to a full close.

So a Stress Position is created in part by the forward progress of grammar, in part by the beckoning of time, and in part by a motion one might call musical; but mainly it is created by *expectation*. The closer we come to the closure we are expecting, the more important it becomes (1) that we achieve that closure and (2) that the emphasis we experience there be that which the writer intended us to experience. If readers are naturally going to give emphasis in a Stress Position, then writers ought to learn to locate in that Stress Position the information they most want the reader to stress.

What if on a regular basis you put the stress-worthy information elsewhere in the sentence? One of two things is likely to happen to your readers – and both are bad: (1) Since that information was not located in a Stress Position,

readers may well have breezed right over it without stressing it; or (2) they will stress, contrary to your intentions, the less important information that you allowed to occupy the Stress Position. If the first of these happens, your readers will become muddled, even without being aware that it has happened; if the second happens, even worse, they will come away from the sentence convinced they have succeeded in reading it as intended, but with the wrong meaning.

I work individually with anywhere from 600 to 800 scientists per year. The last time I encountered someone who did not have a Stress Position problem was in 2012. The one before him was in 2003. Essentially everyone suffers from this problem. If you can eradicate it, your writing will shine in comparison to that of your competition.

Go look at a paragraph of your prose. Circle the words you wanted your reader to stress in each of those sentences. Note how often the circled words do not appear immediately before the period. If it is often, you are one of the many sufferers from this disease. If it is never, rejoice: You are one of only a tiny percentage of writers who has intuited this for yourself. Knowing about it will give you yet greater conscious control both of your writing and your writing process.

Just think: If we could always print those to-be-stressed words in red, only the color blind would ever stress the wrong words. Unfortunately, publishers will not let us do this. Fortunately, we have something that functions just as well: All you have to do is locate your stress-worthy information in Stress Positions.

The definition of "quality" in writing is contained in the answer to this simple question: Did the reader get delivery of what the writer was trying to send? If the answer was "yes," the writing was good enough; if the answer was "no," it was not. And it matters little how impressive or dazzling it may have seemed to be along the way.

The worst writing in English does not cry aloud how burdensome it is. The worst writing seems harmless on first reading but has completely failed to get the writer's message across. If the reader did not get the message but thinks she did, she has no way of knowing she did not get the message. That is the worst writing.

Let me give you a simple example of this. Here is a 10-word sentence of no seeming difficulty, culled from a response to a grant application.

<u>Example 1</u>

1a. The overall scope is the greatest strength of the proposal.

What is the problem? There are no hard words. There is no passive construction. There are no grammatical errors. At 10 words, it is both shorter than the average sentence of a college freshman (13-15 words) and way shorter than the average sentence of a practicing scientist (26-29 words).

Problematically, we are unsure how the writer would like us to "perform" this sentence. Its Stress Position, created by the period, is occupied by "of the proposal." The author told me this prepositional phrase, far from being the most important thing in the sentence by itself, was intended only to qualify "the greatest strength."

Fine. But can we, as readers, be sure which of the remaining two candidates for the StressPosition– "overall scope" or "greatest strength" – was the one she wanted us to emphasize? Semantically, it is a hard choice: One has "overall" in it; and the other has "greatest." Which are we to guess is the more important one? But therein lies the problem: To make the sense of this sentence that the writer intended, the reader has to resort to guessing.

So let us take a guess: Let us rewrite the sentence so that it

emphasizes “greatest strength.” Pushing “of the proposal” to the left somehow, we can thereby let “greatest strength” reap the benefit of the Stress Position. Would that small change really make a large difference? Yes, it would:

1b. The overall scope is the proposal’s greatest strength.

Can you hear how convincing it is that we should be emphasizing “the greatest strength”? Can you hear how we are now leaning forward to learn yet more about that strength? Can you hear how the “overall scope” has the job announcing “whose story” this sentence is meant to be? (We tend to read sentences as being the story of who or whatever shows up early on as the grammatical subject. That is another of several important reader expectations.)

But what if the author now tells us that we guessed wrong? She really wanted us to emphasize “the overall scope.” What to do? Simple: Get “the overall scope” to the Stress Position:

1c. The greatest strength of the proposal is its overall scope.

Once again we can understand, we can “hear,” we can experience her intended emphasis. Once again we are

leaning forward to hear yet more about the Stress Position's occupant. And now the sentence has become the story of "greatest strength." It is a wholly different sentence from (1b).

As simple, short, and seemingly unencumbered as this 10-word sentence was, it was badly written. Only a percentage of us would have come away from it guessing correctly as to what we should have emphasized. All of us would have had to put more reading energy into making that decision than we should have needed to expend. If this writer constantly puts the stress-worthy information in the middle of her sentences, her readers are constantly going to have to use too much reader energy to discern her intended meaning. Quite often, although they will come away from the sentence with what feels like a sufficient interpretation, they will actually have mistaken her meaning. By the end of reading her entire document, no wonder we might feel fatigued.

Almost all scientific writers have this Stress Position problem at times; and those who do repeat it in sentence after sentence. It becomes quietly unsettling for their readers. Our second example increases in complexity just a bit; but with these matters, a bit can be a lot.

Example 2

2a. Platinum agents are the backbone of first-line chemotherapy for pancreatic cancer.

This time we have four units of information. Four is a much harder number to handle than three. Is this a good sentence or a bad one? There is no way we can tell without the writer having sent us the proper reading instructions. The Stress Position is filled with "for pancreatic cancer." Is that the only term to which we should be giving emphasis?

This becomes in part a matter of music. If I were to read this sentence aloud to you, I could change its meaning by varying which words I choose to emphasize by raising my voice. Here are four possibilities, with bolding indicating where I might raise my voice:

> Platinum agents are the backbone of first-line chemotherapy **for pancreatic cancer.**
>
> Platinum agents are the backbone **of first-line chemotherapy** for pancreatic cancer.

Platinum agents are **the backbone** of first-line chemotherapy for pancreatic cancer.

Platinum agents are the backbone of first-line chemotherapy for pancreatic cancer.

All four performances are reasonable; but only one of them can come closest to the one the writer intended. And maybe none of them do: Maybe the writer intended us to stress two pieces of information. Why should the writer be leaving this important task of interpretation up to the reader? If the odds of our guessing correctly are this bad for a sentence that contains only 11 words, what will happen when we encounter a sentence with 37 or 59 words or more?

This is what the last two options above would look like if we moved the bolded words to the Stress Position:

2b. For first-line chemotherapy in the treating of pancreatic cancer, platinum agents ought to be considered the backbone.

2c. The backbone of first-line chemotherapy for pancreatic

cancer should be the use of platinum agents.

