Communications

Note on a Displaced Dogfish

Squalus acanthias is commonly referred to as being an inhabitant of the waters off the coast of New England and northern Europe. Nowhere can I find mention of its having any proclivity to inhabit fresh water. I would therefore like to report the following incident that occurred 30 August.

Morgan and Nick Garrett (ages 10 and 7, respectively) landed a 27-in. female *S. acanthias* while fishing from a bridge over the Appomattox River just north of Farmville, Virginia, in Prince Edward County. The shark appeared to be in excellent physical condition, making it necessary that the boys club it severely after having pulled it out of the water.

The Appomattox River is an uncommonly sluggish and muddy stream located in the James River drainage area. The point at which the fish was taken is 120 airline miles from the Atlantic Ocean.

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Word Saving, Good and Bad

Herman R. Struck [*Science* **119**, 522 (1954)] advocates methods for getting rid of word padding that are broadly similar to some that I have often used in quasi-editorial work. I think, however, that alternative methods of applying one or two of them are worth considering; that Struck is too hard on *there are*, and so forth, and on the use of passives; that words can be saved in ways that he has not mentioned; and that if word-saving is made an end in itself some other important objectives may be overlooked.

Most of the specific advice in Struck's paper may be summarized in these three precepts: (i) Use strong verbs whenever possible rather than weak verbs coupled with abstract nouns. (ii) Be wary of the inverted forms that begin with *it is, there are,* and so forth. (iii) Whenever possible, use the active, rather than the passive, voice.

Precept (i), as Struck develops it, makes *to be* and other weak verbs "chronic offenders." To me they seem inoffensive except when they get into the bad company of abstract nouns. The most effective way to carry out this precept, I believe, is to look for the abstract nouns —which are easier to find than the weak verbs—and get rid of most of them, chiefly by utilizing the strong verbs from which many of them are derived. "The rock shows much alteration" is a word longer and is weaker than "The rock is much altered." Since many needless abstract nouns end in *-tion,* much of the ground is covered by what used to be a pet slogan of mine: "Shun *-tion*!" Abstract nouns do not all end in *-tion,* however, and we have to use some of those that do end that way as well as many of those that do not. To get rid of needless nouns may sometimes take radical recasting, as in the following example, cited on page 524:

> . . . rats have an *ability* to make *selections* conducive to their *well-being.*
>
> . . . rats instinctively select the foods that are good for them.

Chains of prepositional phrases (p. 524) are likely to contain abstract nouns, and those that do can be broken up by cleaning out what the Fowlers call "noun rubbish" (*The King's English,* p. 15). That is what they did in radically recasting two examples on page 525.

The advice that I have summarized as precept (ii) appeared to me, at first reading, to mean that Struck would prefer that we never use the inverted constructions beginning with *it is, there are,* and so on (p. 523). He has been so kind as to point out, through the Editor, that he remarked a little further on that none of the constructions he "cudgels" must be condemned automatically, and that he used a *there are* on the same page. Many readers, however, might overlook that isolated *there are* and be less impressed by that generalized reservation than by the vigorous cudgeling of *there are,* and so forth.

There is good reason for the fact that these inversions, even though often used ineptly, are firmly imbedded in English idiom. They often make for effective placing of emphasis. In the second sentence back, for example, the uninverted form would be: "A good reason [16 words] is"—or "exists." That would throw a violent emphasis on *is* (or *exists*) and also is grotesquely unidiomatic. Of course Professor Struck knows all this, but it would have been helpful for him to say it explicitly.

In precept (iii), Struck is not so hard on the passive voice as he appeared to be on those inversions, but it would have been helpful to point out that the passive is sometimes better than the active, and to show why this is so. Often, of course, the passive does take a word or two more than the active, and when unskillfully used it is weak. But, like *there are,* and so forth, it sometimes makes for good placing of emphasis and good connection. In describing a stratigraphic sequence in ascending order, it is better to write "The Jefferson dolomite is overlain by the Madison limestone" than "The Madison limestone overlies the Jefferson dolomite."

The article fails to point out that words can be saved in ways that have nothing to do with verbs. In the longest example on page 524, many are wasted by elegant variation, which is carried over into Struck's rewrite. The reader's time is wasted, also, in figuring out that "rats," "animals," "rats," "animals," "rats," and "experimental animals," all mean "rats," and that there were seven of them. This secret is divulged in the first sentence of the following version, which con-

tains 57 words as compared with 89 in the original and 79 in Struck's rewrite. I took over his changes of passive to active voice but retained the passive, as he did, in the first sentence.

