

LETTERS

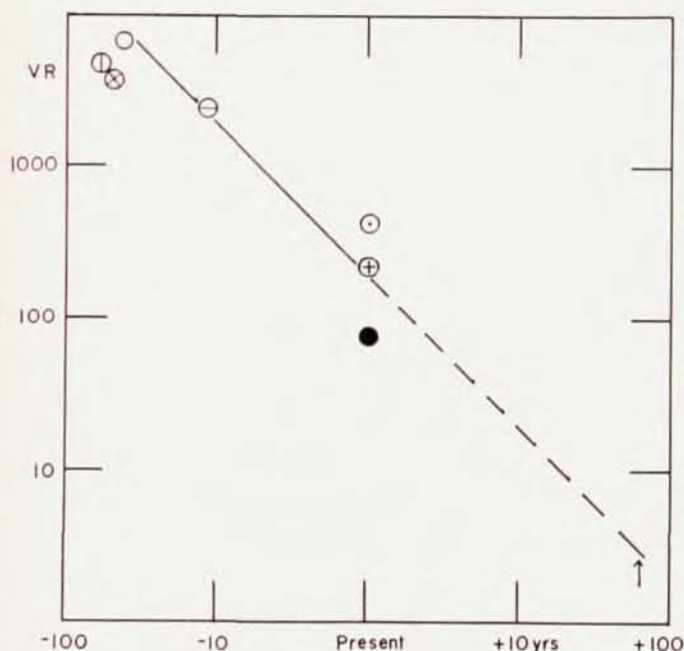
Modest Proposal

The recent publication of articles describing the discovery of the antiscascade particle^{1,2} focuses attention on what has surely become the most serious problem in the communication of scientific results. I do not refer to the proliferation of more and more specialized scientific journals, the increasing thickness of those that exist, or the inevitable creation of "Annual Reviews of X" or "Progress in Y", which help us to find the significant articles we should have read during the previous year. Rather, I wish to describe a phenomenon which has perhaps been hinted at, but not yet fully recognized as a clear and present danger.

A casual glance at almost any scientific journal of fifty years ago shows that most articles were written by one or perhaps two authors. An equally casual glance at a contemporary journal often reveals a list of authors longer than the title of the paper. Also, as Reif³ has pointed out, the pressure of scientific competition and the adage "publish or perish" have helped to spawn a new type of journal (e.g., *Physical Review Letters*), in which only brief communications are published. These two factors may be combined into

what I shall call the "Verbosity Ratio" (*VR*), defined as the ratio of words in an article to the number of authors. The temporal evolution of the *VR* over the past several decades is shown in the accompanying figure, and it is evident that the ratio is dropping rapidly. Intuitively and naively, one would think this a desirable state of affairs, and indeed it would be if the total number of contributing authors were to remain constant. But surely the total number of scientists, and hence would-be contributors, is increasing rapidly with time. Therefore, the slight extrapolation indicated in the figure indicates that in less than a century a *VR* "catastrophe" will take place. At that time, the ratio will have dropped to three words per author, and the space devoted to listing the authors' names will roughly equal that required for the contents of the article.* It is also evident from the figure that articles devoted to high-energy particle physics have a lower verbosity ratio by a factor of almost two, by comparison with other current articles. This appears an inevitable consequence of a type of physical research which demands enormous machines and large teams of researchers to serve them. Goudsmit⁴ has commented eloquently on the impact of this phenomenon on the future of physics research.

Now, my suggestion is simply this: Apply the concept of "team" research logically, consistently, and enthusiastically. Individual scientists in such groups must forego the pleasure of seeing their names emblazoned in 8-point Baskerville and accept authorship designated by a group name.[†] I propose that a suitable international body begin at once to choose appropriate and easily remembered names for the various teams of physicists engaged in high-energy nuclear research. Some possible titles suggest themselves at once: the "Reds" of Dubna, the Harvard-MIT "Yankees", etc. Of course, the make-up of a given team will vary continuously, which will require the publication at annual intervals of a statement of the number of articles attributed to each team, and a list of the group personnel. Each member will be given a "writing average", e.g., .500 means he was a coauthor of half the publications issuing from his team. It might prove desirable to form subgroups of teams, for example an American League of laboratories with accelerators operating at energies greater than 30 BeV and with beams traveling counterclockwise, an Un-American



Logarithmic plot of verbosity ratio (*VR*) against time in years. ⊕, Proc. Phys. Soc. 17 (1899-1901); ⊗, Phys. Rev. 1 (1913); ○, Ann. Physik 64 (1921); ⊖, Phys. Rev. 77 (1950); ⊙, Phys. Rev. Letters 6 and 7 (1961), over-all average; ⊕, Phys. Rev. Letters 6 and 7 (1961), high-energy physics; ●, see Reference 1.

* No allowance has been made for English authors with multiple given names or hyphenated family names, or for authors of Slavic origin.

