spectrum of Fig. 9 indicates folding about the Nyquist frequency of 10 cycles per second. This folding, which was also apparent in other spectra, prevents determination of the true location of the higher-frequency peaks. However, even if the true frequency at the peak had been determined, there is no sound theoretical basis for relating the peak frequency to any visually observed bird motions, such as wingbeat. The relationship between bird motions and spectral peaks, the spread in the spectrum about the peaks, and the ratio of the areas under the spectral peaks to the total spectral area may be cataloged for different species through experimentation. Such a catalog would be useful in the identification of bird species by radar, but its compilation is beyond the aim of the investigation discussed here.

It seems clear, however, that the presence of distinct spectral components at frequencies other than zero, as recorded in these investigations, must be associated with relative motions between the moving parts of a bird. Certain single insects may yield fluctuation spectra similar to those of birds, but insects can be distinguished from birds by their cross sections (*14*). It is highly unlikely that meteorological targets can yield fluctuation spectra having distinct peaks at frequencies other than about zero; thus, a real-time spectral analysis of dot angles should permit their immediate classification as either meteorological, bird, or insect echoes.

Conclusions

A bird in flight is a complex target and produces a highly fluctuating radar return. Thus, the radar cross section should be described in terms of its statistical properties. The radar cross sections have no simple wavelength dependence. The radar return does, however, contain information which provides a basis for identifying an unknown point target as a bird. This information is the radar cross section, the probability distribution of the cross section, and the fluctuation or energy spectrum. The radar cross section of (or power received from) a single bird in flight has a log-normal distribution. The characterizing parameter is the mean-to-median ratio of cross section, which represents a measure of the amount of fluctuation in the returned signal. This ratio, in turn, is a function of the size of the bird relative to the radar wavelength. The fluctuation spectrum contains peaks at frequencies other than zero, which indicate periodic, relative motion within the target—for example, the bird's wingbeat.

Thus, the radar return from single birds in flight differs characteristically from the returns from other possible point or dot targets, such as aircraft, swarms of insects, several birds together, or small clouds or other meteorological structures.

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Free Enterprise in Data Compilation

Committees are urged to open a freeway for compilers rather than to guide and channel their steps.

K. Way

This article is concerned with ways to increase the number and quality of compilations of scientific data. Three papers have recently appeared in *Science* on programs to achieve this end (*1–3*). I propose here to examine a fundamental assumption of these three approaches, to argue against it, and to suggest an outlook to replace it. The assumption is that in the future compiling will not be performed adequately without special inducement, planning, and guidance by distinguished committees or panels.

In his paper on "International cooperation: the new ICSU program on critical data," Brown (*1*) tells of plans for an international committee, CODATA, to conduct a worldwide survey of existing compilation activities on the basis of which ". . . CODATA will attempt to *assess* the needs of science and industry for additional compilations of evaluated data" (page 753, italics mine).

Brady and Wallenstein, in their article on "The National Standard Reference Data System" (*2*), envisage (page 756) "the *planning* and implementation of projects for compiling data." Later they note (page 761) the desirability of "a directive to the Secretary of Commerce to provide or *arrange* for the collection, compilation, critical evaluation, publication, and dissemination of standard reference data . . ." (italics mine).

Overhage, in "Science libraries: prospects and problems" (*3*), sees planning (plus incentive) as the answer. "As al-

ways, the crucial task will be the *selection* of the individuals to whom the stipends are awarded. . . . The government would do well to enlist the help of the National Academy of Sciences in this task" (italics mine).

In contrast to these implied views that distinguished central bodies should assess the field, plan the work, and select the individuals to carry it out, I believe that if certain obstacles were removed, compilations would be prepared without supervision with the same verve and sophistication that distinguishes the performance of research. In my view, data compiling is an activity congenial to scientists. The collection, evaluation, and interpretation of the experiments in a field is a task undertaken by every experimenter before embarking on new measurements and by many theoreticians before suggesting or testing theoretical approaches. I have never seen any evidence that this part of scientific work is in any way disagreeable to those who perform it. On the contrary, in fact, many scientists enlarge their compilations beyond the requirements of their immediate needs. Pride and pleasure in these enlargements often lead to informal distribution, to project reports, and sometimes to journal publication.

