difficult to establish. It now appears possible that application of the bilateral method may considerably enhance the significance of cerebral oxygen uptake measurements and thus offer new opportunities for research in this area.

IRWIN FEINBERG
MARK H. LANE
NIELS A. LASSEN*

Laboratory of Clinical Science,
National Institute of Mental Health,
National Institutes of Health,
Bethesda,
Maryland.

* Visiting scientist. Present address: Medical Dept. B., Bispebjerg Hospital, Copenhagen N.V., Denmark.

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The Relativity of Meaning

THE burden of Dr. Ross Ashby's communication[1]: "the meaning of a message also depends on the set that the message comes from" is known to every careful user of the English language who has learnt the meaning of the word 'context', but his example is incomplete. The messages that he instances may indeed change their meanings as the set is expanded, but "How we wish you were here" does not necessarily become ironic because "Do come and join us" is available as well. If the sender knows that such joining is impossible he may honestly choose the former message, which will then have the same meaning as if it were the only one of the two available. The set is of less importance in determining meaning than is the mutual knowledge that sender and recipient have of one another.

W. B. YAPP

Department of Zoology and
Comparative Physiology,
The University,
Edgbaston,
Birmingham 15.

[1] Ashby, W. Ross, *Nature*, **187**, 532 (1950).

DR. ROSS ASHBY[1] advocates the "postulate that the meaning of a message [as well as its information content] . . . depends on the set of messages that the message comes from". It seems possible that Dr. Ashby was thinking primarily in terms of non-natural languages (such as those used as models in information theory). However, his example is drawn from natural language, and presumably his argument is meant to apply to all languages.

If this is so, I suggest that his point should be thought of as a special case of a quite general rule of language, when it is used to express empirical information. It is normally true that the meaning given to an empirical statement (a message) both by the deliverer and by the receiver will depend on a number of factors in addition to its 'intrinsic' properties; that is, the shapes and ordering of its signs.

The most influential of these factors is the 'purpose' of the statement, which in its turn determines what is its mode of justification or verification, what is the relevant 'set of messages' (context), how much the statement is to be taken as elliptical, and so on; all these are, of course, themselves part-determinants of meaning—of how a statement will be interpreted. Obvious examples are "That object has a low temperature" (in the kitchen or in the laboratory?). "That hill is dangerous" (for motor-cars or aeroplanes?) and "Water is H_2O" (definition or description?).

In current linguistic theory, such cases are treated as exceptions. But in fact there are reasons[2] for thinking that a great deal of trouble could be saved, not only within the field of communication theory but also in controversy in general, if it were regarded as the rule that the way in which sentences (and sometimes individual words) are to be interpreted depends in part on the purpose for which they are used.

RUPERT CRAWSHAY-WILLIAMS

Castle Yard,
Portmeirion,
Penrhyndeudraeth,
Merioneth.

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MATHEMATICS

Theory of Optimal Gammas

Ross[1] asks for a definition of the goodness of a game. A reasonable answer, though presumably incomplete, is that a game is good in so far as it involves skill. A measure, γ, for the degree to which a game is one of skill may also be of legalistic interest in those countries where gambling is somewhat against the law. Several years ago I suggested a definition for γ, and it may now be appropriate to publish it. The definition is relative to a population of learners and trainers and to the number of learners, and is relative to the training time and to the duration of play. If we assume all these parameters to be fixed we should find that the players would fall into γ grades, C_1, C_2, . . ., C_γ, such that, on average, a player in grade C_g would have a probability of say 2/3 of beating a player in grade C_{g+1} ($g = 1, 2, \ldots, \gamma - 1$). The number, γ, of grades, is then the suggested measure of the degree to which the game is one of skill. It is not a good measure of difficulty, since some games, such as the child's game of 'boxes', are so difficult for human beings that training and ability do not count for much.

I. J. GOOD

58A Warren Road,
Ashford,
Middlesex.

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