Psychoenergetics, 1983, Vol. 5, pp. 1–10
0278-6060/83/0501-0001 $18.50/0

Microphysical objects as centres of perception

C.N. VILLARS

40 Borwick Avenue, Walthamstow, London, E17

Quantum nonlocality and the Pauli exclusion principle suggest a novel conception of microphysical objects as centres of perception. Such a conception is tentatively outlined and shown to be consistent with the quantum formalism. The new concept is applied to the discussion of two familiar experiments and shown to throw new light on aspects of the experiments which formerly appeared strange. Finally, a model for ESP in terms of the new concept is outlined.

1. MICROPHYSICAL OBJECTS AS CENTRES OF PERCEPTION

In recent years, it has become widely recognised that microphysical objects (i.e. individual molecules, atoms and atomic particles) possess the novel property of nonlocality (Bohm and Hiley, 1975; d'Espagnat, 1976, 1979; Hiley, 1980). Whereas classical particles were completely localised entities, instantaneously isolated from all other spatially separated particles, microphysical objects can immediately affect one another even when widely separated in space. This is not an exceptional circumstance but a very general and elementary consequence of the quantum formalism. Thus, according to quantum theory, if two microphysical objects interact, then, after the interaction, an observation performed on one of them will, in general, instantaneously affect the state of the other, even though they may have become separated by macroscopic orders of distance.

Nonlocal microphysical objects can be interpreted as centres of perception (Villars, 1981). It is proposed to represent these centres schematically as in Figure 1b. Figure 1a represents a classical particle completely contained in region A, instantaneously isolated from all other particles spatially separated from it. Figure 1b represents a microphysical object conceived as a centre of perception, centred in region A, but having an immediate perception of other centres in the distant regions B and C.

We can give intuitive content to the idea of a centre of perception by considering ourselves as such centres. In our visual perceptions, we are aware