If you are trying to decide which of these two is the better choice, you are probably using the wrong organ of your body – the ear. We tend to judge the quality of prose mostly by its sound. Instead, we should be using the eye and the mind. Knowing *where* readers expect the most important information to appear, we can judge our own prose by *seeing* if it is located in the Stress Position.

Without this knowledge of reader expectations, we are perhaps the worst judges of the efficacy of our own prose. We already know what we want the sentence to mean. When we read it, either silently or aloud, we know what to emphasize and will always get that right. Actually, we are not judging whether or not the sentence is good as it stands; instead, we are judging whether or not the sentence is merely *capable* of meaning what we want it to mean. That is insufficient. For the sentence to succeed, it must convince almost all of our readers to read it as we would read it to them. If the stress-worthy information is located in the

Stress Position, almost all of our readers will understand what to stress.

The correct choice amongst the above revision attempts is the last one. How do I know that? Not because it sounds the best, but rather because the next sentence begins, "These agents target cancer cells . . . ."

> The backbone of first-line chemotherapy for pancreatic cancer ought to be the use of platinum agents. These agents target cancer cells . . . .

The main job of the first sentence was to introduce and highlight "platinum agents." That made it available to become whose story the next sentence was to be. None of the other above revisions could do that job as well.

As readers, not only do we need to read each sentence with confidence and accuracy, but we also need to move effortlessly from one sentence to the next without losing track of where we should be going. (This issue of connectivity is controlled by yet other reader expectations, not part of our present subject. You can find more information on this at my website.) These first two examples we have dealt with were seemingly simple, even simplistic sentences; but what we are starting to see is that a great percentage – I estimate it around 85% – of the instructions the writer sends the reader for the interpretive process come not from word choice but rather from the

sentence's structure. *Where* a piece of information shows up in a sentence will control most of *the use* to which it will be put by most readers. The most important of all these many structural instructions is proffered by the Stress Position.

Let us take a look at a slightly more complex example.

Example 3

3a. This 12-month intervention examined the effect of adding parent training to a weight loss program including education on nutrition and physical activity (PA) compared to education alone, in 21 adolescents and young adults (13-26 yrs) with Down syndrome.

Compared to our earlier, shorter examples, this 37-word sentence contains much more information. As a result, there are more potential candidates for emphasis. But this sentence has only one Stress Position, at its end. It is highly unlikely that "Down syndrome" deserves stress here; and it is almost certain that (even if it does) it would not be the sole piece of information deserving of emphasis.

In order for us to deal with this, we have to develop further the possibilities for Stress Positions. It remains true that a Stress Position is any moment of full syntactic closure; but in

English, that closure can be generated not only by the period but also by both the colon and the semi-colon, properly used.

Most of us were taught the uses of the colon inadequately, if at all. Very few of us were ever taught how to use the semi-colon; as a result, we tend to shy away from using it at all. These two punctuation marks are so important to scientific writing that they require here a discussion of what they are and how they function. Their proper use can help writers better control a reader's reading experience.

Most importantly: For both the colon and the semi-colon, the grammatical rule states that what precedes those punctuation marks must be able to stand by itself as a complete sentence. This is a rule that benefits both the writer and the reader: It should be strictly observed. By giving syntactic closure to the preceding main clause, the colon and semi-colon are able to create a Stress Position in the middle of a sentence. Not following that rule will leave your readers as distressed as they would be if you supplied a period for them before your sentence reaches its. You see what I mean.

There are two main uses of the colon. The first (and more common) use is to announce to the reader that a list of

examples will follow. Those examples may be, and usually are, sentence fragments. Since the colon creates a Stress Position, the reader can let go of the energy used to read that clause and summon fresh reader energy for dealing with the list of examples.

The second colon use is of great importance to the writer of anything sophisticated or complex: It announces that a whole new main clause (a full sentence equivalent) will appear for the purpose of re-stating or exemplifying what was said in the first clause. An example of this is the sentence you have just finished reading. Think of this kind of a colon almost like an equals sign.

When you begin a main clause after this second kind of colon, you would do well to start it with a capital letter. That will warn the reader to expect the structure and weight of a main clause. Aside from designating proper names or reducing a long term to an acronym, capital letters in English are usually used to signal a new sentence is beginning.

> Main clause + colon + lower case letter indicates a list is coming.
>
> Main clause + colon + capital letter indicates a new

main clause is starting, which will re-state what has already been said from a different perspective.

The semi-colon is somewhat similar but subtly – and importantly – different. Like the colon, a semi-colon requires that what precedes it must be a main clause. Like the colon, it therefore provides a Stress Position in the middle of the sentence. Here is what that semi-colon tells the reader: "You have just completed a main clause and stressed the material at its end; but hold that thought in mind, since it is only part one of a two-part thought, the second part of which is starting now." An example of this is the sentence you have just finished reading.

Scientists are constantly faced with the necessity of demonstrating that in order to indicate the vital relationship between the two parts, the two half-thoughts *must* inhabit a single sentence. The semi-colon is a major tool in the hands of the scientist who knows how to use it. Without it, any sentence that reaches 25 words in length is likely to have stress-worthy material in its middle, rendering that material unable to benefit from a Stress Position. Once again, the reader will often be left having to do too much interpretive work in guessing the writer's intentions. The guessing game is far more precarious when a sentence contains 37 words than when it contains only 11.

You might well ask that if few of us were ever taught to use a semi-colon, why should we presume our readers will understand what to do with it? The answer is simple. We all figured out for ourselves what to do with a semi-colon the very first time we encountered one: We paused more than we would at a comma but less than at a period. It was too imposing a punctuation mark to be merely comma-ish; but since no capital letter followed it, it was not as finally final as a period. And, after all, a semi-colon is merely a vertical stacking of a comma and a period.

We were never taught the semi-colon because when we were at an age to be learning grammar, we had not yet developed a real need to articulate two-part thoughts. By the time we were old enough to have a constant need for multi-clause sentences, there was no one around to teach us how to use a semi-colon. If you, like most people, never learned about it, now would be a good time.

Do not be scared of the semi-colon. It is your friend. When I published two books on writing simultaneously in 2004, my editor, who had never learned about the semi-colon, was scared of it. She took out 625 semi-colons in 1,000 pages, thereby ruining every one of those sentences: There was no longer a midpoint in the sentence where the reader had been instructed to stress something. I had to get her to

restore all of them.

