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A dissenting view on the scientific ethos[1]

Students of the institution of science point out that the fundamental goal of modern science is the extension of valid, certified knowledge.[2] Scientific activity directed toward the realization of this goal is carried out within an institutional framework which involves a complex of values and norms which elaborate the appropriate approach and methods to be employed in the quest for knowledge, and which also define standards for the acceptance and certification of additions to the body of scientific knowledge. It is through this system of values and norms that the basic objective is achieved.

Scientific knowledge may usefully be defined as knowledge which is collected and organized in accordance with four technical norms—empirical validity, logical clarity, logical consistency of propositions, and generality of principles.[3] However, it may be argued that such technical norms do not guarantee the objectives of science. It has been pointed out that science has realized its basic objective, and its technical norms have had relevance because of broader institutional values which articulate scientific endeavour. This value system, which is usually referred to as the 'scientific ethos', consists of universalism, organized scepticism, communality, ethical neutrality, and disinterestedness.[4] It is this value system which provides the impetus for scientific activity and guarantees its validity.

The emergence of the scientific ethos has been traced to the historical conditions of the seventeenth century. In retrospect, it is clear that the convergence of a number of trends such as secularization, rationalism, and cultural relativism combined to produce the facilitating conditions.[5] It also appears that ascetic Protestantism was a factor in the emergence of science, and that a democratic social structure may also foster the growth of science.[6] The saliency of this value ethic has been demonstrated by Merton's historical analysis of the behaviour of scientists.[7]

A major problem is that students of the institution of science have been willing uncritically to assume that this value system continues to have relevance for the behaviour of contemporary scientists. For example, in a recent issue of this journal, Cotgrove's excellent analysis of

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the sociology of science and technology builds upon the assumption that the value system has survived without modification from the point of its historical origins.[8] Although it is recognized that the value system is an ideal model and that isolated deviations do occur, the basic thrust of this perspective is that the values are generally internalized and adhered to by contemporary scientists.

However, it is the contention of this paper that a variety of evidence points to widespread deviation from the ideals embodied in the scientific ethos. This would then require a re-examination of Cotgrove's contention that scientists continue to accept the scientific ethos.

This perspective requires a comparison of the ideals of the scientific values with what is known of the actual behaviour of scientists. This analysis draws upon a variety of evidence because few systematic studies are available.

SCIENTIFIC VALUES: IDEALS AND REALITY

Universalism. A most fundamental attribute said to characterize the scientific value system is the use of universalistic criteria in the evaluation of scientific knowledge. The validity or value of any scientific statement is determined solely by the application of the technical norms of science; independent of the personal, social, political or national characteristics of the author.[9] It is quite obvious that such particularistic criteria are irrelevant in the quest for valid scientific knowledge. Those cases in which political or nationalistic (e.g., Nazi attitudes towards Einstein) considerations have superseded universalistic scientific considerations have had serious effects on the progress of science.

This value also implies that science is anti-authoritarian; that ideas cannot be accepted because of the character or qualities of their protagonist. There are a variety of developments in contemporary American science which suggest that particularistic criteria do have relevance, and that there may even be a strong elitist trend which runs contrary to the tenents of universalism.

One pattern which illustrates this elitism and particularism is the distribution of grant money. A grant proposal specifies the nature of a proposed project, and ideally the expected contribution can be judged in terms of its contribution to knowledge by the same universalistic criteria which applies to other work. However, it appears that particularistic criteria such as institutional affiliation are not irrelevant. In 1965, 25 per cent of federal money went to researchers at only ten universities. While at least some of this concentration can be accounted for by the concentration of better scientists at such schools it appears that personal factors do enter in, and that the institutional affiliation is decisive. A number of applicants report being rejected because the referees assume that the employing institution does not have the

'appropriate atmosphere' for research, or other non-scientific criteria.[10]

Such activity suggests the existence of a small scientific elite who receive, and possibly control, some of the most important resources in the scientific community. This particularism is also evident in the area of journal publication. Zuckerman and Merton, in a study of the evaluation of manuscripts submitted to a major scientific journal, concluded that a mixture of universalism and particularism prevails there also.[11] They found, for example, that papers from 'distinguished' scientists tended to be sent to fewer referees, received a more prompt decision, and generally had lower rejection rates.