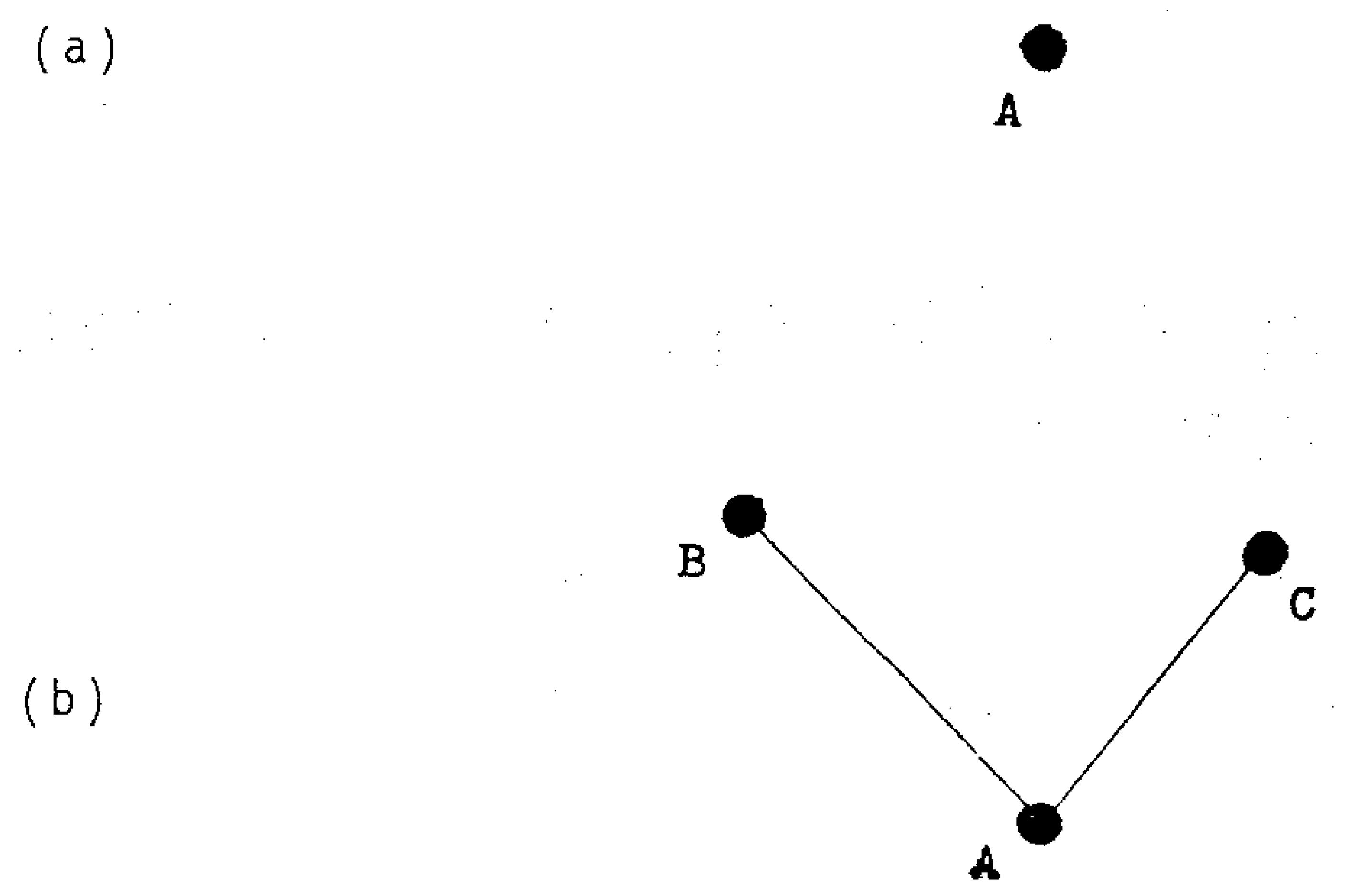

FIGURE 1 (a) a localised classical particle; (b) a nonlocal microphysical object.