Will not a comma do just as well to indicate a Stress Position? Absolutely not. A comma can never create a Stress Position. The comma is the only mark of punctuation in English that does not announce its function at the moment of its arrival. There are so many comma uses in English that we always have to read *beyond* the comma in order to know what "kind" of a comma it is trying to be. Does it introduce a whole new clause? Does it signal an interruption – even one as short as the word "however"? Does it indicate we have just had the first item in a list of three, leaving us to expect the second item will follow immediately? Since a comma always forces us to read beyond it to find out what kind of a comma it is trying to be, it can never create a moment of full syntactic closure. Thus, it can never create a Stress Position.

Let us return to Example 3.

3a. This 12-month intervention examined the effect of adding parent training to a weight loss program including education on nutrition and physical activity (PA) compared to education alone, in 21 adolescents and young adults (13-26 yrs) with Down syndrome.

This author told me that everything after the word “alone” was meant to be background, merely contextual, and therefore not worthy of emphasis. He wanted us to stress three things: “parent training”; “education on nutrition”; and the combination of “physical activity” and “education.” “Parent training” was meant to be an umbrella for the others. So we needed to create a Stress Position sense of closure for all three items. The contextualizing material had to be transported to the beginning of the sentence, where its context is created. Here is the revision:

3b. Taking for its subjects 21 adolescents and young adults (13-26 yrs) with Down syndrome, this 12-month intervention examined the effect of adding to a weight loss program some significant parent education: That included both nutrition education by itself and a combination of education with physical activity.

The colon here acts both as a mid-sentence Stress Position and as an umbrella for the other two programs. But how, you might ask, does “nutrition education” get stressed, being so far removed from the period? Well, in addition to the elegant definition of Stress Position I gave you earlier (“any moment of full syntactic closure”), we also need a more cumbersome definition as to when the Stress Position begins: You know you are just beginning a Stress Position

when you are correctly assured that there is nothing left in the sentence other than that which you are now beginning to read. That moment is a signal that you can start exhaling what is left of your breath of sentence energy. Example: "After 12 blind-controlled experiments, with results conforming to our previous expectations, we can confidently state that (1) . . . ." Most readers will feel confident, when they see the "(1)," that all that is remaining in the sentence is this numbered list we are now beginning to read. The entire list, therefore, is in the Stress Position. Want to know how you can oppress your readers to the point that they will wish never to read any more of your writing? Just give them a long Stress Position like this list but give them no period. Give them a comma and keep on going. Destroy their expectation of being able soon to let this sentence go. Do this a lot, and by the end of the document you will leave them both fatigued and annoyed. In this revised (3b), we see an example of how to stress two things in one Stress Position: All you have to do is announce that there will be two items to be stressed. That is done neatly by the word "both." In a sentence structured as "We will do this by both X and Y," readers will stress the first item on an upbeat and the second on a downbeat.

I can tell you, from long experience, that almost all writers in the professions (especially science and law) have this

problem of not locating stress-worthy information in a Stress Position. Some have it much of the time; more have it most of the time. It is ubiquitous.

For our next example, then, let us look at a 59-word sentence – by no means the longest you will encounter in scientific writing, but long enough to make the point. As you read it, try to decide, as you go, which words you might think you should be stressing.

Example 4

4a. A comprehensive integrated approach has not yet been considered to the problem of identifying the cellular and molecular pathways of NCI resulting from chronic radiation-induced inflammation employing specific mouse models as proposed here using both WBI and partial CI techniques such as HSI to study brain areas associated with memory formation and other important cognitive faculties including executive functions.

This author has moved forward with a kind of linear logic; but his structure is fashioned by a method we could well describe as stream of consciousness. That might serve English literature well, where multiple interpretations by

multiple readers is considered praise-worthy; but a piece of scientific writing is praise-worthy when it comes close to meaning only one thing to all its readers.

Can we say this sentence is too long? We can; but what do we mean by "too long"? It has nothing to do with how many words it contains. Here is a new definition for the term: A sentence is too long when it contains more viable candidates for Stress Positions than it has Stress Positions. When that is the case, we often get to a moment in the sentence when we think we might need to stress something but have no mark of punctuation (colon, semi-colon, or period) that invites us – instructs us – to invoke that sense of emphasis. When that happens multiple times in the same sentence, as in Example (4a), our reading of that sentence leaves us both wearied and muddled.

Occasionally, as in this case, separating a lengthy sentence into two sentences is one – but only one – of the possible remedies. But even then, it will still seem too long unless everything that requires stress has its own Stress Position. Once the author cleared up for me what those stressworthy pieces of information were, re-structuring the whole was not very challenging. Here is his list of information for Stress Positions. How close does it come to the words you chose to emphasize?

-- chronic radiation-induced inflammation -- HSI -- memory formation

Here is the resulting revision:

4b. As yet, there is no comprehensive, integrated approach to solving the problem of identifying either the cellular or molecular pathways of NCI resulting from chronic radiation-induced inflammation. Here we propose employing specific mouse models, using both WBI and partial CI techniques such as HSI; with these we can study brain areas associated with a number of important cognitive faculties, including numerous kinds of executive functions, but especially memory formation.

When a reader comes to trust that you will always provide a Stress Position for everything you are intending to stress, the reader will read more swiftly, more smoothly, and more confidently; this, in turn, will greatly increase the likelihood of their understanding what you intended them to understand. When they get constantly rewarded for stressing everything in your Stress Positions, they will cease to consider words located elsewhere as candidates for stress. You will have produced for them clarity.

In the competition for grant funding, for success in publication, and for power in all other professional communications, the constant use of a Stress Position to indicate emphasis and provide closure is the single greatest secret of clear writing in English.

Now we turn to the second major difficulty for scientific writers – the main clause first problem.

Our first two examples above each contained only a single clause, using 10 and 11 words. Examples #3 and #4 added to a single clause a good deal of additional, modifying material. The Stress Position problem by itself, subtly but seriously, caused difficulty in those one-clause sentences; but when multiple clauses are involved, it poses yet a greater challenge for both writer and reader.
Just as we were rarely taught how to use a semi-colon, we also were not taught much about how to handle a sentence with multiple clauses. Young people in their teens attempt to write multi-clause sentences only occasionally. Scientists, on the other hand, write multi-clause sentences about 50 % of the time. For them, handling that structural difficulty poses a constant, major, writing challenge. Much more often than anyone realizes, it creates a specific problem for the reader that I call the “Main Clause First” problem.

In order to understand it, we must revisit the grammar lessons you were taught about the different units of discourse. If you were in school during the 1970s, 1980s, or 1990s in the USA, you may never have been taught any grammar whatsoever. A popular study demonstrated there was no connection either between (1) knowing grammar and writing well nor between (2) not knowing grammar and writing poorly. Out went the grammar books.