This elitism does not imply that scientific criteria are suspended for they found that questionable papers were rejected with the same frequency regardless of the eminence. Rather it suggests that particularistic criteria such as school, previous work, and position within the stratification system of science are not irrelevant in judgments about the merits of scientific contributions.

Systematic Scepticism. While ideally particularistic criteria are irrelevant, the technical norms of science are not, and therefore, systematic scepticism is a necessary correlate of universalism. No scientist's contribution to knowledge can be accepted without careful scrutiny by empirical and logical criteria. Until such a time that validation occurs, judgment must be suspended and the findings approached with an attitude of professional scepticism or doubt. As Robert Oppenheimer has put it: 'For scientists it is not only honourable to doubt, it is mandatory to do that when there appears to be evidence in support of that doubt.'[12]

It is in this way that science protects itself from fraud, and that the technical norms are maintained. The crucial point is that scientific criteria alone should determine acceptance, but the evidence would suggest that systematic scepticism frequently takes the form of overt hostility to evidence which is 'scientific' by the criteria suggested above, but deviates from conventional methods of thinking or is proposed by unknown scientists. Immanuel Velikovsky stands as the prime illustration of this behaviour.

Velikovsky, a trained psychiatrist, developed a theory to account for various cosmological and terrestrial phenomena. His works became popular best sellers but his thesis was met with derision by eminent astronomers because he was not consistent with the currently accepted ideas in science at that point. They were not evaluated by the criteria of scientific scepticism, and he was even refused in his attempts to test his ideas empirically; his papers were rejected without reading and his books were boycotted by other scientists.[13] This is but one instance of what has been documented as the frequent rejection of scientific contributions on other than technical criteria. Zuckerman suggests that scientists confronted with work presented by unknowns or work which

runs counter to currently accepted ideas will routinely assume that such work is trivial and possibly misleading.[14] This phenomenon can also be observed when the citation patterns of scientific papers are examined. If scepticism prevails, the characteristics of the author should be irrelevant in the acceptance of the findings as valid and their incorporation into subsequent research. However, Cole reports that the speed of diffusion of papers of equal quality is influenced by the reputation of the author.[15] This stratification variable loses relevance as time progresses, but it does appear to influence initial acceptance of papers. This appears to be merely a special case of the 'Matthew Effect' in which greater recognition goes to eminent scientists primarily because of their eminence.[16]

Ethical Neutrality. Another value imperative of the scientific ethos relates to the consequences of scientific findings. What might be called ethical neutrality or 'no-holds-barred' research[17] stresses the idea that the quest for knowledge should proceed regardless of the sensitivity of the subject matter. It is clear that in certain areas there is conflict between scientific and religious, political, ideological, or other interpretations of evidence. Science is invariably hindered if such non-scientific considerations are allowed to influence scientific interpretations. One need only consider the consequences of artificial constraints imposed upon genetics by Soviet ideology.

Unfortunately, no-holds-barred research does not appear to prevail throughout the scientific community. The responses to Jensen's recent paper on genetics and intelligence[18] provides striking evidence of the importance of keeping scientific research in an area which is popular, and keeping research findings consistent with the prevailing ideological climate *outside* the scientific community. Jensen, whose findings appear to have gone unchallenged when they were in one direction is denounced as racist, and antidemocratic when they tend in another.

While the sensitivity of scientists to the consequences of their work is to be applauded, it may be that the substitution of a social policy ethos may serve to effectively prohibit research in certain areas, or to exert unwarranted pressure to interpret findings in a manner consistent with the conventional wisdom. The point is, scientists are not responding to the merit of other scientists' work, but rather to the appropriateness of their findings in terms of a preconceived moral and social position. This is a dangerous trend regardless of merits of the moral position which articulates it.

Communalism. Another central value is the stress on the communality of scientific knowledge. It requires that the scientist shares his findings with all other scientists. Secrecy is inimical to the objectives of science for it makes professional evaluation impossible and hinders the cumulative nature of science.