† In addition to the paper cited in reference 2, there is an earlier precedent for this: *The Physical Review* once published a paper by a Summer Study Group on Something; since I can no longer remember what Something was, I cannot find the reference.

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League with accelerators of greater than 30 Gev and beams traveling clockwise, an AAA league with energies between 3 and 30 Bev, etc., etc. Further possible extensions of this system, such as "trading" of team members, relegation of members to minor leagues, and so forth, are left to the imagination of the reader.

We remain, Sir, etc., etc.

Ralph Emerson Weston
R. Emerson Weston
R. E. Weston
Ralph E. Weston
and several others

Library Lane, Brookhaven, L. I., N. Y.

References

1. Brown and 16 others, *Phys. Rev. Letters* **8**, 255 (1962).
2. CERN, Ecole Polytechnique, and Saclay, *ibid.* **8**, 257 (1962).
3. F. Reif, *Science* **134**, 1957 (1961).
4. S. A. Goudsmit, *Phys. Rev. Letters* **8**, 229 (1962).

Information Retrieved

In an article beginning on page 22 of the February 1962 issue, it is stated that existing information retrieval tools are inadequate for compilations of data. It is suggested—perhaps rhetorically—that readers should ask their library to find three quoted references. I took the authors at their word and put the enquiry to the Harwell Library in the following terms:

"Could you please try and find references to compilations of information on the following subjects:

- (a) Thermal neutron capture gamma rays
- (b) Range and energy loss of charged particles in aluminum
- (c) Radial Coulomb integrals

A single reference on each subject would suffice."

The library staff were not told of the nature of the enquiry, and using perfectly conventional library methods (i.e., consultation of the catalogues and abstract journals, reference to experts on the site, and use of the searcher's memory) the following references were produced:

- (a) Atlas of γ -Ray Spectra From Radiative Capture of Thermal Neutrons, by L. V. Groshev, V. N. Lutsenko, etc. Translated by J. B. Sykes. Pergamon Press, London, 1959, pp. 198.
- (b) Nuclear Data Tables. US Atomic Energy Commission, 1960. Part 3, pp. 1-19.
- (c) Radial Coulomb Integrals. Iron Series Hartree-Fock Calculations. MIT Tech. Report No. 12, 1959.

You will notice that the references produced are in all three cases to more recent articles than those quoted in your article. Had the searcher looked for additional references, there would have been no difficulty in tracing those quoted as they all appear in *Nuclear Science Abstracts* or in the Harwell Library Subject Catalogue. Both these tools were used in the search, but the searcher worked back from the most recent reference.

R. M. Fishenden
AERE, Harwell, England

Testing Again

Dr. Frank J. Fornoff,¹ of the Educational Testing Service, has taken on the task of defending ETS in the matter of certain multiple-choice science questions used by me in a challenge to that organization.² But, as will be shown, he has not taken the preliminary step of carefully reading what I have written.

His principal defense of the "potassium" question consists of an application of the well-known "Daddy knows best" routine, which can work wonders when one is dealing with children: he says that the question "was reviewed by a group of competent college and school chemistry teachers, and, in the context for which it was intended (high-school chemistry), they were satisfied it had merit". If the question is defective, this type of defense carries implications that Dr. Fornoff may well find surprising.

Let us look at the other aspects of his defense of the "potassium" question. His inability to appreciate the strength of the hierarchical relationship of the answers does not necessarily do him credit. And his illustration of the way the committee system for test review operates shows that he failed to understand my argument, for he is under the misapprehension that Mr. Hart³ and I are in disagreement, though the fact is that I had been well aware of Mr. Hart's cogent point and had specifically stated, in *Testing*, that it was for the sake of argument that I was assuming that the potassium and lithium were supposed to be in a gaseous state—an act that Mr. Hart characterizes as "too generous" on my part.

Again, it is strange that Dr. Fornoff should tell of the multiple-choice testers' "belief"—I would myself have said "hope"—that "the rare high-school student who has pushed his knowledge of the field far beyond his textbook will be sophisticated enough to recognize the context associated with the question and will answer it correctly." Can it be that Dr. Fornoff does not realize, for example, that he is here making a damaging admission of the fact that the question penalizes the "rare" student? Though the "rare" student has negligible effect on the testers' statistics, he is not therefore unimportant, and one should not dismiss him thus easily. Nor should one impose on him the burden of estimating what degree of "sophistication" to apply to a particular multiple-choice question, especially since the appropriate degree of "sophistication" varies from question to question. Indeed, one would do well not to condone tests that penalize him for failing to subordinate truth to "sophistication".

Dr. Fornoff's defense of the "potassium" question is notable for what he does not say. He makes no reference at all to my charges, in *Testing*, that ETS' official defense of this question, in *Explanation*, was invalid, contained elementary blunders in science, used an argument that boomeranged, and revealed that ETS did not understand what its own question was about. These are strong charges. Did Dr. Fornoff read *Testing* in such haste that they escaped his notice? If so, was