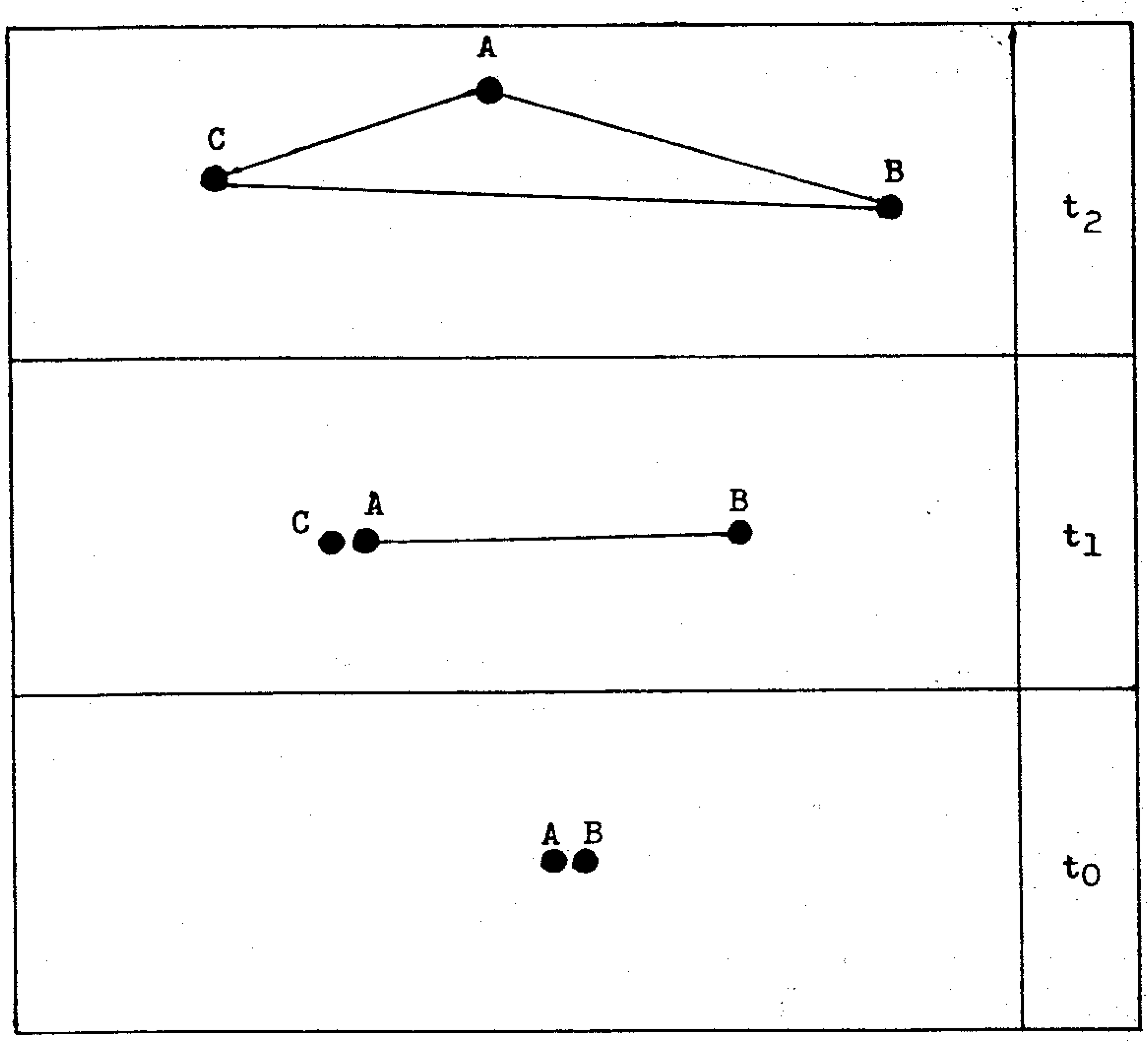

FIGURE 2 Extension of perceptual contacts through interaction.

of ourselves as the centre, or focus, of a perspectival apprehension of the things around us. The painting over there on the wall and the typewriter before me on the table are perceived in perspective from here, where my body is. Human visual perceptions frequently involve consciousness and are usually understood in terms of an underlying causal process, whereas the perceptions of microphysical objects are, presumably, devoid of consciousness and have the character of immediate contact. Nevertheless, the intuitive form of our visual perceptions is that of a centre, ourselves, in immediate contact with what is presented to it (certainly we are not *conscious* of any underlying causal process), and can thus provide a reasonable analogy for the idea of a centre of perception.

Suppose that two microphysical objects, A and B, interact at time t_0. At a later time t_1, they may have separated in space and yet still have an immediate perception of one another. Suppose further that, at t_1 A interacts with a third object C. At a still later time t_2, A and C may have separated whilst, again, still retaining immediate perceptual contact. This sequence of events is represented schematically in Figure 2. Since, at t_2 C has an immediate perception of A which, in turn, has an immediate perception of B, it follows that C has an immediate perception of B, for any observation determining the state of B will immediately affect the state of C. Each of the objects is a centre having an immediate perception of the other two. Thus, through their interactions, the perceptual contacts between microphysical objects become indefinitely extended. Even if we supposed all of them to be isolated at a given time, they would very soon become, through their interactions, interconnected. In reality, a microphysical object will have a long history of interactions with other objects, and consequently, a widely extended range of perceptual contacts.

2. PAULI'S EXCLUSION PRINCIPLE

The above considerations suggest that we generalise the concept of a centre of perception and adopt as our basic idea the picture of a microphysical object as a centre having an immediate perception of *all* other centres. Each centre is a vertex in a completely connected manifold. Its connections with other vertices are its immediate perceptions of them. This generalisation receives further support from Pauli's exclusion principle. This principle implies that some microphysical objects, i.e. similar fermions, have immediate perceptions of one another, even when they have not previously interacted.