Moreover, it has long been recognized that good compilations bring considerable prestige. One has only to think of the fundamental constants of DuMond and Cohen or the energy levels of light nuclei of Lauritsen and Ajzenberg to realize that the sophisticated compiler wins wide applause and enduring respect from his fellow scientists. Why then is there talk of the difficulty of getting people to do compiling, of the necessity for trying to attract them with high pay or special acclaim?

The reason, it seems to me, is that the tedious part of the work has increased beyond the tolerance point. This is because there are now many more data, more journals, more indexing systems, more references to get straight, and so on and on, than in the past. The interesting part of a job of any size is soon snowed under by hundreds of troublesome details which, if not handled carefully, will discredit the entire work. If compiling can be made as easy as in the "old days," compilers will reappear without special inducements. There will be no need for committees or panels to wheedle them into the job. Moreover, designation by the committees or panels of areas in which compilations are needed will have an irritating effect. The people in the field usually know the needs much better than the committees. Just as committees are not needed to suggest important and interesting research problems, neither are they needed, in my view, to point out the important and interesting compilations. Scientists want to select their own problems and tasks in compiling, just as they do in research.

What has made compiling and reviewing jobs so frightfully tedious?

1) *The indexes with which one must work. Physics Abstracts* or *Nuclear Science Abstracts* may get you started, but they do not see you through. Soon you are involved with separate journal indexes—all different. You have to learn to work each one. The computerized systems seem to promise some help, but almost too much. They may flood you with unwanted items, all of which must be scrutinized before they are discarded.

2) *The poorly presented papers.* Most papers are not "skimmable." Sometimes the abstract is rewarding. After reading it, you often think that if you could just find the table or the curves, you could get the whole message. But, alas, the curves show B_i as a function of $1/h$. Often the tables are better, but almost always there is a mystery column, $C_{i(\mathrm{exp})}$ perhaps, which seems to contain all the meat since it is compared to $C_{i(\mathrm{th})}$. After a while you find C_i defined in Eq. 34 as a function of $g(r)$ and $t(p)$. So it goes. Everything is usually there, but you must start from the beginning and read every word.

3) *The job of organizing and presenting in approved style all the references used in the compilation.* Each medium has its own style for references. Those used must be written, or key-punched, in the approved manner. The spelling of certain names must be looked up, peculiar-looking abbreviations checked, decision made as to whether Ong Ping Hok should come under O or under H, and so forth. Maybe librarians or assistants are at hand to do these chores for some, but the average compiler, especially the one-shot compiler, will have to cope with all these little problems for himself. If he has 200 or 300 references, the job is a real burden.

4) *Lack of good places to publish.* Once the compiler has surmounted the difficulties cited above and has also performed the pleasant work of his compiling task, he has to find a publisher. Many friends will tell him he should choose one that will distribute his work either free as a report, or at a low price as a government publication perhaps. If he adopts the first advice, he may find his work presented in some cumbersome form (600 pages perhaps where 100 would have served). Moreover, he will often be called upon to write descriptions and announcements, make lists for circularizing—in short, to be his own publisher. This last may devolve on him even if he chooses the more experienced Government Printing Office, but in neither case will he usually get the professional skill in presentation that he really needs. It is just not available at a low price.

The cure for all this, it seems to me, is to stop trying to induce people to put up with these difficulties and to set about removing them. The committees and panels could start to do this forthwith. Their help would be much needed since national and even international decisions must be made in many cases.

In the indexing field, a new approach is being made at present by the American Institute of Physics. Since the results may be used by *Physics Abstracts*, the needs of compilers all over the world should be strongly represented in this effort.

How do you make a paper "skimmable"? Experiment and study are necessary, but a beginning could be made at once. Contests could be held, prizes offered, samples published and criticized; perhaps psychologists and Madison Avenue could be consulted. A good beginning has already been made by the UNESCO *Guide for the Preparation of Scientific Papers for Publication*. Further rather obvious ideas are a collection of definitions (perhaps in a box) with every paper, and tables and graphs which together with the definitions are self-explanatory. Journals could carry, on the inside back cover, internationally agreed-upon abbreviations which could be used without explanation. A trail was blazed in 1952 by Blatt and Weisskopf who ap-

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pended to each chapter of their book *Theoretical Nuclear Physics* explanations of the symbols and abbreviations used in that chapter.