But if you were taught grammar, you might have experienced some of the reasons why grammar (mistakenly) became considered unnecessary. We were taught to be able to recognize a number of different kinds of units of discourse. We had to learn to distinguish not only main clauses from dependent clauses, but also to recognize other more specialized units like compound clauses, complex clauses, and compound-complex clauses. We tried to memorize these distinctions for the exam; most of us forgot about them immediately after the exam.

We were right to do so. Most of these distinctions make no significant differences for readers. For the sake of our readers (and for ourselves as writers), we need recognize only three units of discourse: the main clause; the "qualifying clause"; and the phrase. Unlike the discarded others, these three serve important functions in the

communication process between writer and reader. They instruct readers how much weight to give the information they contain. They do so whether or not we are aware of it. As long as we are all sending these instructions, it is important that we send the right ones.

A unit of discourse is any group of words that has a beginning and an end. A clause is any unit of discourse that contains a subject and a verb. A main clause is a unit of discourse that contains a subject and a verb and can stand by itself as a sentence. That is a long-standing term in English grammar.

The second type unit of discourse has long been known as a "dependent clause"; but I rename it here a "qualifying clause." As you will see, that term will remind us better of its function. The qualifying clause comprises all clauses that are not main clauses. A main clause can stand by itself as a sentence; but a qualifying clause, while having both a subject and a verb, cannot stand by itself as a sentence. Usually that disqualification is caused by the word that begins it, such as "that" or "if" or "although." *"Although a qualifying clause is a noble unit of discourse,"* by itself, cannot stand as a sentence.

The third category comprises any other unit of discourse

that does not rise to the level of importance of a clause. This is because it does not contain a subject and a verb. We call this kind of unit a “phrase.”

I urge you to become able to distinguish between these three at a glance. Being able to do that can profoundly affect your writing. Each of the three send different instructions to your reader as to how much weight their contents should be given.

What are these instructions?

> The main clause says, “I am so whole and so important that I could stand by myself as a sentence. I therefore contain something of importance. Stress something in me.”
>
> The qualifying clause says, ‘Although I *c*ontaining both a subject and a verb, and therefore carry some weight and dignity, my sole purpose here is to help modify or support or qualify my more important sibling, the main clause. Do not stress anything in me.”
>
> The phrase says, “I am just some extra information you should know. Do not stress me.”

It is essential that these instructions not conflict with the instructions sent by the presence or lack of a Stress Position. If you put stress-worthy material in either a qualifying clause or a phrase, both of which say “don’t stress me,” you confuse your reader. The material in question may sound stress-worthy; but the unit of discourse it inhabits instructs the reader not to stress it. If you put stress-worthy material in a main clause, but supply for it no Stress Position, you confuse your reader: The main clause invites the reader to stress something in it; but its lack of a Stress Position tells the reader not to stress anything. As you will see from the examples below, the result of this conflict is confusion for the reader. That confusion – especially if it happens often, produces weariness. A confused and weary reader will not be happily and clearly in touch with your intended meaning. The creation of a main clause with no stress position is what I call the main clause first problem. I use “first” because so often a main clause that opens a sentence is given no Stress Position; but the problem can also happen when a main clause ends with no Stress Position in mid-sentence. In my experience, every single writer of scientific prose in English suffers from this main clause first problem. You are highly likely to find it in your prose, once you learn to recognize it by sight.

Let us look, then, at some typical scientific sentences of two

clauses or more. In working with these examples, I will be using a bolded double slash (**//**) to indicate any moment in a sentence when we could insert a period without offending any rules of grammar. We will find a **//** at the end of every main clause without a Stress Position because, as a proper main clause, it could stand by itself as a sentence; but often we will find that double-slash a few words later as well, where the sentence once again could have properly been brought to an end. This can happen a number of times in a single sentence.

Scientific documents average 26-29 words per sentence. (See the discussion of such statistics below.) A simple single clause in an English sentence averages from 12-15 words; therefore, the average scientific sentence contains an average of two clauses, inviting the possibility of a main clause first problem.

Example 5

5a. Inhibition of CMA in heart unexpectedly confers resistance to stress-induced cardiac dysfunction in both pressure overload and myocardial infarction models, which is opposite to MA deficiency in heart, and differs from CMA deficiency in other tissues.

This sentence could have ended at the first comma, without offending any grammar teacher, since those 20 words form a main clause; the rest of the sentence is a qualifying clause – a "which" clause. The 20-word main clause can stand by itself as a sentence; the qualifying clause cannot.

But the trouble starts earlier than that comma. As a first-time reader, when I reach the 12th word, "dysfunction," I have already experienced a whole main clause– and therefore have been handed enough for a whole sentence. Words 13-20 are a phrase that further describes where the dysfunction might occur. The natural weight of that 12word main clause suggests that something in the sentence so far deserves emphasis. Again, if there had been a period there, a grammar teacher could not have take off any points.

> Inhibition of CMA in heart unexpectedly confers resistance to stress-induced cardiac dysfunction
> ***//***

But since, as a reader, I *could* stop there, my forward motion towards the expected closure of the Stress Position that did not materialize raises a kind of interpretive tension in me. I could stop; I perhaps want to stop; but I am not allowed to stop. It is both a retroactive-leaning and a forward-looking problem.

Retroactively, the question becomes how should I have been reading these 12 words? Since there is enough for a full sentence here, should I already have stressed something? And if so, what? Consider the number of reasonable candidates for stress: “inhibition of CMA”; “in heart”; “unexpectedly”; “confers resistance”; and “stress-induced cardiac dysfunction.” That makes five. But perhaps I should be stressing more than one. Or, importantly, believing the lack of punctuation here, which tells me not to stress anything yet, perhaps I should stress nothing. All of these decisions have to be made by the reader retroactively at the clause’s end; but at that confusing and unconfident moment, the mind is also barreling forward to finish reading the sentence. Hence, the problem. We have been given two conflicting instructions at the 12-word mark – “stress something here ” and “do not stress anything here.” Thereafter, we will be reading units other than a main clause that tell us “do not stress anything here”; but at their end, we find a period that instructs us “stress something here.” This is a serious reading problem – highly likely to occur several times on every page.

That is so even if the reader remains unaware either of the problem or of its causes. All those conflicting interpretive instructions cause a cumulative sense of fatigue for the reader; but they also lower the likelihood of the reader’s not

clearly having comprehended the writer's intended meaning.

It was the responsibility of the writer first to make those decisions for the reader and then to communicate them clearly. The sentence's structure, signaled by its punctuation, should allow the reader to continue reading forward without either mental interruption or undue interpretive burden. As readers, we should be able to trust that the most important material will appear in a Stress Position. If, as a writer, you can manage to do that for your readers on a regular basis, they will quickly learn to trust you.

