

might be possible. These include the optical phenomenon of the hologram where it is possible to repeatedly subdivide the photographic plate yet retain the whole overall image though at a lower level of definition. Another example of this sort of one/many correspondence is provided by the mathematical procedure of the Fourier Transform and the transitions between the space or time and periodicity domains it permits and this latter technique has been used by, for example, visual physiologists looking for visual cortex cells responsive to particular spatial frequencies.

In conclusion I would just like to say how pleased I was to see an essay addressing such basic and broad ranging scientific and philosophical questions in your pages and would wish to congratulate the author on a most thought-provoking piece.

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DEAR SIRS

I found Peter O'Hara's article on the mind science very interesting. As a model of the relationship between neuronal activity and mental function, it does offer food for thought and may well reappear in some form in future research into the relationship of mind and brain. Dr O'Hara applies his understanding of the working of electronic computers in arriving at this model, and it may well be that we have built computers to reflect the way our brains work—impelled by intuition.

However, in the concluding paragraphs of his article, Dr O'Hara expresses a disquieting conviction, not only that his viewpoint constitutes a *science*, but also that it is *satisfactory* and above all *true*.

It may in the long run prove to be the case, but at this point in time it is only an opinion, an analogy drawn from another field of knowledge. Some day, perhaps, a way may be found to subject this hypothesis to experimental testing.

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DEAR SIRS

Writing as one who has only a limited understanding of the mind and the brain and no understanding at all of computers, I found Peter O'Hara's article fascinating and incomprehensible. If I am right in thinking that the gist of his argument is that there is a connection between mind and the brain which we do not yet understand then, for what it is worth, I agree with him.

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## *Dr O'Hara replies*

DEAR SIRS

I am gratified to see so many responses to my article, and glad of the chance to reply to them. I had never seen such matters discussed in psychiatric journals and felt impelled to bring them to psychiatrists' attention after reading J. R. King<sup>1</sup> say 'at one end of the scale physical scientists scratch patiently away at the chemistry of receptor sites on cell membranes, at the other clinicians make brilliant deductions by sheer intuition, and in between is a hazy land'. Unsure of its reception, I kept my article clear of references to philosophical schools of thought, much as I would avoid giving myself a party political label if publicly arguing for a new social proposal. However, Dr Tantam has referred to most of these philosophical terms, in some cases misunderstanding my position, and so I must address them.

With regard to philosophical behaviourism (readers can see from my second and third paragraphs that I am not a psychological behaviourist), Flew<sup>2</sup> defines it as the idea that 'psychological concepts can be analysed in exclusively behavioural terms, and this is what such words mean'. Bullock & Stallybrass<sup>3</sup> rather emphasise behaviourists as viewing mental states as dispositions or tendencies to certain behaviours. In contrast, I have emphasised the possibility of an internal mental state description.

I was also surprised to be seen as rejecting reductionism and so, perhaps believing in holism. Here Flew<sup>2</sup> and Bullock & Stallybrass<sup>3</sup> see reductionism as *reducing* mental events to physical and chemical events. Both define holism as the idea that some wholes are more than the sum of their parts. Bullock & Stallybrass<sup>3</sup> add that the wholes have characteristics that cannot be explained in terms of the properties and inter-relations of the parts. Hofstadter<sup>4</sup> defines holism similarly but sees reductionism as 'a whole can be understood completely if you understand its parts and the nature of their "sum"'. The reductionism of Flew<sup>2</sup> and of Bullock & Stallybrass<sup>3</sup> is obscure because they don't define *reducing*. The extreme view of reducing, of an *identity* or one-to-one correspondence between events and predicates of the reduced science (e.g. psychology) and those of the basic science (e.g. physics), is given by Fodor.<sup>5</sup> By this standard I agree with Fodor in rejecting reductionism. However his reductionism is so extreme that it appears false at first sight, and indeed he states that he defines it thus in order to prove it false. I suspect that Fodor is in a minority in defining reductionism so extremely. It also cedes the middle ground to holism which I have always seen as the idea that 'something else' (spirit, perhaps) must be added to the parts (neurons and brain structure) in order to explain the whole (mental function). My many examples were designed to show that properties of neurons could cause them to relate to each other in such a complex fashion as to underlie (or be a satisfactory substrate for) mental function. In my fifth paragraph I also criticised holism's 'something else' for being amorphous and so not open to further investigation and analysis. So I

am clearly opposed to holism, and reductionism (by the majority of definitions) is what I support.

