missive dog presents his jugular vein to the dominant animal. I have observed aggressive behavior in dogs for over 20 years and have seen a great variety of adjustments between dominant and subordinate dogs, but I have yet to see a behavior pattern that could be interpreted as presenting the jugular vein.

There are two defects in the classical instinctual analysis of behavior as presented by Lorenz. One is that it provides a theoretically complete explanation for behavior and so offers no new leads for research. The second defect arises out of the first. Because it is limited by theory, the analysis provides only limited practical solutions. If destructive aggressive behavior is caused by a spontaneous outburst of internal energy, then sublimation is the only practical answer to the problem. While it has some application, sublimation by itself is a very weak reed upon which to rest our attempts to control aggression. Lorenz is on the side of the angels, but his theory limits him to using only one of the many tools available. This is essentially the same as William James's idea of the Peace Army, which has become a modern reality as the Peace Corps. As we know, this will not by itself eliminate aggression.

Actually, there is no evidence that there is any physiological mechanism in any mammal which produces stimulation to fight in the absence of external stimulation. Rather, there is much evidence indicating that mechanisms exist which are easily excited by external stimulation and which function to prolong and magnify the effects of this stimulation. Aggressive behavior can be greatly enhanced or completely suppressed by training; the capacity to develop such behavior can be greatly magnified or almost completely eliminated by genetic selection. Furthermore, Lorenz has entirely missed one of the most important newer findings arising from the study of animal behavior, namely, that a major cause of destructive fighting in animal societies is social disorganization.

As a student of the evolution of bird behavior, Lorenz has presented a bird's-eye view of mammalian and human aggression. It is fascinating, but it is only 50 percent science.

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## A Tribute to Littlewood

A special volume of the **Proceedings of the London Mathematical Society** [vol. 14A (1965). J. D. Wesson, Ed. Oxford University Press, New York, 1966. 320 pp., illus. $12.80] was presented to J. E. Littlewood, professor emeritus at Cambridge University, on the occasion of his eightieth birthday, 9 June 1965. Here was a felicitous occasion: Littlewood is one of the greatest living mathematicians, the London Mathematical Society (with which he has been closely identified for decades) was to celebrate its centenary the following month, and the papers in the volume (written by prominent mathematicians) are almost all in fields to which he has greatly contributed.

Littlewood's name is frequently mentioned in the form Hardy-Littlewood, signalizing his notable collaboration of 35 years with G. H. Hardy. (An atrocious example, which nonetheless illustrates the point: the wife of a number theorist, herself no mathematician, on learning that Littlewood was traveling to the local university and was then 77, exclaimed, "My, but he's a hardy Littlewood!") A good half of Littlewood's output is in joint papers with Hardy. The collaboration, conducted almost entirely by correspondence, was governed by two inflexible rules: (i) either one, on acquiring any idea, however rough or tentative, had to write it down in a letter that was then sent to the other; and (ii) the recipient didn't have to read the letter. Perhaps the most famous fruit of the collaboration is the "Hardy-Littlewood method," also known as the "circle method." If the authors had done only this, they would still be permanently enshrined in the mathematical hall of fame. The method was successfully applied in the twenties to the fundamental problems of additive number theory; for example, in how many ways can a positive integer be written as a sum of squares, of primes, of $k$th powers, and so on. It survives and will continue to survive as a fundamental tool in analytic number theory and has been used recently, to give only one example, to obtain powerful new results in the theory of diophantine equations (Davenport, Birch, Lewis).

Many of the papers in the volume under review are closely connected with Littlewood's own work. A good example is A. E. Ingham's article, "On Tauberian theorems." Consider a series $\Sigma a_n$; if it converges, then the power series $\Sigma a_n x^n$ converges in $|x| < 1$, and it is relatively easy to show that $\Sigma a_n x^n \to A = \Sigma a_n$ as $x \to 1$ (with $x < 1$). But the converse is false: with $a_n = (-1)^n$, $\Sigma a_n x^n = 1/(1 + x) \to \frac{1}{2}$ but $\Sigma a_n$ is not convergent. However, if we impose the condition $na_n \to 0$ as $n \to \infty$, the converse theorem becomes true, as was proved by A. Tauber. In 1910 Littlewood made the outstanding improvement of assuming only that $na_n$ is bounded as $n \to \infty$ and proving the convergence of $\Sigma a_n$. For this purpose Littlewood used a "peak function" $u^N e^{-su}$, which as a function of $u$ has a peak at $u = N/s$, and the peak becomes sharper as $N$ increases. In 1930 Karamata greatly simplified Littlewood's proof. At first sight Karamata's method seems to have nothing to do with Littlewood's, but Ingham points out that there is a peak function concealed in Karamata's argument. He then generalizes the whole situation, eventually obtaining theorems which include not only the original Littlewood method but some of a more numerical nature that are of more recent discovery.

This volume will take its place of honor in the long list of distinguished volumes commemorating the lives and work of outstanding mathematicians.

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## Festschrift for Weisskopf

It is a custom, more in Europe than in this country, to honor outstanding men of science by publishing books or special issues of journals containing articles by their colleagues and former students. What other purpose, if any, can such *Festschriften* serve? An answer to this question must be given in order to give a fair appraisal of **Preludes in Theoretical Physics, In Honor of V. F. Weisskopf** [A. de-Shalit, H. Feshbach, and L. Van Hove, Eds., North-Holland, Amsterdam; Interscience (Wiley), New York, 1966. 361 pp., illus. $12.75].

The disadvantages of the practice of publishing *Festschriften*, especially in the case of the special issues of scientific journals, have recently been put forward eloquently by S. A.