So far, even though we have looked at only 12 words of our 36-word sentence example, we have already over-taxed our supply of reader energy for this sentence. Too much has been left to our being able to make reasonable guesses.

I reprint the example here with double-slashes for every time the sentence might have come to an end.

5a. Inhibition of CMA in heart unexpectedly confers resistance to stress-induced cardiac dysfunction **//** in both pressure overload and myocardial infarction models, **//** which is opposite to MA deficiency in heart,

// and differs from CMA deficiency in other tissues. **//**

Again, a sentence is "too long" when it has more viable candidates for Stress Positions than it has Stress Positions.

At each of those double-slash moments, the reader once again has to decide what, if anything, he should be stressing along the way. Recall that there were five reasonable candidates in the first 12 words alone. The sentence sounds professional and dignified; but it is an interpretive headache. This is the case with a large majority of scientific sentences that contain more than one clause.

This sentence was written by a highly intelligent and professionally competent scientist; but if we try hard to decide for ourselves as readers which pieces of information we should stress here, we come away with a mistaken sense that she is somewhat disorganized or perhaps just a pedestrian thinker. Over multiple occurrences of this on every page of the document, the cumulative effect is hard for the reader to bear: Once you have guessed wrong as to what the writer meant in one clause, all your subsequent guesses will be based more on sand than on concrete.

Here is the revision she and I devised, based on her decisions concerning stress-worthiness. We made sure not

only that each main clause contained stress-worthy information, but that the stress-worthy material appeared at the main clause's end, in the Stress Position created by the period. That eliminated the "stress something" versus "stress nothing" conflict. See if this is easier and clearer for you to read:

5b. Inhibition of CMA in heart unexpectedly confers resistance to stress-induced cardiac dysfunction. This happens in both pressure overload and myocardial infarction models: In heart, this is opposite to MA deficiency; in other tissues, it differs in CMA deficiency.

As readers of this, we can feel confident in leaning forward to the moments of stress signaled by the periods, the colon, and the semi-colon. Having perceived, clearly and easily, what she wanted us to stress, we are ready to move on to the next sentence.

What if 80% of the sentences that have more than a single main clause tired us out the way example sentence (5a) does? The truth of it is that they do. (Again, see the statistics below.) As readers, we do not like thinking that we have been defeated by a sentence. It is in our best interest, psychologically, to believe we are as competent a reader as the author is a writer. The truth of the matter is that our non-comprehension is real – and is the fault of the author.

Most of the time when I ask clients what they wanted us to stress in a given sentence, they point to something in the middle, with no Stress Position. Sometimes they point to two things. An alarming number of times they themselves cannot recognize what they wanted us to stress. If they do

not know, how can we? Whether or not the science behind the document is sound, if Stress Position after Stress Position fails to contain stress-worthy material, we as readers cannot be at all sure that we have gotten the author's message. That is particularly true when seemingly stress-worthy information abounds, with too few Stress Position moments to help make our decisions. The writing, which is supposed to be a conveyance, proves to be an obstacle.

Let us look at an example that at first glance might seem relatively unproblematic. Recall that the worst of sentences are those that seem faultless but fail to deliver their message to a majority of the reading audience.

Example 6

6a. The problem continues to flourish, **//** despite efforts by Congress to enhance opioid prescription monitoring **//** to limit drug diversion **//** and trafficking, **//**suggesting that a novel strategy is needed. **//**

From the brain of the writer to the brain of the reader, how could this sentence go awry? Let me write for you an accurate yet annoying single-sentence tour guide for its readers, describing its reading as a slow-motion process. I

intend it to burden you consciously in the way your mind subconsciously struggles while reading the example sentence for the first time.

> Right off the bat we are handed a full main clause ("The problem continues to flourish"), which could easily have been the end of the sentence, allowing us a Stress Position, but refuses to end and is followed by a phrase ("despite efforts by Congress'), which efforts are then described by the phrase "to enhance opioid prescription monitoring," with that "monitoring" then getting identified by the phrase "to limit drug diversion," which could have ended the sentence but instead adds the feature "and trafficking," which certainly could have been the end of the sentence, but, to our increasing sense of burden, is followed by a whole new qualifying clause ("suggesting that a novel strategy is needed,") which, though new it may be as a grammatical structure – and one that ends with a period, thus signaling the single Stress Position in the sentence and inviting emphasis, even though it is only a qualifying clause – sounds suspiciously like the main clause we encountered 20 minutes earlier, maybe.

I trust my sentence was burdensome to read – one long, rambling sentence, with several interruptions and backward

looks, always frustrating your journey towards closure. It's only Stress Position contained the anti-stress word "maybe." While you, reading the original (6a) for the first time, may not be conscious of having to make all these judgments and revisions of judgments, your reading process is being taxed in much the same way as it is by my guided tour. I am demonstrating what your mind has to do – whether you are aware of it or not.

If you have ten readers try to rewrite (6a), producing a Stress Position for everything they think the writer intended us to stress, you will be likely to get anywhere from four to seven different revisions.

When the author thought about revision in this manner, here are the decisions he reached:

-- Two Stress Positions were needed – one for the problem's "flourishing" and another for the need to devise a new strategy to solve it.

-- The attempts by Congress ought not to be stressed: They are included mainly to help build the context for the rest of the sentence.

Given the new-found clarity of the author's intentions, the revision was relatively easy to accomplish. The Congress's

activity deserved only a phrase, near the beginning of the sentence, where contextualizing naturally takes pace. Care should be taken to warn the reader that "limiting" will be applied to a pair of activities – to drug diversion and to trafficking. All that, in the "don't stress me" unit of a phrase, should lean forward to a main clause, ending with the "flourishing" in a Stress Position. Then there should be another main clause, with another Stress Position, to signal the importance of the need for a novel strategy. This accomplished, the reading becomes easy, forward-flowing, and confidence-breeding:

6b. Despite efforts by Congress to limit both drug diversion and trafficking by enhancing opioid prescription monitoring, the problem continues to flourish: A novel strategy is needed.

If we could provide this kind of clarity for each of the 100-150 sentences found in a typical journal article, think what a joy scientific reading might become.

Are you beginning your sentences on a regular basis with a main clause that has no colon, semi-colon, or period at its end? (I recently re-read the opening page of my first book, published in 1980. After only 14 words of the first sentence, I had already encountered my first main clause first

problem.) As a new part of your revision process, decide whether that main clause contains stress-worthy information or not. If it does, you have three remedies: (1) Leaving the main clause at the beginning, use a colon, if that suits the occasion; or (2) instead, use a semi-colon, if that suits the occasion; or (3) move this main clause to the end of the sentence, where it can benefit from the Stress Position created by the period. If, on the other hand, you decide there is no stress-worthy information in this main clause, you would do well to demote the main clause structurally by making it either a qualifying clause or a phrase. When you get used to doing this on a regular basis, your documents will become more and more reader-friendly.

