surreal numbers[17,18] (B. E. P. Clement, P. V. Coveney and P. J. Marcer) have also been proposed. Excellent reviews of 'Computation, measurement, communication and energy dissipation' have been published by Rolf Landauer,[19] and on 'The limits and capabilities of machines' by Ian White.[20] Tom Stonier has also published several papers 'Towards a general theory of information'.[21]

I hope therefore that Gordon Scarrott's article heralds a significant increase of interest in this so far peripheral area of computer science, but one which I feel will become of central importance.

Yours sincerely,
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Algorithmic information theory

Dear Sir,

In connection with your editorial[6] which I interpret to call for a new theory of information and computation, I would like to point out that an extremely theoretical new theory has indeed been developed; I refer to 'algorithmic information theory.' Two books[1,2] have recently been published on this subject, as well as a number of nontechnical discussions.[3,4,5,7] The main thrust of algorthmic information theory is twofold: (1) an information-theoretic mathematical definition of *random sequence* via algorithmic incompressibility, and (2) strong information-theoretic versions of Gödels's incompleteness theorem. The halting probability of a universal Turing machine plays a fundamental role.

Yours faithfully.
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Dear Sir,

Inanimate objects may not be living in the same sense as we consider organisms based upon carbon chemistry, but in an organised system such as the universe – or part thereof – they do react to certain circumstances. The reactions are entirely due to the substances from which each object is made and which elements form those substances.

The attribute which causes chemical reactions is known as valency, and the factor which causes reactions between elements is the position of the element in the electrolytic table.

Therefore in any collection of inanimate objects there is stored the vital information which pre-determines how each substance will react in any given situation. The same applies to the physical laws to which the objects are subjected. Indeed without such an inanimate organised system there would be no solar system and no planet earth.

If matter is viewed simply as being nothing more than locked up energy, then the motivation or release of that energy provides the driving force in all reactions. Who caused the initial action to start the whole thing off we do not actually know; we therefore normally ascribe the initial design and action to our Creator.

The important point is that the vital information is stored in all forms of animate and inanimate objects; all systems comprising these objects depend upon the communication of information. Mr Scarrott is quite right: we do need a better and more precise understanding of information and its role in life. We also need to educate the computer industry in avoiding the delusion that the computer is the panacea for all ills; it is not. Logical systems have their limitations and in order that we humans are able to effectively use the machines as an aid to judgements, we must fully understand those limitations, . . . and work within them. Mr Scarrott's exposition is a step, but only a step, in the right direction.

Yours faithfully,
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Dear Sir,

I am responding briefly to your editorial 'Information and Information Systems' [*The Computer Journal* **32** (3), 193 (1989)], and Gordon Scarrott's article in the same issue.

I have long admired Scarrott's efforts to develop a theory of information. However, there is an alternative view: **Information is a basic property of the universe**. Information has as much *physical* reality as do matter and energy. Information is not confined to living organisms but is contained by *any system* which exhibits organisation. That is, as mass is a manifestation of matter, and momentum of mechanical energy, so is organisation a manifestation of information. This means that not only do cells and viruses contain information but so do crystals, molecules, atoms, and nucleons. Not only all organised matter, but also energy may exhibit organisation. Light waves represent organised patterns of energy and, as such, contain information.

Once it is understood that information is not merely a construct of the human mind, or even a property of those sophisticated feed-back systems which we recognise as life, we will understand that information involves a multi-layered hierarchy of phenomena. The upper end of that hierarchy involves *human* information being processed by the human brain utilising humanly invented information tools such as language and computers. Intermediate are the living systems alluded to by Scarrott. Still farther down are the self-organ-