PSI AND CREATIVITY

Some Neuropsychological Doubts and Discoveries

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I have a particular difficulty because I'm skeptical about the existence of psi and I'm also dubious about the definition of creativity. I sometimes feel that there may not be any such thing as creativity at all as distinct from other mental processes.

First of all, the physical scale of the brain is large enough to contain any such notions that you might like to develop. Second, the elements of such processes as creativity and imagination can be identified in the brain.

If you work out the number of patterns or interactions that can exist in the brain, this is far, far greater than the number of elementary particles in the whole universe, so that the universe is bounded by the mind of man in a very real sense. The brain is big enough and complicated enough and the connectivity is rich enough for us to imagine anything we please, which of course is one of our difficulties—that there is almost no limit to the imaginative and fantastic powers of the brain.

The next point about the brain functions themselves, as we can see them in electrical or chemical terms, is that they are probabilistic. The word that I prefer to use, and I must here introduce a definition, is "stochastic," a word misused very often in some disciplines, I think, as being almost synonymous with "random." The derivation of the word from the Greek implies a process of aiming or guessing, and stochastic means literally "a good shot," a person with a good aim or power to guess; the brain is essentially a guessing machine. Somebody mentioned just this morning, that the mind is logical and rational. I say this is only partly true. The mind is not basically logical and rational. The mind is a guessing, aleatory (that means dice-throwing) stochastic machine. The processes that we call "logical, rational thought" are very special, highly cultivated versions of the basic processes of the mind

which are essentially stochastic, aiming continuously at something. What are they aiming at? They are aiming at a probabilistic world; a world in which anything may happen and in which most things do happen. The match between the stochastic powers of our cerebral processes and the probabilistic universe is as delicate as our main topic—creativity. It is the attempt by organisms—possibly including animals below man—to match their internal stochastic models to external aleatory events and vice versa. These attempts are all questions of probability and not of logic; logical thinking (literally logical in the sense of verbal or syllogistic) is a special case of a probabilistic stochastic process in the brain. I shall try to illustrate later how we know this is true and why this is not merely a matter of conjecture. We can see in the brain the workings of this probabilistic guessing machine.

The next point is about psi. I said I am skeptical, but my skepticism is an accessible one. Psi is, by any definition I think, a very weak force in the sense that it manifests itself rarely and irregularly. We wouldn't be here if it were a commonplace experience; there would be no discussion. It's a weak, rare effect in our experience, but because it is weak it should not therefore be neglected. I do not, as a scientist, neglect the possibility that a very weak force could influence a stochastic machine to an extraordinary degree. And I mean *extra*ordinary, that is, paranormal, to the extent that it is highly unpredictable, and unlikely. On the scale of probability from zero to plus one it is right down near the 0.001 level. But a nearly impossible event could occur, because of the interaction between a stochastic machine and a very weak force. By weak, I mean something rather like what physicists mean by gravitation.

Gravitation is a very weak force by physical standards as compared with the nuclear forces. If we imagine a spaceship, say the size of the whole of this building, floating somewhere between earth and some distant galaxy, it would be impossible to demonstrate the force of gravity. There would be no experiment you could make that would show the effects which are so familiar here on Earth. Momentum, yes, of course, and mass, but not gravity. If you were teaching a class of children in a spaceship jetting to Andromeda, you would have to explain that gravity is a very important effect which they would experience when they reach their destination. They will find that they have something called "weight," and things would "fall down." You couldn't demonstrate it there on the spaceship because nothing is big enough to show this effect. One could work out the smallest mass of a spaceship in which one could actually demonstrate gravitation experimentally; but one would have to get outside the ship too. It happens we live on an enormous amount of matter, Earth, and there's no doubt about

gravity. Things do fall to the ground. The weakness of a force, therefore, doesn't mean it couldn't be extremely important, given a certain size, and I suggest we may be living in our minds in a rather small mental spaceship in which the effects of mutual attraction or psi are difficult to demonstrate and have only occasional effects on the probabilistic mechanisms of the brain. So as scientists we must not ignore it although it may be extremely weak. And let us remember also, if we are thinking in terms of explanation, not description or anecdotal reports, that we cannot yet *explain* gravity in any inferior terms. We say, as Newton did originally, it is a "force," and we still use this term in the vernacular; it is difficult to avoid it, although we can't explain it in any sense.

Now, as to creativity again, I'm not sure this may not be just a fashionable term that we are beginning to use because so many people now are educated and leisured, and their development is so free that invention and discovery are becoming commonplace. It may be that we err in assuming that there is some particular process or event which we call creativity. For a long time in the evolution of society the act of creation was taken for granted as a rare gift of God or a genetic freak, according to the culture, but we now believe that something of this sort exists as a special entity. In the dictionary, the definition is: *Creation: act of causing to exist.* I mentioned to a woman friend that I was coming to talk about creativity, and she said "the only real creation is the creation of another human being." This is the only real creative act in which something which wasn't there at all before is suddenly and surely caused to exist.

