

sense) to respond. (Peebles along with Dicke, Rolle and Wilkinson, had started experiments for detecting CMBR in the early 1960s. After hearing Peebles' talk about this experiment in 1965, Penzias and Wilson, the actual discoverers, realized that the radiation noise, which they were unable to get rid of, was just CMBR¹⁰.) Peebles accepts some of the criticisms about tall claims and has tried to summarize what has been really learnt in cosmology in recent times. He claims confidently that cosmologists have firmly established the foundations of our field. He is, however, appropriately modest in his claims for cosmology. The first, and strongest claim is 'abundant evidence that our universe is expanding and cooling'. He says this is the essence of the big bang theory. According to him, even the latest alternative version (QSSC mentioned earlier⁴) does not dispute this claim. He carefully avoids the word 'explosion', as according to him the big bang theory describes how our universe is evolving, NOT how it began.

Peebles is highly conservative about various claims made by other cosmologists. He feels the idea that 'universe expands as the general theory of relativity predicts' has still to be tested in a tight-enough fashion. About 'dark matter of exotic particles dominating galaxies', he feels that there is only indirect evidence and alternative theories are yet to be ruled out. He is even less sure of the evidence for cosmological constant (sometimes generalized and called dark

energy). Finally, according to him, 'The idea that the universe grew out of inflation is inconclusive. It is elegant and a brave and pioneering work still to be tested'. A more detailed quotation may be justified in the context of criticism by some social scientists that science involves only creation of theory frames¹¹.

According to Peebles, 'One version of the deconstructionist picture of science as I read about it is that clever people make up internally consistent stories to fit agreed-upon conditions, and that another group could have made up another story, equally consistent, with an equally satisfactory fit to some similar or may be different set of agreed-upon conditions. Those of us who believe we have convincing evidence (that) physical science describes aspects of an objectively real world, even on scales very different from what we can hold in our hands, reply that our theories have been validated by agreement with tightly overconstrained and cross-checked empirical tests. Inflation, as we now understand it, can be adjusted to fit a broad range of possible empirical results. This situation is unnervingly close to the deconstructionist picture, unless we stipulate that inflation is a working hypothesis.'

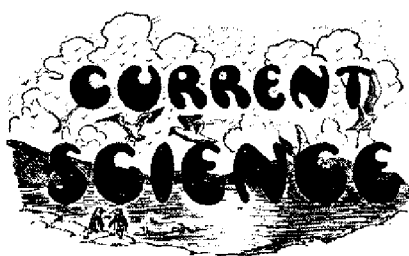
This is a refreshingly different view from the tall claims made for the inflationary scenario. With such a reasonable claim, there is no difficulty in agreeing that, 'Cosmology was a real physical science decades ago, though with a meagre well-established centre. The big

recent change has been the rate of addition to the established centre'. Researchers work far from the established centre, where there is a large uncertainty and facts are unknown. So, 'Is cosmology a science?'. The very existence of introspection and debate shows it is, unlike in the case of astrology or even some of the social sciences.

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From the archives



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Science and Society

Immediately after the formation of a "New Division" by the British Associa-

tion for the Advancement of Science, whose ostensible object is to institute enquiries into the social relations of science, events on a stupendous scale occurred in central Europe whose impact on international affairs was such as to rock the whole fabric of civilization to its very foundation. The ardent supporters of the "New Division" maintained a solid silence which must have earned for science the obligation of politicians for not embarrassing their delicate and difficult negotiations. Manifestly the function of creating public opinion either in favour of or in opposition to the conduct of diplomatic

relations has become the prerogative of the lay press and of the members of the parliamentary opposition. From the general attitude of the whole body of scientists during the recent crisis, it is to be inferred that they make a sharp distinction between social affairs and political problems and that while the former might constitute a legitimate sphere for their interventions, the latter had best be avoided. We doubt the existence of such a sharp demarcation between the social and political questions whose paths cross one another and in certain directions become interwoven, and it must be dreadfully pretentious to keep them

isolated. We can hardly conceive of any political topic the material of which does not prejudice social interpretation, and what is most obvious is that social progress depends in a large measure upon the political acts and policies of statesmen, while both are sustained by the inventions and discoveries of science. Our inability to determine the future trends of human affairs is mostly due to our lack of faith that the progress of social science must be a solvent of most of the economic maladjustments and because we do not maintain the courage and spirit of adventure, so successfully employed in the realms of science, in the political and administrative fields, we are confronted with widespread social and political disappointments.