Reference problems could be eased considerably if an internationally acceptable style of presenting references were worked out. If this could be achieved, national or even international reference "banks" can be imagined. Authors could just send to the bank long lists of designations, such as PHRV 109 0234 (*4*), and receive back the complete references in the accepted style, with guaranteed spelling, in a form that could be directly photographed for publication.

In the publication field a number of new experiments are needed, like the compilation journals *Nuclear Data* (*5*) and *Crystal Data* (*6*). The important thing here is to guard against the growth of a system of subsidies that would close the field to venturesome commercial publishers whose expertise and imagination can make noteworthy contributions.

Other novel proposals can easily be imagined. They should all, of course, be discussed and weighed before adoption. The committees proposed and existing seem eminently suited for doing this. The important thing, I believe, is that the fundamental need to devise new tools for the compilers should be recognized. Bulldozers are needed where only spades exist now. Once the bulldozers are provided, there will be no need to plead that spades really are not so bad, especially with committees to tell you where to dig. Prospective bulldozer operators will be stepping forward, without inducement, to guide these machines into new and fruitful pathways.

Won't there be need for standards? Of course, but science has already evolved light-handed ways of providing these through editors and referees. For compilations too large for journals and edited compendia, book reviews and the marketplace test itself will set very severe standards. Coordination? This could come naturally through bibliographies and directories of existing works. A compiler is not likely to undertake duplication of a work he believes competent, if he knows about it. Today it is very difficult to find out. In the near future the work started by CODATA may produce the tool that is needed.

When this day arrives, you may get the notion some morning to do a little summary of the data on the 3^- octupole states in nuclei. You find quickly that in this field there is only one compilation which is pretty much out of date. A list of the key words nearest your topic goes off to a center. Back come bunches of cards with references and abstracts. You start to read, skimming here, really studying there. You plot this and that. Things settle, explode, reorient themselves. At last you see it. The writing is not so hard. The references are really easy. Everything goes off to a professional publisher. Probably no one will give you $3000 (*7*), but you will be full of joy.

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NEWS AND COMMENT

The Brain Drain: New Law Will Stem Talent Flow from Europe

A 1965 immigration law that becomes fully effective 1 July will plug the "brain drain" from Great Britain, Germany, and other parts of Western Europe for about 3 years and will open the way for a drain of talent from the Far East and the underdeveloped world. This unforeseen consequence of a widely hailed "liberalization" of American immigration laws is causing consternation in Washington. Some government officials and congressmen fear the new law will strip developing nations of their limited talent, thus aggravating their economic and political problems and undercutting the U.S. foreign aid program. Others are reluctant to see American institutions and industry deprived of the beneficial flow of highly trained scientists, engineers, and physicians from Western Europe. The European scientists who have come to the United States in search of higher pay or greater opportunities in recent years are considered more competent, on the average, than the scientists who are likely to replace them in the new immigration pattern.

A handful of American officials has been aware for several months that a dramatic shift in the composition of the brain drain was likely, but this realization did not reach a wider public until the State Department's Visa Office published a detailed analysis of the new law late in November. In the ensuing weeks efforts have been launched, by the Executive branch and by members of Congress, to nullify some of the unwanted consequences of the new law. Significantly, even an architect of the 1965 immigration law, Representative Michael A. Feighan (D–Ohio), has cited the "need for some modification of the system."

The new immigration law began taking effect in December 1965, but it included provisions for a 2½-year transition period before becoming fully effective at the beginning of the coming fiscal year. The main thrust of the law was to eliminate the old national-origins quota system and replace it with a series of "preference categories" under which immigrants from outside the Western Hemisphere are admitted to the United States on the basis of family relationships or personal skills, regardless of their country of origin (except that no more than 20,000 a year can be admitted from any one country). The new law set ceilings, for each category, that were expected to accord with demand, but during the transition period long waiting lists have built