> Several weeks after these symptoms developed, the 7 rats were put on the self-selection diet. They then showed a marked appetite for fat, olive oil, and yeast, and little or none for the carbohydrate (sucrose). In all of them the diabetic symptoms disappeared or greatly decreased, but in 4 they reappeared when the McCollum diet was resumed.

Some words were saved here by using pronouns (*they, them*) and by ellipsis (*4 of the seven experimental animals,* for instance, was replaced by *4*). Both pronouns and ellipses are great word-savers. And the words they save are chiefly nouns; at least this is true of pronouns. The best way to save words is to get rid of expendable nouns—concrete as well as abstract. By doing this, one can save words of other kinds, including some of those weak verbs.

With this idea prominently in mind I rewrote the long example on page 522. Here all the nouns I removed entirely were abstract: *offer, exists, entrances, factor, control, case, study, fact, and practice*; but I also cut down the number of *scientists* from five to one. The original contained 159 words, Struck's rewrite 137, and mine 115.

Padding is bad, but the shortest way of stating a fact is not always the best way, especially when saving a word or two impairs continuity—the quality that makes one thing lead naturally to another—and cadence, which consists mainly in effective distribution of emphasis. The beginning of a sentence ought to connect well with the one that precedes it and to indicate promptly the general drift of what is to follow; the end should as a rule contain the most emphatic words.

Struck has perhaps not always borne the value of these qualities in mind. In the rewrite near the beginning of page 523, the first part of the last sentence is jerky, and the drift is not clear until we get halfway along; the best part is the last, which retains the strong ending of the original. In an example on page 524, shifting from passive to active changes a strong ending ("it is surrounded by great industrial regions") to a weak one ("great industrial regions surround it"). This saves two short words; but by so rewriting the sentence that it has good cadence throughout, one can reduce the wordage from 26 to 21:

> It is rather remarkable that there is so little industry in this area, surrounded as it is by great industrial regions.

I believe, after long experience in revising manuscripts, that that result is typical; good continuity and cadence cost a few words here and there, but they save words in the long run. So the reducing diet that I would prescribe is this: (i) improve the continuity and cadence; (ii) get rid of all needless nouns—which will automatically raise the percentage of "efficient verbs."

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Mr. Calkins and I are clearly brothers under the skin. But we prefer to go home by different ways. He is a noun-pronoun-ellipsis man and I am a verb man. The difference is probably not earth-shaking.

Looking for abstract nouns first, for instance, may get rid of weak verbs more efficiently than examining verbs first. I don't think so. I am inclined to think that looking for *tion* nouns (without worrying about their abstractness) is somewhat more valuable. Abstraction, however, is a concept often frustratingly elusive. Is *tree* concrete or abstract in "I think that I shall never see a poem lovely as a tree"? What about the nouns in "They take the logical position that improved working conditions for all workers will have a beneficial effect on the union membership"? I'd hate to be dogmatic about any of the nouns here, though I would probably run little risk in calling *effect* abstract and *workers* concrete. In short, the idea of abstraction isn't easy; it frightens some people, including me. I'd just as soon bypass it. I find that a writer, dissatisfied with a sentence, can spot *is, are, was, has, had, take, give,* and so forth, more readily than he can decide what is abstract and what isn't. If abstract nouns would only label themselves as clearly as the verb *to be,* I might change my mind. But until *-tion, -al, -ment, -ence, . . .* point the way as effectively as I find a relatively few verbs do, I'm staying a verb man. The interested reader can choose either system—or any other—as long as it helps him unpad his sentences.

While Calkins' revisions are consistently excellent in themselves, his criticisms sometimes fail to recognize that emphasis and plain acceptability of an article occasionally make perfection in handling details undesirable. His "rats instinctively select the foods that are good for them" is, in my opinion, superior to the original "rats have an ability to make selections conducive to their well-being" and to my "rats can make selections." However, too much revising can obscure a point. Though *make selections* is, normally, weaker than *select,* I avoided this change lest it dim the value of changing *have an ability* to *can.* And Calkins' addition of *instinctively* might provoke protest. I understand psychologists instinctively avoid it.

My emphasis on the verb permits Calkins to outscore me 57 to 79 on the diabetic rats. I concede. And his means are effective, too. Still, knowing that inaccurate pronoun reference can wreck the whole meaning of a sentence more readily than a repeated noun can, I hesitate to endorse the pronoun-for-noun substitution unreservedly. (An authoress on nutrition, next door to me, is so miffed with pronouns that she will use them only at gun point.) But, with reservations, the pronoun is a useful tool; in the hands of a skilled workman it can contribute its share to such an excellent rewrite as Calkins' 115-word revision of an originally 159-word passage. Since this revision merits a wider publicity than my unkempt files will give it, here it is:

> Most of the scientists were able to work in places that suited them, and to get new jobs immediately if they left the old. Of the 155 who had held one job

> 8 years or more, all but 18 had been offered some other worthwhile job within that period. Of the 574 who quit, only 67 did it because they had to, and 28 of these had been employed on war projects that were terminated. Of the 670 who had accepted employment, all but 75 had some other opening. This was partly due, presumably, to their having shopped for new jobs while remaining in the old: they rarely left one without having lined up another.