Two closely related concepts, *emergent property* and *epiphenomenon*, have been applied by Tantam and myself to the 'coating' property in the cellular simulation and would be analogously applied to personality characteristics. Now both *Chambers 20th Century Dictionary* and the *Shorter Oxford English Dictionary* (SOED) define *emergent* (adjective) as 'unexpectedly arising', that is, without prejudice to whether or not it can be explained by the properties of the parts. Chambers defines *epiphenomenon* as a 'fortuitous, or irrelevant, by-product', again without similar prejudice. My article has tried to show that, however unexpected the epiphenomenon or emergent property, and however distant or apparently unconnected that property is to the properties of the parts, the *epiphenomenon* can be a result of the properties of the parts. This is in opposition to the prejudice of some philosophers; Bullock & Stallybrass<sup>3</sup> say an emergent property 'cannot be explained in terms of the properties of the parts'. Oddly enough, the SOED defines *emergent* (noun) as 'that which is produced by a combination of causes but cannot be regarded as the sum of their individual effects'. My original definition of *epiphenomenon* is from Hofstadter.<sup>4</sup>

I do not believe in epiphenomenalism. I also fail to understand how Tantam thinks I was trying to abolish or avoid causality. My major thesis is that humdrum properties of the parts (neurons) *cause* the whole formed by their interaction to have properties as complex as minds. However, this only refers to how the system (whole) is built from the parts and not to causation between the levels of description. Tantam rightly criticised the embryological simulation and I will give a concrete example. A drop of phospholipid (the major constituent of cell membranes) when dropped into water forms into bilayers with the lipophilic tails of the two layers meeting, and these bilayer 'membranes' form closed vesicles because the otherwise exposed edges of the lipophilic centre of the membrane would be less stable exposed to water. In this example the partly hydrophilic and partly lipophilic structure of the molecule causes them to organise into 'cells' (*epiphenomenon* and *reductionism*). This is typical causality. There are now molecular-level and vesicle-level descriptions of the same collection of phospholipid and water. Neither level of description causes the other. This is my position regarding the neuron-level description (list of all neurons and their interconnections) and the mental-state description (list of memories, beliefs, ways of thinking etc.). For most people it is a big leap of the imagination to see two so completely different descriptions referring to the same object or group of objects. I regret that the *Bulletin* cannot print a colour photograph: I would like to insert one of atomic ball-and-stick models of a set of human chromosomes. The whole might be seen as an abstract painting or a tweed cloth. A list of the proportions of the elements or their colours could be given; or the proportion of DNA and proteins, or of nucleotide sequences.

But when suitably translated the picture is a description of an individual human. Each of these descriptions has its uses: similarly the mental and neuron descriptions apply to the same collection of objects, but each has its own use. I have not sought to abolish the mental description (as Tantam seems to assert) but to show a possible connection to the neuron description.

Tantam is right to draw attention to the architectural origin of 'levels', and perhaps we have a bias towards 'higher' derived from looking up to heaven! What I have called a higher level is one in which the basic unit is more complex. I agree with Dr Marshall that memories may be stored and mental processes carried out in regions extending across the brain, these being units of higher levels. However, each level of description still refers to the same set of neurons (the brain). So Tantam's question about the tiny wish and the cerebral hemisphere is mistaken: the tiny wish is a small part of a high-level description and the hemisphere is a large unit of a low-level description.

With regard to the examples of levels, the three levels of languages are taken from Hofstadter,<sup>4</sup> who is a computer expert, which I am not. I did not claim that there was no relationship between instructions in a compiler language and instructions in machine code but that there is no *simple* relationship between them—as there is a simple one between assembly language and machine code.

The comparison with computer language levels was intended only as analogy and Dr Marshall's comments about qualitative differences are correct.

Tantam is wrong about the analogy of the mass of gas. To simplify, I will assume that for the moment there is no external force tending to change the condition of the gas. In other words, the pressure, temperature and volume are not changing. From this description, you can calculate only probabilities of the position and velocity of a specified molecule. But it is not the *property* of any molecule this is probabilistic. At a specified time it has a definite position and velocity. And the molecular description of each molecule's position and velocity all measured at one time, when combined with the laws of motion and molecular interaction (gas molecules collide fully elastically) and a description of the container, enable you to predict the positions and velocities of every molecule at every time in the future. This is fully determinate. The subatomic, molecular, and cellular descriptions of the human are in a similar relationship. Properties of the subatomic particles that closely determine their behaviour cannot be fully used in the two higher-level descriptions which only give probabilities of the position and behaviour of the subatomic particles; and the cell-level description gives only probabilities for the position and behaviour of particular molecules. This is fully consistent with my other statements about levels.

