Eddington

SIR,—The letter you published by H. W. Grayson (*Nature*, **242**, 317 ; 1973) must, on internal evidence, be judged to be fraudulent: the strong implication of a pre-1926 date in the letter does not agree with a reference to Sir Arthur Eddington—Professor A. S. Eddington was awarded a knighthood in 1930.

Yours faithfully,

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Complementarity

SIR,—The book review by E. H. Hutten, "Microphysical Phenomena" (*Nature*, **241**, 220 ; 1973), suggesting the need for a new approach to such problems after fifty years of discussion, has just come to my notice.

Complementarity is invoked, but it is the principle of interdependent incompatibility which needs to be applied. According to this principle, the co-existence of mutually exclusive states is possible when each state determines the other and is thereby instantaneously excluded (like the concepts "position" and "displacement from that position", for instance), so that the two states alternate so rapidly within any given period of time that they appear to co-exist at the same time.

The Greeks worried about this problem, but notoriously never made experiments. Now, some 2,000 years of test results later, it pays to look once more at the problems they posed, in the light of these results.

I have postulated the principle of interdependent incompatibility not as an abstruse hypothesis, but because it is simple, obvious and fits the observed facts better than any other—as I could show, given the chance, or as could be worked out by others who put their mind to it. So far, I have hawked the principle variously, in vain. What good is the demand for a new approach if, when such approach is made, no one wants to know?

Yours faithfully,

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Fossils of Creation

SIR,—I feel that I really must argue with E. C. Lucas (*Nature*, **242**, 355 ; 1973) on his suggestion that fossil evidence supports the Hebrew creation myth. The old ideas of the "ages" must be dropped ; the age of fishes, the age of the coal forests and so on, have no reality. Fishes appear in the Devonian but must have had a long evolutionary history which has not been preserved. Reptiles and mammals appear in the Perino-Trias, again fully evolved. One cannot interpret the six days of creation in terms of artificial geological epochs; it is taking credulity too far and is interpreting "Neolithic science" in terms of modern science. Why six days? The Neolithic farmer would have known that the phases of the Moon repeated every 28 days. His natural submultiples of numbers would be obtained by halving. The smallest whole number which would be obtained by repeated halving is seven. Seven days becomes a week. Four weeks becomes a month (lunation), thirteen lunations becomes one year of 364 days. Thus he had seven days to the week, four weeks to the month and thirteen months to the year. The "science" of numerology led to giving magical significance to these numbers. I need elaborate this argument no further.

The Neolithic farmer would work for six days and worship on the seventh because the seventh day was "magic". Naturally he would extend such reasoning to the creator who would labour for six days on his creation. As to the order of creation he would start at the "bottom" and work his way up to the "top". The ocean, the land, the heavens. Man, naturally, would occupy a special phase as the last and most perfect of all the creation.

The *Bible* is a collection of stories, songs and legends not necessarily in the correct chronological order. The *Bible*, like the *Iliad*, or Geoffrey of Monmouth's history of the Kings of Britain, contains a strong element of historical fact (or should it be inference?) which we must be careful not to interpret too literally.

I am sorry, but the Hebrew creation myth has no support at all from the fossil record. If Mr Lucas wishes to believe in it then he must evoke an act of faith—a highly unscientific mental process.

Yours faithfully,

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Games with GNP

SIR,—Although grateful to *Nature* for printing my paper "Features of a Closed System Economy" (*Nature*, **242**, 561 ; 1973), I should point out in connexion with the editorial, "Fun and Games with GNP", that Boulding's writing, and especially his books, *Economics as a Science* and *Beyond Economics*, in fact led to my paper, and in both the professor is apparently guilty of the "curiously subjective" error which I am accused of, because he roundly equates GNP to gross national cost with, I think, rather brilliant reasoning based on thermodynamics. My question of gross product to the sum of gross consumption (and the rest used to improve society) is a precise quotation from the professor's book *Economics as a Science* (page 45).

I have gone further than did the professor in analysing "good" and "bad" costs but the idea is his. There is also no difficulty on real cost. The real cost of an activity is the amount of non-renewable resource converted by it from potential energy in the ground to useless and irrecoverable waste (plus the personal effort involved in it). It is obviously akin to entropy in physics although essentially a vector rather than a scalar quantity. The difficulty of avoiding some arbitrariness in drawing the line between activities which obviously increase entropy and those which decrease it (Boulding's negative entropy of "structures of increasing improbability") is because we are dealing with a social science and not physics. But difficulties of definition do not destroy realities.

The illustration given about education is mistaken, and does not invalidate Boulding's argument (or mine). Clearly the contribution of policies towards discouraging the kinds of investment which merely add to further wasteful or unnecessary consumption must in the end be to limit the supply of unnecessary goods—and the consuming public (including the school teachers) can only buy what is available. The difference is clear enough, I think, between the likely behaviour pattern of a potentially rational society and the situation of the artificially stimulated captive consumers so well described in Vance Packard's book, *The Waste Makers*.

The technological optimism of the last paragraph is, I believe, of the wrong kind, and here I draw attention to recent published work of the US Geological Survey relating to energy resources for power production. This makes it clear, I think, that one of the risks of absolute or near shortages could be increasing rigidity, as substitution technology is invariably power hungry. From this kind of thinking I would guess that the oceanic uranium referred to will probably remain where it is! I believe the true direction of future technology is towards more advanced conservative systems as suggested in the last part of my paper, to which no space or regard is given; this, along with quite far-reaching changes in values and habits of mind, which are at present almost hopelessly one-tracked. And are we so sure that we are on the right track, in looking at the possibilities of tearing the Earth apart merely to sustain a high level of activity and a rapidly ageing body of dogma