Example 7

7a. TB is one of the top 10 causes of death globally, and now the leading cause of death from a single pathogen worldwide, surpassing HIV.

This sentence begins with an 11-word main clause without a Stress Position; we then get a phrase that could have ended the sentence; but we are asked to extend our energy for another two-word phrase, “surpassing HIV.” Was

"surpassing HIV" intended to be the only words we emphasized? If so, why are they but a lowly phrase?

What if the author wanted us to stress "top 10 causes of death"? In that case, we need to move the main clause it inhabits to the end of the sentence; and we need get that top ten statistic (instead of "globally") all the way to the Stress Position at its end. When trying to find a Stress Position for "globally," we realize that its work has already been done by the word "worldwide." Here is the result of that revision:

7b. Now the leading cause of death from a single pathogen worldwide, surpassing HIV, TB has become one of the top 10 causes of death.

But what if I guessed wrong about the writer's intentions? What if the most noteworthy piece of information here was intended to be the term "globally" ? Reducing most of the rest of the sentence's information to a mere contextualizing phrase, which would then clearly lean forward to the sentence's main clause, we could ensure that "globally" will shine in the Stress Position's moment of closure. Then the repetitive quality of "globally" would be interpreted not as wordiness but as emphasis:

7c. Now the leading cause of death from a single pathogen worldwide, surpassing HIV, TB has become one of the top 10 causes of death globally.

But what if the author instead wanted us to stress "single pathogen"? Then that term should inhabit the sentence-ending main clause.

7d. One of the top 10 causes of death globally, and now surpassing HIV, TB has become the leading cause of death from a single pathogen.

What if the author also wanted us to stress that TB has now surpassed HIV? Then we create for HIV another main clause – with its own Stress Position:

7e. One of the top 10 causes of death globally, TB is now the leading cause of death from a single pathogen: It has even surpassed HIV.

Where grant applications are concerned, carefully crafting your sentences so that every piece of stress-worthy material inhabits its own Stress Position can lead directly to funding. There are lots of good ideas out there, asking to be funded; but if your good idea is written so clearly that your fund-controlling reader is both properly instructed by it and

delighted by it, you are likely to triumph over the competition. Those equipped with this new way of looking at the structure of sentences have already laid down an impressive track record of success.

Example 8

If you have ever had to read (or write) job application letters, the next example should sound familiar. It is filled with information. It has no semantic nor grammatical errors. There are no highly complex issues discussed. It sounds ever so professional. What could be wrong with it?

8a. Working with our clinical staff, I became the subject matter expert and primary author of our CMS national coverage decision (NCD) reconsideration request **//** (submitted in October 2013), **//** and also performed a systematic literature review of the existing clinical data **//** and supporting economic evidence, **//** which I compiled into a global value dossier **//** for worldwide reimbursement activities. **//**

Are you slightly wearied – or bored – when you reach the end of this sentence? What if you were regularly wearied that way throughout this letter? If this letter were the only introduction you would have to this candidate, how lively a

candidate would you find her to be? How likely would she be to survive the first cut? Again, let us look at it structurally. After a 5-word phrase, we encounter the main clause. The sentence could easily have ended at the 23rd word "request." It is somewhat offputting to be robbed of closure here by having to extend our efforts just for the inclusion of the submission date; but after the date we encounter a (sub-consciously) muchdespised structural word – "and." It tells us there is no immediate rest for the burdened reader. On we go, but not to a new main clause; "and also performed" assumes we have the grammatical subject of the sentence ("I") still in mind. It takes energy to carry such a burden.

Knowingly or not, we are already starting to lose patience with this reading task. Our annoyance with the letter can transform into annoyance with the applicant.

The "review" then is extended beyond the "data" by another "and"; but at least we seem promised that we will have reached a Stress Position by the 43rd word "evidence." Alas, when we arrive there, we have yet another whole qualifying clause to read. The only Stress Position in the sentence is given over to "worldwide reimbursement activities." By this time, we have no confidence that those "activities" are what we should have been waiting all this

while to stress. Our expectations for reaching closure have been violated a number of times along the way. The sentence suffers not from containing 55 words, but rather from containing only one Stress Position for all of those words. One Stress Position might have been sufficient if the sentence as a whole had been organized into one, long crescendo climaxing in one glorious piece of information at the end. In this case, that is by no means the case. The worldwide scope of the reimbursement activities did indeed, according to the author, deserve a Stress Position; but by the time we get to it in our journey through the sentence, we have stumbled so many times that we cannot trust that this sole piece of information at its end was the only stress-worthy one.

What instructions does the structure of this sentence send us? The main clause, invoking "main" importance, contains a great deal of action engaged in by the candidate; but none of it has the benefit of a Stress Position.

main clause + no Stress Position = main clause first problem
Then an important detail does indeed get a Stress Position; but it inhabits the lighter-weight, sentence-ending vehicle of a qualifying clause. We are being told "Stress this but don't" in mid-sentence and "don't stress this but do" at its end. The instructions are neither clear nor confidence-building.

Here are the questions I asked the author, with her responses:

Q: Given this is a letter about you, do we need to mention the clinical staff at all? A: No.

Q: Is it enough to indicate you were the expert and the primary author? Do we have to pound on it by making it the main clause? A: Pounding is probably a bad idea. It sounds insecure.

Q: Do you ever use the initials "NCD" again? A: No.

Q: Does the act of the NCD submission deserve two full lines in an 8-line sentence? A: Probably not.

Q: Is your reviewing the literature a major action on your part? A: Yes, it is one of two. The other is my having created the dossier for worldwide activities.

With the author's intentions now clear, devising a revision was again not difficult: Get rid of the clinical staff; get rid of "NCD"; tone down the self praise ("expert," "primary") by putting that material into a phrase – a much less impressive unit than its original main clause; make the act of doing the literature review a main clause with a semi-colon for its

Stress Position; and transform the final qualifying clause into a main clause, allowing the sentence to achieve closure with full emphasis.

Here is the resulting revision:

8b. As the subject matter expert and primary author of our 2013 CMS national coverage decision reconsideration request, I performed a systematic literature review of both the existing clinical data and supporting economic evidence; these I compiled into a global value dossier for worldwide reimbursement activities.

If her writing were always this easy to comprehend, this constantly flowing forward, this forcefully emphatic, the candidate would have had a much improved chance of getting this job – or any other in the future.