I would take this further and suggest as a definition of creativity, from the biological standpoint, that it is *transitive adaptation.* Biology depends for its understanding of the living world upon the notion of adaptation, the origin of species by adaptation to environments. I am speaking here, though, not of the adaptation of the organism *to* the environment, but the adaptation *of* the environment *by* the organism. That is, organisms (mostly human, but again not only human perhaps) create insofar as they transitively adapt the environment to their needs. This may be merely for survival, but whether it be material or mental it is essentially a creative act, I suggest, and depends upon transitive adaptation. For example, insofar as I succeed in changing your minds at all, to that extent and only to that extent, is what I am saying creative. If you had any thought in your minds, or take any action after I've spoken which you would not otherwise have done—to that extent, I am creating something. If none of you are in any way influenced by

what I've said, then my contribution is absolutely zero on the creativity scale.

By transitive, I don't mean merely that I can move an object from here to there, which is perhaps a single unit of creativity. The most exciting aspect of creativity in the human context is the ability of one person to change another person's mind, to make him feel or think or act differently. That is what I mean by transitive adaptation: an organism adapting the environment, particularly the human environment, to its own needs or to its own internal brain models. One point, in parenthesis: insofar as we adapt the outside world to our needs instead of adapting ourselves to the outside world, we are paralyzing biological evolution. In the end, if we adapt the outside world (both human and non-human) to what we need and what we want, there will never be any more pressure for human adaptation, human organic evolution. There will be no environmental pressure. We shall ensure that the survival of the fittest applies not to ourselves, but to the environment. It is the fittest *environment* that will survive.

One sees this, of course, in rhetoric, in politics—the dictator or politician who succeeds in changing the minds of the people will not himself change. He will keep his ideas intact. It's only insofar as he fails to adapt the environment to himself that he will have to change his own policy. So I am suggesting that in considering transitive creativity, we may be dealing with something which is, in a rather subtle and possibly dangerous sense, antibiological. It will tend to impede or even to arrest the process of biological evolution in a species which is creative.

Now, I would suggest that when we come to scientific creativity, what I mean by transitive adaptation is essentially the asking of a question. I apply this also, tentatively for discussion, to all forms of creativity; that the basis of creativity in this sense is the asking of a question, not the answer to a question, but the putting of the question to the environment including, of course, to one's fellow beings. I suggest that *the question is the creation.* The scientist, when he makes an experiment, is asking a question. When a painter paints a picture, he is asking a question. He's saying, "What do you think of this?" He may be asking the question of himself, but it is the question that is the creation. Here, there is the possibility of an infinite regress because there may be a question about a question. There may be no answer, but I suggest that this is the second factor one has to consider as to the degree to which a question is being asked. A mere statement: "This is a glass," is not creative. But if I say "What sort of glass is this?" "Where does it come from?" "What is it for?"—this begins to require

an answer from somebody, and then there is a new idea; new statements are being made; new properties are being evoked and surmised.

Now the third aspect of creativity which seems to be interesting and important, particularly in relation to human creativity, is redundancy. I put this definition of creativity as transitive adaptation to several of my friends, and a woman friend said to me, "Ah, but this won't apply in art because artistic creation is always more than necessary." When one talks about transitive adaptation, one thinks of the perfect economical match between environments and organisms which the organism adjusts exactly the way he wants it and no more. But in human creativity, particularly in the human brain with its enormous amount of intrinsic, spontaneous activity, I suggest that there is nearly always a high redundancy. The transitive adaptation of the environment by the organism goes beyond necessity and this is why, for example, the scholastic philosophers were so frightened of multiplying entities beyond necessity. They did not want to create. They only wanted to analyze, to describe, and insofar as we now feel free to multiply entities beyond necessity, we can create, but we still have to satisfy the specification that they must be transitively adaptive. They must do something. Something must be changed as a result of our redundant adaptation.

In other words, if a painter paints a picture, it may be extremely expressive to him, but if nobody looks at it and nobody says anything, it falls flat. Nothing happens. There's no creation. If it's later rediscovered, to that extent it may be creative at a later time, so I include also a wide time scale. It's not necessary that you should have a change of mind here and now in order to supply my discourse with some element of creativity. You may think of something new in a year's time, or twenty years' time, and if this goes back to what I said, at all, to that extent I can claim a small element of creativity. So I feel that the redundancies and ambiguities one introduces in this way should adapt the environment, so that it not only matches some need but also introduces some additional novelty.

Now this brings the whole subject within range of the experimenter. What I've said so far could be purely speculative; in fact, it's based upon observations of what the brain seems to be doing when it's working, and our records show that we are not dealing with a purely mechanical system, that is, one which is state-determined.

The study of brain activity has so far been rather trivial, a matter of looking at stimuli and responses and showing how very complicated a communication system the brain is. But it is also a creative system that generates activities which would otherwise not have occurred.