Yet, at least one observer has claimed that scientists are as secretive

as dress designers.[19] The author suggests that such secrecy flows from the competition for priority, grants, and recognition which are coming to characterize contemporary science.

In addition to such secretive involvements there is also the situation of the 'invisible colleges'. These are groups of scientists in specialized areas (e.g., molecular biology) who selectively exchange progress reports, preprints and reprints. The problem with such invisible colleges is that they have the potential to violate the ideals of communalism. They are selective, closed, and have no adequate refereeing system to assure that the technical norms of science are maintained. This situation has led Weinberg to warn that invisible colleges threaten a restoration of the secrecy which characterized seventeenth century science.[20]

Disinterestedness. The institution of science has its own reward system for contributions to the advancement of knowledge. Such rewards include eponymy, scientific prizes, and historical position. However, the value of disinterestedness prohibits the scientist from making the search for professional recognition his explicit goal. It also prohibits active interest in doing research which would bring prestige or financial success in the lay community. The outcome of this value imperative is to limit the interest of scientists to research and discovery as an end, in and of itself.

Although this value may have had force at an earlier period, it would appear that the explicit search for public and professional recognition has reached the point of open competition. In its most transparent manifestation it takes the form of a race to establish priority in the publication of findings. This has reached the point where experiments are reported before they are performed, and publications in newspapers are used to circumvent the slower scientific journals.[21]

The situation is best illustrated by the lament of a scientist caught up in this situation:

> The work in laboratories is less gay now; the enthusiasm is being misplaced, from acts of discovery to the work of quick publication. The practice of science is becoming less for its own sake than for the advancement of scientists. A slow terror is descending upon us, compounded of fear and pride and envy, of hate and waste and misguided zeal, of lacks of joy and satisfaction; let us stop this before it becomes complete.[22]

Even more striking instances of the state of the competition are provided by James Watson, codiscoverer of the structure of DNA, and Christiaan Barnard of heart transplant fame, who have recently reported their motivations in the unabashed use of science as a tool for prestige and success.[23] It is easy to dismiss Watson as a special case; an exception who proves the rule. But it also may be that Watson is typical of the new scientist. A noted psychologist who studied the moti-

vations of eminent scientists was led to suggest that science might be becoming an occupation which is chiefly a vehicle for social and economic success.[24] Studies of scientists show that money and other extrinsic rewards are important.[25] Therefore, it may be that the success ethic which characterizes the larger society may neutralize the esoteric norms of science.

CONCLUSIONS

It is this type of evidence which seems to compel a re-examination of the nature of the scientific ethos. Although the evidence is admittedly selective it does suggest that the scientific ethos as originally conceptualized by Merton and others may no longer effectively guide the behaviour of scientists. It would appear that the effectiveness of these norms or values which seem to receive widespread verbal support is neutralized by a complex of internal and external factors. A thorough examination of the causes of this phenomenon are beyond the scope of this paper but several factors seem to be operative. One is the growth of what Price calls 'big science' and its resultant dependence upon external money. External support is frequently accompanied by overt pressures (e.g., government 'black lists'), or subtle remoulding of opinions.[26]

Another factor may simply be the intrusion of the values of the broader 'middle class' culture from which these men are typically drawn. Despite their professionalism, it would be unrealistic to expect that the dominant value themes of materialism and success, conformity and morality would not intrude into their professional activities.

If the basic interpretation suggested here is valid it raises some crucial issues and questions. The most fundamental question relates to whether these violations of the scientific ethos represent a recent trend, or if there has always been this deviation from the scientific ethos. In the former case, it may mean that the quest for knowledge may be becoming directed and dominated by considerations such as keeping one's research and *findings* in conformity with majority ideas, and a situation in which non-scientific criteria play a major role in determining the allocation of research money, publishability, and recognition within science. In short, the imperatives which once protected and guided the scientific quest may be weakening to a point where science becomes vulnerable to the stagnation, elitism, and ideological subversion which have characterized the history of science in its darkest moments.