An important point: Do not begin trying these new methods in the process of your writing a first draft. They will constantly interrupt your normal procedures. They will seriously challenge many of your long-held writing habits. Use them at first as part of a revision process. Take what you have written and discover for each sentence the answers to two important questions: (1) Does everything I want the reader to stress occupy an Stress Position? and (2)

do any of my main clauses end without the presence of a colon, semi-colon, or period? You will soon grow to recognize when there is a Stress Position or main clause first problem.

It may well be a bit of a struggle at first to make the appropriate structural revisions. Overcoming long-established habits is difficult indeed. But the more you change them, the better you will get at changing them. If you fail in your effort to revise a given sentence, let it go. Succeeding 50% of the time on a first attempt is a good result.

Persevere. After just a few documents, you will find these new principles becoming habits that will eventually infiltrate the initial drafting process. After a while, it will all become natural. This process will slow you down for a few documents; but once it becomes part of your initial writing process, you will find that your writing will take you less and less time, with better and better results.

A major cause of these ubiquitous problems in scientific writing is, I believe, that we were never taught the difference between our writing task in school and what our writing task would be after our final graduation from school. In the real world of scientific work, the scientist is presumed

to be the expert in what she or he writes. The act of writing then has as its purpose the transfer of thought from the writer's mind to the reader's. We have a technical term for this in the field of Rhetoric: We call it *communication*.

But that is not the rhetorical task we were called upon to do when we were in school. There, it was the teacher who was presumed to be the expert in anything on which we might have to write. Our job was first to gather information and then to put it all down on paper without breaking any of the rules of writing. Our rhetorical task was not *communication*, but rather the more odious, burdensome task of *demonstration*. As long as we could demonstrate to the teacher that we had made enough of an effort and found enough information, we received a good grade. It did not matter *how* we got all that material down on paper, but only *that* we managed to fill the pages full enough, without error. Teacher – we were sure of this, and we were right – would know how to put all of those facts together. Just get 1492, Christopher Columbus, and "ocean blue" down on the page somewhere, and teacher would put it all together – and assume that you too knew how to put it all together. Nobody tells us that the game changes when you enter the professional world. Many of us still write grant applications as if our job was merely to deposit the facts, the statistics, and the pictures on the page, feeling that the people on the

receiving end of this prose would know – perhaps better than we know – how it all should fit together.

But the reality is that the writer's job – in every single sentence – is to send readers the correct instructions for how they should put all these words together. Without knowing the crucial importance of the Stress Position, we cannot control our own prose. Without understanding how the different units of discourse (main clause, qualifying clause, and phrase) send instructions concerning what information should and should not be considered important, we cannot control our own prose.

When I finally became convinced that essentially everyone suffers from this main clause first problem, I started wondering why that should be. Essentially everyone. That is a lot of people. I think I have found the answer.

When we are 15, we have been writing for about 10 years. We have developed in our brain a sentence-writing machine. It has a start button on it. If you are called on to write a sentence, you push the start button, and the machine bursts into action: "Choose a subject. Choose a verb. Unravel your complement. Put a period." You want to write another sentence? Push the button again. Then you turn 18. They send you to college. No longer are you

reading textbooks, which slice and dice the intellectual material into morsels small enough to be digested by the young mind. No, now you are reading primary sources. If you are studying Physics, you read Einstein. Psychology? You read Maslow. It does not take long for you to discover that these important people sound different from you. Two main reasons: (1) They use a lot of hard words, that you must come to know and use; and (2) their sentences go on for twice as long as yours. So now you have to write a college paper. What are you going to do? You are going to do what you always have done: You will push the button. "Choose a subject. Choose a verb. Unravel your complement. Put a period . . ." – No! I have to go on twice as long as I used to. I'll put a comma and keep going. And on you go. You are constantly producing a main clause first problem. You used to write primarily one-clause sentences. Now you have to write two-clause sentences; and no one has taught you the difference.

For all those pre-college years, because most of your sentences were made up of just a single main clause, *your act of beginning the writing of a sentence was one and the same as your act of beginning the writing of a main clause.* That became a habit. There was no one around later on to tell you that if you usually begin your sentence with a main clause but give your reader no Stress Position, your reader is

already in deep trouble. You have already lost control of the structure of your own sentence. You have lost the ability to indicate what the reader should stress.

Please do not consider anything I have said in this article to be a new rule for writing. Any of my principles can be violated to good effect. For some typical examples of this, see Appendix A, below.

The only rule I would have you take away from this is, "If what I am doing in this sentence makes things clearer for the reader, then it is a good thing to do." In order to make such a judgment, you have to know how the Stress Position functions, especially when a main clause is involved.

I have recently been reviewing the top 45 sellers in composition textbooks and hand books. I have not come across a single paragraph that purports to help us in approaching the adult task of fashioning a sentence that has more than one clause. So I have devised a four-part typology of two-clause sentences. It should cover almost all of the two-clause sentences you will ever have to write. It acts as a final summary of the main clause first problem.

Type #1:

We start with the barest of bones:

.....MC..... , ...MC..... .

Here are two clauses, separated by a comma. Each is a main clause. The period at the end establishes a Stress Position. I wrote this sentence; and I am now judging whether it needs revision.

The first clause, I decide, has something in it that is worthy of stress. The more I contemplate these two statements, the more I believe that the second one deserves its own separate unit. How can I produce both a Stress Position for the first clause and isolation for the second? To do so, I put a period at the end of the first clause; and then I begin the second with a capital letter.

.....MC..... . G.....MC..... .

Both now have Stress Positions. They live separated lives.

Type 2:

.....MC..... , ...MC..... .

Again, I wrote this sentence, with a main clause in each half.

Again, the first main clause contains something important enough to be stressed. But the relationship between the two clauses is different here: The second clause restates or exemplifies the first. How can I both create a Stress Position for the first and advertise that the reader should be expecting a full main clause restatement of it in the second? To do so, I put a colon at the end of the first clause; and I begin the second with a capital letter.

.....MC..... : G.....MC..... .

Type 3:

.....MC..... , ...MC..... .

Again, I wrote this and now think I need a Stress Position for the first clause. But the relationship between the two clauses is again different: The first clause is part #1 of a 2-part thought; the second clause is the completion of that thought. Both require Stress Positions. To signal this, I put a semi-colon at the end of the first clause; but I need no capital letter to begin the second clause. That is what semi-colons tell the reader: Hold onto Part 1, stressing its end); part 2 is now beginning, with stress expected at its end.

.....MC....1... ; g.....MC.....2.... .

Type 4:

.....MC..... , ...QC..... .

