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; over-concise 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 weight equaled the strength of the rock. Their collapse would squeeze hot plastic rock into the rifts and crush cold brittle rocks into fragments. The failure of these rocks would cause large chunks of the surface rocks to break off and fall into the widening rifts. The original size of the fragments of the crust would be measured in hundreds of kilometers, but their thickness, limited by the weakness of the hotter interior rocks, would be perhaps 25 km. The changing direction of the tidal forces would eventually break these large crustal fragments into sizes of the order of 50 km. When the weight of the materials at right angles to the tidal forces is considered, as well as the reduction in their tensile strength because of internal heat, the size of the fragments would vary from Jeffreys' (*2*) 200 to 400 km to fragments perhaps the size of sand or dust (*3*).

The materials in the fragments would be identical in composition and structure with the materials of the disrupted body, just as the fragments of crushed rock are identical chemically and physically with the rock from which they are broken.

Quasi vulcanism. If the planet is assumed to have been similar to the earth, its subsurface rocks would have contained gases, principally steam, dissolved under pressures that exceed 10,000 atm in terrestrial subsurface rocks. On the earth, when tension rifts through the crust penetrate deep enough, molten magmas well to the surface, often escaping with explosive violence. If the interior rocks of the disrupted planet were not hot enough to flow into the rifts, but were too weak to retain the rapidly expanding gases, the dissolved gases would expand with such terrific violence that they would hurl the fragmented rocks into the widening rifts and at the same time fill the rifts with gases under considerable pressure.

When tidal forces were great enough, the metal core itself would be violently torn apart. At the temperatures and pressures existing within the planet at this stage, the metals would be fluid. Sulfides, halides, other volatile salts, volatile metals, and possibly dissolved water and occluded gases would all expand with terrific violence, tearing apart the tidal fragments of the core. The expanding gases would hurl molten metal toward the surface of the planet, but the molten metal would be expected to collide with and adhere to or interpenetrate the fragmented rocks in their paths, for unlike gases, their paths could deviate only slightly from a straight line. In general, the metal fragments would be larger than the stones, since tidal tension would be less effective in the fragmentation of the denser metals, the back pressure of the expanding gases above would partially replace gravitational force, and the time interval of tidal disruption of the core would be shorter.

Conclusion. If the tidal disruption and fragmentation of a planet would cause it to explode, it would seem that the whole interior of the planet would become an enormous volcano, belching forth its substance through every tidal crack and at the same time tearing to pieces and nearly pulverizing all rocks hot enough to permit the escape of their dissolved gases. Such an explosion, detonated almost simultaneously throughout the entire planet, would be so much more disorderly than an ordinary explosion that any attempt to describe the results in detail is necessarily speculative.

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References

1. H. N. Russell, R. S. Dugan, and J. Q. Stewart, *Astronomy* (Ginn, New York, rev. ed., 1945), p. 357.
2. H. Jeffreys, *Monthly Notices Roy. Astron. Soc.* **107**, 260 (1947).
3. P. S. Palmer, *Nature* **173**, 499 (1954).

28 June 1954.

This communication, which is based on a portion of Mr. Palmer's unpublished paper, "The origin of meteorites," was prepared by Katharine B. Palmer after the death of her husband in September 1953. Mr. Palmer's paper and the present communication have been the subject of some criticism, privately transmitted to the authors. But our advisors, who saw these critical comments, have pointed out that none is very specific, probably because of the difficulty or impossibility of giving a merit rating to a hypothesis that involves essentially qualitative reasoning—however, this can hardly be held as an argument against publication.

Some Comments on a New University

It was certainly a pleasure to read William Seifriz' thoughtful article [*Science* **120**, 87 (1954)]. Surely he will not lack applicants for positions in the new university. I doubt, however, whether under present conditions his goal can be realized.

Seifriz complains that science has become tough. But is not everything tough today? Why should science be exempted from the general trend of events? Young men who wish to make science their career are not taught the value of contemplative attitudes, of a fuller view of life, but instead are trained in graduate "trade" schools where their advancement must depend on their ability to get results, that is, answers to problems posed by their teachers or initiated by themselves. If such results lack significance in a deeper sense, it is hardly fair to blame the students or their preceptors. In investigative work it is just impossible to foresee where an idea will lead. Some ideas that appear brilliant at their conception unfortunately turn out to be dreams without any basis in fact and, therefore, have to be discarded; others that seemed of little value at first yield results significant beyond expectation because they happen to be in accord with the course of natural processes. Failures will outnumber successes; but, regardless of what he himself may think of the results he has obtained, the scientific worker feels he has to present them in order not to lose in competition with others. No doubt, this makes many scientific congresses a hodgepodge of trivia, as Seifriz describes