Tantam is right that I am a materialist. By this I mean that there is no separate substance called 'mind' or 'spirit' and that if either exists it is only as a patterning or organisation of matter. Materialism favours determinism and opposes free will. Free will as traditionally defined is an illusion as social science has gradually been accumulat-

ing evidence that behaviour is influenced by present and past environments. However the illusion of free will adds to self-esteem, and has probably been selected for by evolution, which might be seen as giving it a materialist or determinist type of origin. And Tantam may choose to go on with a sentence because my views have upset him.

He refers to a view of science as dealing only with constructs in the style of 'properties', 'fields', and 'forces'. He seems to think I am inclined towards this view. My third paragraph suggests that science exists where there are phenomena that *any* investigator can examine and replicate; and when their description is a general proposition and not one about particulars. One difficulty about my thesis for Tantam, and also for Teichman,<sup>6</sup> is that a mental-state description by an outside observer must be different from a self-description of the same person; both see this as a barrier but in fact there can be a one-to-one correspondence between the two except for some unconscious parts which will only appear in the external description. Failure to recognise unconscious mental processes (almost surely the vast majority of the mind is unconscious) was a major fault of the speculations of the philosophers. I see *intuition* as the derivation of conscious conclusions by unconscious methods of inference from perceptions which may be conscious or unconscious. Because we don't know how we reach these conclusions intuition is unreliable and unscientific. That is not to deny that people regularly carry out mental acts called 'reaching conclusions by intuition'. When a better external description of a person's mental state is available we will probably see that some of our self-described states are illusions: I would guess that free-will and our belief in nearly complete self-knowledge by introspection will be among these states. For the present I, like Tantam, have no knowledge of my mind from studying successive levels of description. I have not, as he suggests, put introspective knowledge out of account.

I do take myself and other people to be wonderful machines. Most people can't do this because their model of a machine is too simple, as I have suggested in my article (fifth paragraph). Those who would like to stimulate their imaginations in this direction should read Hofstadter.<sup>4</sup>

I presume Tantam is right that the computers commonly dealt with are stupid but Artificial Intelligence investigators hope that better computers may pass a certain threshold and, at their highest level, do something unpredictable yet smart. The effects of unreason in people can be predictable or unpredictable in different cases. However, I feel that where the effects of reason are glorious they are only unpredictable to persons of a lesser degree of reason.

I cannot see how I can be accused of pre-judging the conclusion when I 'self-effacingly' state it in the subjunctive. Similarly, Dr Azuonye is mistaken about my concluding paragraphs, in which the words 'science', 'satisfactory', and 'true' do not appear at all. I cannot see why Tantam should consider any of his knowledge 'inviolable'. Any part of it could be in error or be changed

by new data. If he feels he cannot make all of his knowledge consistent, then perhaps one part is false, and consequently not knowledge. If however, he means that he has two or more bodies of knowledge based on good evidence and no ready hypothesis or theory that would explain both together, then my article has tried to suggest a form for such a hypothesis.

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### Diversity of teaching

DEAR SIRS

I am interested by the diversity of teaching to be found in the December 1985 issues of the *Journal* and the *Bulletin*. At the same time as Duesp (*Bulletin*, 1985, 9, 256) advises familiarity with psychological therapies, Quitkin (*British Journal of Psychiatry*, 1985, 147, 593-597) feels it necessary to state dosages of antidepressant drugs. The question posed is how such contrasting dogmas can simultaneously be considered necessary. I am increasingly suspicious that psychiatrists with leanings to one mode of treatment, be it organic or psychological, may be reluctant to exploit the other to the full even when to do so would be more appropriate. A diabetologist does not allow blood sugar to remain abnormal if dietary control is inadequate; he administers adequate doses of insulin.

I can only infer that Strupp's<sup>1</sup> criteria, 'What kinds of therapeutic procedures will be helpful to particular patients under particular circumstances?' should not have been restricted to psychotherapy! The Working Party for review of the MRCPsych examination hopes to test 'the skills of psychiatric practice at a more advanced level'.<sup>2</sup> I wonder if others share my concern that more basic skills may be in need of attention?

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