Goudsmit [*Phys. Rev. Letters* **15**, 229 (1965)]. Goudsmit points out that "the quality of the papers is often not such as to do much honor to the celebrity" and that most of these articles, which are accepted without refereeing and editorial interference, would hardly have been published in a regular issue of the same journal. He also draws attention to the difference between theoretical and experimental scientists in that the former can always write some "second-class" papers, whereas an experimentalist would have hardly anything ready in his drawer at any given time.

If the articles in the present book were judged as journal articles, I should in general agree with Goudsmit's judgment. But perhaps one should make a distinction between a special issue of a journal and a book dedicated to an eminent man. Such a volume need not be merely "an outlet for second-class papers by first-class authors," as W. Pauli's article in *Niels Bohr and the Development of Physics,* and R. Jost's article in *Physics in the Twentieth Century*, a volume honoring Pauli, demonstrate. It can provide a place where contributions not necessarily original in a scientific sense, but dealing with pedagogical, philosophical, historical, and expository aspects of various scientific questions, are presented. If in addition these contributions deal in particular with the wider impact of the work of the person being honored, the collection is not only a true honor but also can be of great importance to a wider audience of scientists and to the history and philosophy of science. We should like to see more very carefully prepared books of this type.

The present volume has to be looked at from this point of view and meets, on the whole, the above criteria. Because of Weisskopf's preference for simple, clear, and beautiful formulations and because of his renowned "intuitive" way of looking at things with minimal formal derivations—"which has been a source of esthetic pleasure to everyone who has had the good fortune of working with him"—a number of theoretical physicists who have visited CERN (European Center for Nuclear Research) at various times have put together this volume with articles in the tradition of the honored. Weisskopf was Director General of CERN for five years. The book contains 42 articles with a wide range and variety of topics: articles by W. Heisenberg, J. R. Oppenheimer, and P. Morrison on the philosophy and foundations of theoretical physics; intuitive and "*anschaulich*" description of a number of important concepts (articles by M. Fierz, O. Klein, H. J. Lipkin, G. Källen, L. L. Foldy, K. Huang, G. C. Wick, H. A. Bethe, H. B. G. Casimir, G. Wentzel, B. D'Espagnat, D. Amati); recent problems and results in high-energy and particle physics (T. D. Lee, L. Van Hove, A. Martin, S. Okubo and R. E. Marshak, Y. Yamaguchi, B. T. Feld, T. Kinoshita and N. N. Khuri, Y. Nambu, R. Oehme, L. Wolfenstein, D. C. Peaslee, K. Gottfried, J. Prentki and M. Veltman, S. D. Drell, D. R. Speiser and J. Weyers, A. Pais and M. Cini) and in nuclear physics (A. de-Shalit, J. D. Walecka, E. M. Henley, D. R. Inglis, H. Feshbach and A. K. Kerman, A. S. Goldhaber and M. Goldhaber, T. E. O. Ericson); an article by W. Thirring on the quantum theory of electric conductivity; and finally, two articles to smile about (by H. Hagedorn, J. S. Bell and M. Nauenberg).

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## The Physical Measure of Man

In writing **The Human Body in Equipment Design** (Harvard University Press, Cambridge, Mass., 1966. 380 pp., illus. $11.95), Albert Damon, Howard W. Stoudt, and Ross A. McFarland have drawn on more than 70 years of combined experience in anthropology and psychophysiological measurement. The book has four chapters in addition to its introduction and conclusions: "Anthropometry and human engineering," "Biomechanics and equipment design," "Human body composition and tolerance to physical and mechanical force," and "Design recommendations."

For those designing equipment to be used in propinquity to man, this book is the best presentation that I know (with 140 tables of measurements) of previously scattered anthropometric data. But I found, in addition, that the clear exposition and frequent use (with 108 figures) of cartoon sketches to illustrate test principles and methods of measurement give a striking sense of the "measure of man," interesting as literature. In the following sample quotations (which are generally further qualified and referenced in the text), the word pictures presented may indeed be interesting to many more than those who design black boxes with people inside, or near people:

> Goals of the design engineer in accommodating human dimensions: (1) All men should be able to operate all machines. . . . (2) Do not limit the machine's performance by human failure . . .
>
> A truck seat should be stressed for 215 pounds per nude civilian driver.
>
> At the end of the day, erect stature decreases by approximately 0.95 inch among adults, because of compression of the intervertebral discs in the erect position.
>
> Women exceed men in the range of movement at all joints but the knee.
>
> Exercising one arm or leg significantly increases the strength of the other limb as well ("cross education").
>
> Comfort, which promotes (but cannot ensure) efficiency, is one segment of a continuum between luxury and death.
>
> Solely by muscle power, a normal man can transport about 200 tons a day through a horizontal distance of 1 meter or 50 tons through a vertical distance of 1 meter.

The statistical limitations of using these anthropometric data for other than the original (mostly United States) populations are emphasized, but the richness of population types considered in this book is a delight, from Ernest Hooton's classical "travelers on a railroad train," to "Army Drivers, Negro," to the National Health Examination Survey's "6672 people carefully selected to represent racially, geographically, and socioeconomically the non-military and non-institutionalized American population between ages of 18 and 79," and so on.

There is some repetition at the end, with perhaps not enough cross-referencing from "Design recommendations" to the rest of the book. The elements of "static and dynamic fit" are well reviewed, with some 500 references. The authors conclude, "Research is more urgently required [than on static dimensions] on dynamic body measurement and biomechanical abilities as they affect human performance and equipment design. . . . Working together, the human biologist and the designer can materially improve man's comfort, efficiency, health, and safety in a world increasingly man-made."

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