A good deal of the data I'm going to talk about are derived from contacts inside the brain. In order to get any information out of these data, we have to use complicated methods of computation and analysis. The interaction between the strictly logical processes in computers and the fantastic processes in the brain are beginning to reveal an entirely new dimension in brain research.

The recording equipment is connected to a general purpose computer which does the logic for us. If, as I suggest, logical thinking is artificial and unnatural for us, then we can exploit the logical powers of our artificial brains to check our fantasies against reality.

Until a few years ago, a scientist had to do everything—invent and discover and imagine, and also try to corroborate and confirm or check his mental processes against logical probabilities. This is now done better and more quickly by computers so that we are free to surmise and fantasize. We are free to imagine what might be the case and leave the computer to tell us how far wrong we are.

I have described elsewhere how we can detect and measure mental states such as expectancy and decision in the brain. We have found also that the electric signs of attention and intention may be used to operate external devices so that a person can obtain limited but direct control over the outside world by attaining the appropriate state of mind. This is an example of transitive adaptation without the intervention of any ordinary effector system; the computer replaces the muscles which would otherwise be used to utter words or press buttons. An outstanding question is: What are the states of mind or brain which precede the effective stage of transitive adaptation? This is the stage where creativity is created and the simple term for it is *understanding*. We have been able to detect some features of brain activity that seem related to the transition from bewilderment to understanding; these are generally in the nature of *increased coherence* of the incessant intrinsic electric rhythms in the brain. By coherence I mean the physical effect whereby a train of waves maintains a constant phase relation between the peaks and troughs of the separate components. A physical example of extreme coherence is the *laser* in which light waves are constrained to fit in with one another to an extraordinary degree. The coherent light from a laser can be used to form a "hologram" and it has been suggested that the coherence of brain waves may provide the means for image storage and recognition and for the free association which is a part of our stochastic thinking.

What we call "understanding" a situation is one of the prerequisites of creativity; another is the tendency to *guess*. Both understanding and guessing I consider aspects of stochastic brain analysis—in crude terms

one could say that the first is concerned with finding a target and the second with trying to hit it. The development of understanding seems to be associated with the establishment of wave-coherence in the frontal lobes of the brain. When the situation involves guessing, a rather different but equally consistent effect appears. In this situation, devised by my colleague Dr. Harold Weinberg of Vancouver who was working with us for a year, the subject has a little lever which he can move to left or right whenever he likes. Whichever way he moves it starts the computer collecting samples of his brain activity. He is told that if he expects a stimulus to occur, or rather guesses that it will occur, he is to move the lever to the left, and if he guesses a stimulus will *not* occur, to move the lever to the right. The experimenter sets a switchboard so that the stimuli occur randomly for left and right movement. Since the experimenter cannot know which way the subject will move his lever and the subject cannot know (but is asked to *guess*) whether left or right movement will produce a stimulus, no one knows whether a particular guess will be right or wrong. So there are four conditions: guess yes and correct; guess yes and wrong; guess no and correct; guess no and wrong. We offered the subjects sixpence for three right guesses in a row. The brain activities corresponding to all four conditions were collected and averaged by the computer and finally plotted out automatically.

The results we obtained were surprisingly clear. When a person guesses that a particular event will occur (whether a flash of light or a click or a touch on the hand) the brain emits an electric signal as if the event had occurred whether it did or not. If it actually did occur, of course, there is the usual large "evoked response" whether or not the guess was accurate, but even when there is no real signal at all the brain still emits a sort of replica of what would have happened if the signal had been there. In other words we can see the brain imagining an event; the electrochemical changes in the brain are as "real" as when the stimulus is real. The brain has created an image of what might have been. Contrariwise, when the person guesses that a stimulus will *not* occur and it does not (a guess as right as the other and equally rewarded), the records show the growth of expectancy before the lever movement but a much smaller emitted potential—sometimes none at all. The subject knows he is guessing and so may be mistaken; even when he guesses that nothing will happen, a part of his brain may still feel that it *might* happen.

Of course these two effects, the coherence of comprehension and the emission of potentials during guessing, are very simple, rudimentary examples of what I believe underlies creativity. We are exploring more

complex situations, now that we know we can observe some of these elusive properties of the brain. What I hope is that we may be able to advance our thinking about such notions as creativity. A century ago physicists spoke of "electricity," thinking of it as a subtle fluid or occult force, and of course we can still use the term for convenience in paying our "electricity bills" for example. But physicists are no longer concerned with the nature of electricity, but with the nature of the electron and the other invisible particles which are as mysterious as electricity was, but at a different level. I hope that we may be able to establish a neuronic theory of creativity which will be just as exciting as if we were dealing with a psychic force but more amenable to experiment and explanation.

I know this could be dismissed as "reductionism" but why not reduce intractable complexity to something more accessible. Such a procedure in no way reduces the wonder or joy we can feel when we consider our faculties; it should, however, make us think more carefully about our terms and units and axioms, if entities are not to be multiplied too far beyond necessity. At any rate, when we do surpass necessity, perhaps we can be comforted by supposing that this is creative, even if it be a poor explanation.