the urge to instrument

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THE empirical nature of current physical thought has often been called into question by our colleagues in epistemology. The implication of their charges is that we physicists are progressively constructing a set of dogmas so highly abstracted from experience as to be unreal. The complexities of the question preclude any simple answer, but some of its grosser aspects will submit to evidence.

Are we deserting sense data? If we are, there should be an increase in the work arising independent of measurement. Such a trend is not evident in the quantity of articles published for the past thirty-five years in the *Physical Review,* in which experimental reports—that is, original reports of new physical measurements—have steadily outweighed theoretical reports by about three to two (Fig. 1). The ratio was lower during the lean '30's—an indication, perhaps, that restraints on the urge to instrument lie more in economy than in metaphysics. The ratio was low, also, immediately after the war, during a tooling-up period (and a declassifying one); but the return to the three-two ratio followed and has been maintained through a tripling of production over the pre-war output. A vigorous growth of theoretical physics is unmistakably evident, but it is one which has been nurtured by a generous influx of empirical information.

Are we progressively moving our empirical concepts away from instrument readings? If so, our reporting articles should have become lengthier with the increasing burden of interpretation. But the average length of articles has undergone no drastic change in recent years, even contracting slightly from somewhat more than six pages to somewhat less for both theoretical and experimental reports. The distribution of page-lengths by articles, illustrated in Fig. 2, is indicative of the general condition.

The one marked change in the published reports is the increase of participants in each experimental report (Fig. 3). The lone investigator, dominant in 1930, was threatened in 1940 and surpassed in 1950 by the two-man team. Now the three-man team has surpassed the soloist and is gaining on the duo. The triple authorship has been spawned by large equipment, anything over a Mev apparently producing hexapods. The theoretical species has not been so susceptible to higher energy, the single mind still being dominant in that line, although the multi-headed mutant has made its appearance.

Submerged within our journals is the evidence of more deep-lying changes in our science than a mere article-counting can reveal. There appears to be some growth in the tendency of theorists to appeal for validity to theory rather than to measure and of experimentalists to strain for agreement with theory rather than to criticize their procedures. But this tendency does not amount to a loosening of the restraint of thought by observation. One of our mathematicians, in cautioning against too generous an intepretation of invariance, pointed out that "the peculiar structure of particular existential subject matter surely contributes toward the selection and adequacy of an ordering mathematical pattern".[1] Thus the ideas we sustain by measure flourish; the others die. It seems likely that our experiments, even though abstracting according to theory, are measuring something real. And it is on this reality that the structure of current physical thought continues to be erected.

[1] Erwin Biser, "Invariance and Timeless Laws," *Methodos,* **7**, 213 (1955).

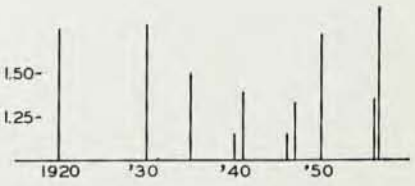

Fig. 1. Ratio of experimental reports to theoretical reports in *The Physical Review* (Vols. 15–16, 35, 47, 57, 58, 70, 72, 77, 101, 102).

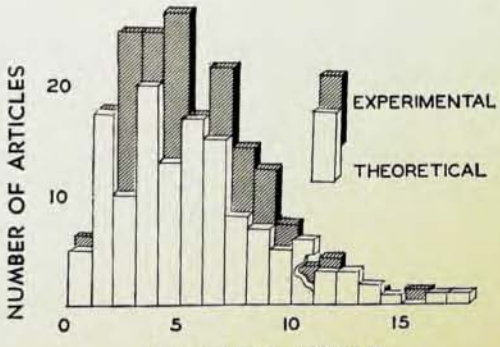

Fig. 2. Experimental reports outnumber theoretical reports most noticeably in medium-length articles. The distribution is that of *The Physical Review,* Vol. 101.

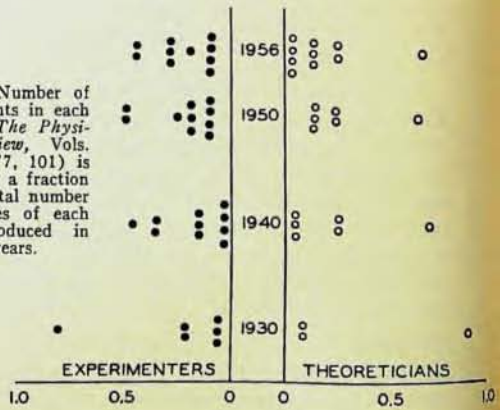

Fig. 3. Number of participants in each article (*The Physical Review,* Vols. 35, 57, 77, 101) is shown as a fraction of the total number of articles of each kind produced in various years.