On the other hand, it may be that the scientific community has never really adhered to the scientific ethos. The question then becomes one of discovering the mechanisms by which science has been able to realize its goal of advancing knowledge. That is, how is the institution of science able to protect itself from fraud, motivate and reward its practitioners, keep itself free from external influences, and so on? The goal

of this paper is to suggest the need for a rethinking and a re-examination of the nature of the scientific community, and the nature of the scientific ethos.

Notes

1. Some of the ideas presented in this paper were originally developed in an interdisciplinary seminar on Science and Society at the University of Delaware in March of 1970.

2. R. K. Merton, *Social Theory and Social Structure*, 2nd edn., Free Press, 1957, p. 552.

3. T. Parsons, *The Social System*, Free Press, 1951, pp. 326–83.

4. The original formulation of the elements of the scientific ethos is to be found in R. K. Merton, op. cit., ch. 16; subsequent formulations which are relevant include, B. Barber, *Science and the Social Order*, Free Press, 1952; N. Storer, *Social System of Science*, Holt, Rinehart and Winston, 1966; and W. Hagstrom, *The Scientific Community*, Basic Books, 1965.

5. H. Butterfield, *The Origins of Modern Science*, Collier, 1962, ch. 10.

6. R. K. Merton, op. cit., chs. 15, 17, 18.

7. R. K. Merton, op. cit., ch. 19.

8. S. Cotgrove, 'The Sociology of Science and Technology', *Brit. J. Sociol.* vol. 21 (1970), pp. 2–15.

9. R. K. Merton, op. cit., p. 553.

10. See S. Klaw, *The New Brahmins*, Morrow, 1968, p. 120, for a report of one such instance; for a general consideration of grant application actions, see E. M. Allen, 'Why Are Research Grant Applications Disapproved?' *Science*, 25 November, 1960, pp. 1532–4.

11. H. Zuckerman and R. K. Merton, 'Patterns of Evaluation in Science', *Minerva*, vol. 9 (1971), pp. 66–100.

12. R. Oppenheimer, *The Open Mind*, Simon and Schuster, 1955, p. 115.

13. A. deGrazia, 'The Politics of Science and Dr Velikovsky', *Amer. Behavioral Scientist*, vol. 7 (1963), entire issue.

14. H. Zuckerman, 'Stratification in American Science', *Sociol. Inquiry*, vol. 40 (1970), p. 242.

15. S. Cole, 'Professional Standing and the Reception of Scientific Discoveries', *Amer. J. Sociol.*, vol. 76 (1970), pp. 286–306.

16. R. Merton, 'The Matthew Effect in Science', *Science*, vol. 159 (January 1968), pp. 56–63.

17. B. Eckland, 'Is No-Holds-Barred Research Possible?' *Harvard Educ. Rev.*, vol. 39 (1969), pp. 596–8.

18. Jensen's paper originally appeared in *Harvard Educ. Rev.* vol. 39 (1969), pp. 1–123. A good selection of reactions are found in subsequent issues of the same journal. E. van den Haag's comments in 'Jensen's Article is a Good Beginning', are especially useful for he reports similar criticism of his own work.

19. S. Klaw, op. cit., p. 112.

20. A. Weinberg, 'Scientific Communication', *Internat. Sci. Tech.*, vol. 16 (1963), p. 71.

21. A good summary of this activity is found in W. Hirsch, *Scientists in American Society*, Random House, 1968. See also P. Reif, 'The Competitive World of the Pure Scientist', *Science*, vol. 134, (15 December 1961), pp. 1957–62.

22. P. Siefevitz, 'Letter's Column', *Science*, vol. 154 (21 October 1966), p. 334.

23. J. Watson, *The Double Helix*, Antheneum, 1968. C. Bernard and C. Pepper, *Christiaan Barnard: One Life*, Macmillan, 1970.

24. B. Edison, *Scientists: Their Psychological World*, Basic Books, 1962.

25. W. Hirsch, op. cit., pp. 24–30.

26. S. Klaw, op. cit., p. 250, reports that support for the space programme was noticeably greater among scientists receiving N.A.S.A. support.