Taking up Calkins' discussion of the passive, I should, first, admit that he showed thoroughness and perception in pouncing upon the *great industrial regions* sentence. With so many bullet-proof illustrations to choose from, I can only kick myself for having used this one.

Second, perhaps I do overstate the case against the passive; let's call it the shock treatment or the academic white lie. If an awareness of the passive gives a writer a handle for straightening out a stumbling sentence, I've accomplished my mission. Obviously many passives are pure in heart and indispensable: the doer of the action may be unknown or unimportant; the doer may be a string of nouns too long to precede an active verb effectively; a weak construction may be more appropriate than a forceful one—in being tactful, for example. I object not at all to these:

> The cathedral at Chartres, founded in the 4th century, was dedicated to the Virgin and Child.
>
> After the fall of Rome this area was occupied by the Eruli, Ostrogoths, Greeks, Longobards, Moslems, Greeks (again), Normans, and the forces of the Holy Roman Empire, in that order.
>
> This paper is poorly written.

Calkins' statement that "words can be saved in ways that have nothing to do with verbs" is certainly true. But surely he is aware that space is limited—particularly for an article on writing in a scientific journal.

While most of Calkins' points are worth making, I do not understand his strong defense of inversions, particularly *there is*. True, inversions are occasionally necessary, even invaluable. Changing the following sentence, for instance, would be idiomatic suicide: "After V-J day, there was a counter movement into normal civilian activities." Too, I may have slightly overstressed the evils of *it is*. But on *there is* I refuse to retreat. In fact, if I were to rewrite the article, I would flail the construction harder. Although, unfortunately, I don't go in for statistics, from my reading I would guess—conservatively—that one out of every four sentences that contain *there is* would be better without it. This passage from a pamphlet on technical writing shows its potential for messiness:

> Any survey of the deficiencies in a large group of manuscripts is likely to show that these cover a wide range. Nevertheless, there is evidence that in some areas, there is need for much improvement of papers, while in other areas there is less need for attention.

The final sentence, without *there is*:

> Nevertheless, evidence shows that papers need much improvement in some areas and less in others.

Calkins' objections that my approach was negative means only that I used bad examples rather than good ones. And purposely, since I hoped to reach primarily *Science* readers who write bad sentences, know it, and feel stymied in their attempts to improve them. Good examples are admittedly a first-rate technique, but, within the space available, I preferred bad examples. I wasn't brain-washing the reader; I was blackjacking him.

Nor am I a blind devotee of concision. If my article so implied, I repent—slightly. I'm not greatly concerned, because even if the article did give that impression, it will probably injure few people; overconcise writers are as hard to find as a golden needle in a haystack.

Finally, Calkins' guiding principles of tone, continuity, and emphasis are beyond reproach—and in his hands highly effective. But they're also highly abstract. My article tried to suggest specific devices that less skillful writers might find helpful in achieving the desired tone, continuity, and emphasis.

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The Explosion of a Planet

The heterogeneous structure of the meteorites suggests that they might have originated in an environment of violence, such as the explosion of a former planet; but the opinion of astronomers has been that ". . . there is no known reason why a planet should explode" (*1*). Despite this adverse opinion, it is suggested that, if a planet similar to the earth approached within Roche's limit of a larger body, its tidal disruption would release forces that would cause the planet to explode. Although the two catastrophes would occur almost simultaneously, they would result from such different causes and with such different results that they will be described in sequence.

Tidal disruption. When a planet approaches within Roche's limit of a larger body, tidal forces, which are tensile, pull it apart into disks at right angles to the tidal forces. The distance from rift to rift would vary from a few hundred kilometers in the cold exterior rocks to a few meters in the hotter interior rocks, since the distance from rift to rift would vary inversely as the square of the strength of the material. Gravitation of the material in the planet would be neutralized in the direction of tidal forces, but it would not be affected at right angles to tidal tension. The width of the rifts would continually increase, and at the same time the change in direction of the tidal forces through over 90° would cause new rifts at increasingly greater angles to the original rifts until the planet would be crisscrossed with rifts of varying and increasing widths. In the meantime, the vertical walls of rifts through the crust, like the walls of a deep trench or a deep mine, would collapse at a depth where their