It seems to us that the Indian Science Congress which enjoys a high prestige in the country should convene a conference of scientists in India for inaugurating a department with the ostensible object of exploring the possibilities of extending scientific methods to the study of social problems. Science has too long been divorced from society, because of the idea that the province of

science is matter, and the human sciences like biology, sociology and economics had not acquired the status and importance of the physical sciences. The consequence has led to a dreadful state of affairs where the physical and the moral are indistinguishably mixed up in the social conditions. It becomes increasingly clear how hopeless it is to disentangle them and establish new trends in society whose development has been permitted to grow ever more confused and chaotic. The new age of liberalism which has emerged from that of traditionalism must obviously create dynamic changes in the whole social framework, but the impulse of expansion is restricted to special groups which discovered the inadequacy of the traditional mode of moulding character and mind. The changes have now overtaken the masses without being prepared to profit by their results. This unbalance in the social structure must account for all its ills. Have the scientists any technique or formula for their solution? While the social legislator should possess a clear and far-sighted vision of the kind of society he would bring into being, the social scientist

should have knowledge to control and direct its tendencies. Science ought to be able to offer answers to questions which governments might ask for their solution and unless a symbiotic relationship is established between social sciences and statecraft, society must drift perhaps on a down-hill course. The infusion of a scientific temper into governance might remove the fanaticism and arrogance of injudicious zealots, "transforming the blaze of passionate propaganda into a cool grotto where people would humbly investigate economic facts and social conditions – which would render the politician sufficiently uncertain about his own conclusions to respect the honest convictions of those with whom he differs".

The Congress is most favourably endowed for bringing to bear upon society the broadening and stimulating effects of science, and its realization that the immediate purpose of science is the ordered progress of society, ought to lead to a revision of the Congress programme of functions so as to bring it into intimate touch with the social thoughts and reactions of the body politic.

SCIENTIFIC CORRESPONDENCE

Experimental forecasts of all-India summer monsoon rainfall for 2002 and 2003 using neural network

Alternative modelling and forecast methodology can complement/improve forecasts of complex atmospheric and oceanic processes by conventional method through enhancement of the range, scope and quality of forecasts. A very relevant example is long-range forecasting of monsoon rainfall; accurate long-range forecasting of monsoon rainfall can have manifold benefits for the country, from crop planning to power generation to policy planning¹. However, conventional techniques still do not have adequate skill at long-range forecasting, especially at longer than a season. It was to address this issue that an alternative forecasting technique using neural networks² (NN) was

explored by the author and his collaborator. However, the skill of conventional NN for forecasting rainfall was found to be inadequate; a generalized NN, termed cognitive network (CN) was designed and evaluated³ for forecasting all-India summer monsoon rainfall (ISMR). The principle and the design of cognitive network (CN) were adopted from a generalization of conventional NN; in particular, a CN also carries out a cognitive summation in addition to conventional neuronal summation. Cognitive networks have proved to be a successful tool for generating long-range forecasts of all-India summer rainfall (ISMR). Hindcast experiments for more than 70 years of

ISMR showed CN to have significant hindcast skill^{3,4}.

Using a 3-layer (input layer, hidden layer, output layer) CN configuration, the author and his collaborators have generated experimental forecasts of ISMR for the past seven years. It is noteworthy that all these experimental forecasts, generated well ahead of the season and several of them two seasons in advance, have been fairly accurate^{4,5}. This is all the more remarkable since years like 1997, characterized by the presence of a warming event over the Pacific, were expected to be deficit monsoon years. Table 1 compares the observed and the predicted values of ISMR for the years 1995–2000. The