This time they are not both main clauses. One is a qualifying clause. How can I get the main clause a Stress Position? I move the main clause to the end of the sentence: There it can benefit from the period's ability to create a Stress Position. If the QC, appropriately, contains no stress-worthy material, how can I manage to end it, appropriately, with no Stress Position? I move the qualifying clause to the beginning of the sentence: There, by using a comma, I can signal the reader not to stress anything in it.

.....QC..... , ...MC..... .

If we put these four revised sentences together, we discover something powerful and elegant:

Type 1 .....MC..... . G.....MC..... .

Type 2 .....MC..... : G.....MC..... .

Type 3 .....MC..... ; g.....MC..... .

Type 4 .....QC..... , ...MC..... . Look

vertically down the middles of these sentences – at the punctuation marks. Period, colon, semi-colon, and comma. These are the four major marks of punctuation in the English language. If you can master the differences they make in the middle of multi-clause sentences – the different instructions they send to the reader -- then you can control any scientific sentence, no matter the length nor the complexity. These four marks of punctuation send to your readers two important instructions: (1) They tell the reader when to stress something and when not to stress something in the first clause; and (2) they promise what the relationship will be between the first clause and the second. Usually, produce a Stress Position for anything you want your reader to stress. Most of the time, do not let a main clause end without the presence of a colon, semi-colon, or period.

Because I have been experientially overwhelmed by the frequency of both the Stress Position and the main clause first problems, I have felt no compulsion, until now, to generate formal statistics to back up my claim of their consistency in practice. But I thought it might be interesting to see if the statistics I have intuited about the main clause first problem would hold up under the scrutiny of a reasonable sampling. I have long felt secure in stating the following statistical estimations:

-- Average words per scientific sentence = 25-27

--Percentage of scientific sentences that have 2 clauses or more = 50%

--Percentage of scientific sentences with more than one clause that have a main clause first problem = 75-80%

To test these assumptions, I selected five articles (averaging 2,100 words) from each of five consecutive recent issues of *Science* with which to do some careful statistical work. I identified three sentence structures: (1) sentences containing one clause only; (2) sentences containing a single main clause with added, qualifying information following the main clause; and (3) sentences containing more than one main clause. I counted everything that needed to be counted. Here are the results:

-- Average words per scientific sentence = 28.89

--Percentage of sentences that have 2 clauses or more = 49.0%

--Percentage of sentences with > one clause that have a main clause first problem = 90.0%

90% was even more than I had expected.

Scientists, like lawyers, have always considered producing and consuming difficult-to-read writing as a necessary part of their professional activities. Writing experts have told them (1) to shorten their sentences and (2) to avoid the use of the passive. Both those pieces of advice are dead wrong. Allow me a comment on each.

As we have seen above, the sense of a sentence being too long depends not on the number of words but rather on the number of Stress Positions there are for the number of pieces of information the writer wants us to stress. A 13-word sentence can be completely opaque; a 130-word sentence can ring clear as a clear bell.

The passive is absolutely essential to sophisticated writing that deals with complex thought. What does the passive do? It shifts around a sentence's furniture. "Jack loves Jill" becomes "Jill is loved by Jack." Jack and Jill trade places. What does REA argue? It argues that *where* a word shows up in a sentence will determine *how* the word is intended to be used by the reader. REA is the *feng shui* of rhetoric. Thank goodness for the passive.

As readers of professional prose, we have long felt ourselves

successful, and even praiseworthy, if we can arrive at a sentence's end with a feeling that we have successfully perceived a notion of what the sentence was intended to convey. Exploring prose with the Stress Position and the main clause first problem in mind, we can come to see how the odds of having achieved that success are far lower than we would like. This is the case whenever (1) a Stress Position is not to be filled with what the writer considers a stress-worthy piece of information or (2) or there are pieces of information elsewhere than in a Stress Position that seem to be clamoring for our attention, or (3) we encounter a main clause that has no Stress Position at its end. When you have cleansed your prose of those problems, your readers will not only arrive at the correct interpretive decisions for your sentences, but they will do it with relative ease. This translates into a flourishing export of your ideas, as well as an increased import of funds with which to continue your work.

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To the Editor:

Two items:

(1) If you wish the tables that set forth the statistics concerning sentence length and the frequency of 2-clause sentences and main clause first problems, here they are.

Art #	# sent	# wds	sent w 1 cl	sent wmain clause +	sent w >1 cl	sent w main clause F
1	86	2,188	12	19	55	64
2	87	2,509	16	21	45	59
3	65	1,828	11	19	35	47
4	64	2,051	11	27	26	50
5	68	2,112	18	26	24	50
Ave. Totals	74	2,138	14	22	37	54

Average words per sentence = 28.89.

article #	% 1 cl	% 1 cl +	% 2 cl or+	%main clause first(excl 1 cl)
1	14.1	22.1	64.1	85.3
2	18.2	23.9	51.1	89.4
3	24.6	29.2	53.8	87.0
4	17.2	42.2	40.6	94.3
5	26.5	38.2	35.3	94.0
Ave. Totals	20.1	31.2	49.0	90.0

(2) If you allow appendices, the following could be a helpful one.

Here are three examples of when it can be a gift to your reader to end a main clause *without* a Stress Position – and another on when not to put your most stress-worthy material in a Stress Position.

(1) At times, you might want to state a situation and the cause of that situation in the same sentence; but you want your reader to focus most on the cause. In that case, start by stating the situation in a main clause and let the "because"qualifying clause enjoy the Stress Position. That way, the main clause provides for the situation the weight and dignity it deserves, without claiming for itself the primary focus of the reader's attention. Example: "The opioid problem in this country has spiraled out of control because governmental regulations have been badly misconceived by legislative bodies." If you constantly supply a Stress Position for everything stress-worthy, your reader will come to trust you. Then, when you occasionally give them a main clause without a Stress Position, they will feel confident to end your main clause *without* having stressed anything.

(2) At times you can instruct the reader not to expect to stop at the end of a main clause by giving them a semantic clue. Example: "As readers, not only do we need to read each sentence with confidence and accuracy, but we also need to move effortlessly from one sentence to the next without losing track of where we should be going." The "not only" tells the reader not to expect a Stress Position for this main clause, but rather to continue on in expectation of the arrival of the "but also."

(3) Sometimes you want to make a point – but then add something even more impressive. You can accomplish that by ending your main clause with a double dash (as I did in the previous sentence) and then adding the even more dramatic moment. The double-dash tells us that the sentence would have been fine to end right there – but here is an even better ending for it.

Not every sentence need end with the most striking piece of information in the Stress Position: Sometimes it can be kinder or more politic of you to undercut that painful information by ending with a softening of it. Example: "Because of the present health crisis, and given the resultant financial repercussions, we are forced to furlough 20% of the staff here, at least for a while."