The state function of a system of two completely independent microphysical objects should be a product of two functions, one describing each of the two objects separately. In general, according to quantum theory, the state function of a system of two non-interacting microphysical objects has this product form. However, Pauli's exclusion principle requires that the state function of a system of two similar fermions, e.g. two electrons, must be antisymmetric. Let $\psi_1(x)$ and $\psi_2(x')$ be functions describing two non-interacting similar fermions, where x and x' are the coordinates of each of the two fermions respectively. According to the exclusion principle, the general form of the state function of the combined system must be

$$\psi_1(x) \cdot \psi_2(x') - \psi_1(x') \cdot \psi_2(x) \tag{1}$$

A function of this form cannot in general be expressed as a product of two terms, one describing each fermion separately. Hence, even though non-interacting, the two fermions are not completely independent. The state of one is immediately dependent on the state of the other. How is this possible? Each must be a centre having an immediate 'knowledge' or perception of the other. It follows from the form of expression (1) that ψ_1 cannot equal ψ_2, for then the describing function would vanish. Hence, similar fermions cannot occupy the same state. Consider the process of building up a complex atom from its constituents. Each new electron captured by the nucleus cannot go into an already occupied state. It follows that each new electron must somehow 'know' which states are already occupied, even though it has not interacted with the other electrons by any known forces, i.e. each must have an immediate perception of the other electrons in the atom. Pauli's exclusion principle implies that all similar fermions have an immediate perception of one another, and hence supports the generalised conception, proposed here, of a microphysical object as a centre having an immediate perception of all other centres. (A thorough discussion of the exclusion principle and its philosophical implications is given by H. Margenau (1944)).

3. PARTICLE TRAJECTORIES. HIDDEN VARIABLES

The idea of a centre of perception can be made more definite in various ways. Here, it is proposed to conceive the centres as continuously existing points. This implies that, like classical particles, they have continuous space-time trajectories. Each centre has a precise position and momentum at all times. That this assumption is not inconsistent with quantum theory is demonstrated by the various 'hidden variables' interpretations of the theory, such as that proposed by D. Bohm (1952), which retain the idea of particles with continuous trajectories, where the successive positions and momenta of the particles are conceived as hidden variables, and which can be shown to be formally equivalent to ordinary quantum theory. Though not inconsistent with ordinary quantum theory, it is clear that if microphysical objects are conceived as having continuous trajectories, the quantum position and momentum observables cannot be interpreted as measuring their successive positions and momenta, i.e. these *must* be conceived as hidden variables. The quantum position and momentum observables cannot simultaneously have precise values, and hence cannot represent the positions and momenta of the centre, which always have precise values. Furthermore, it can be shown quite generally that the assumption that the quantum observables measure the actual positions and momenta of the centres leads to predictions contrary to well-established results of the ordinary theory (d'Espagnat, 1976). The quantum position and momentum observables can perhaps best be thought of as some kind of function, i.e. in the simplest case as some kind of average, of the successive positions and momenta of the centre over the period of its interaction with the measuring apparatus.

4. TWO THOUGHT EXPERIMENTS

The picture of microphysical objects as centres of perception can be used to elucidate aspects of microphysical experiments that appear strange from a classical point of view. Consider, for example, the well-known two-slit electron diffraction experiment. A beam of electrons, all emitted from an electron-gun apparatus with the same initial energy, is diffracted by a screen containing two narrow slits and recorded on a photoemulsion. We suppose that each slit can be instantaneously opened or closed independently of the other. When this experiment is performed with slit 1 open and slit 2 closed, the photoemulsion is evenly fogged with no trace of interference effects. When both slits are open, the familiar interference pattern of light and dark fringes is obtained. If the electrons are conceived as having continuous trajectories, it follows that the trajectories they follow when both slits are open must generally be different from those they follow when slit 1 alone is open.

Consider an electron (Figure 3) which, when slit 2 is closed, passes through slit 1 and produces a mark on the photoemulsion at a point X, where no electrons are recorded when both slits are open, i.e. a point corresponding to one of the dark fringes in the interference pattern. Suppose that when this electron is at a point P, approaching slit 1, slit 2 is instantaneously opened. The trajectory of the electron must be immediately affected so as to take it to a point on the photoemulsion other than X, such as X′. If the electron were a localised classical particle, completely contained in region P and instantaneously isolated from all other spatially separated regions, it would be hard to understand how it could be immediately affected by opening the distant slit 2. However, if the electron is a centre of perception, having an immediate perception of its environment, it is evident that its behaviour could be immediately affected by any changes made to the slit system.

This view of the experiment is represented in Figure 3. When slit 1 alone is

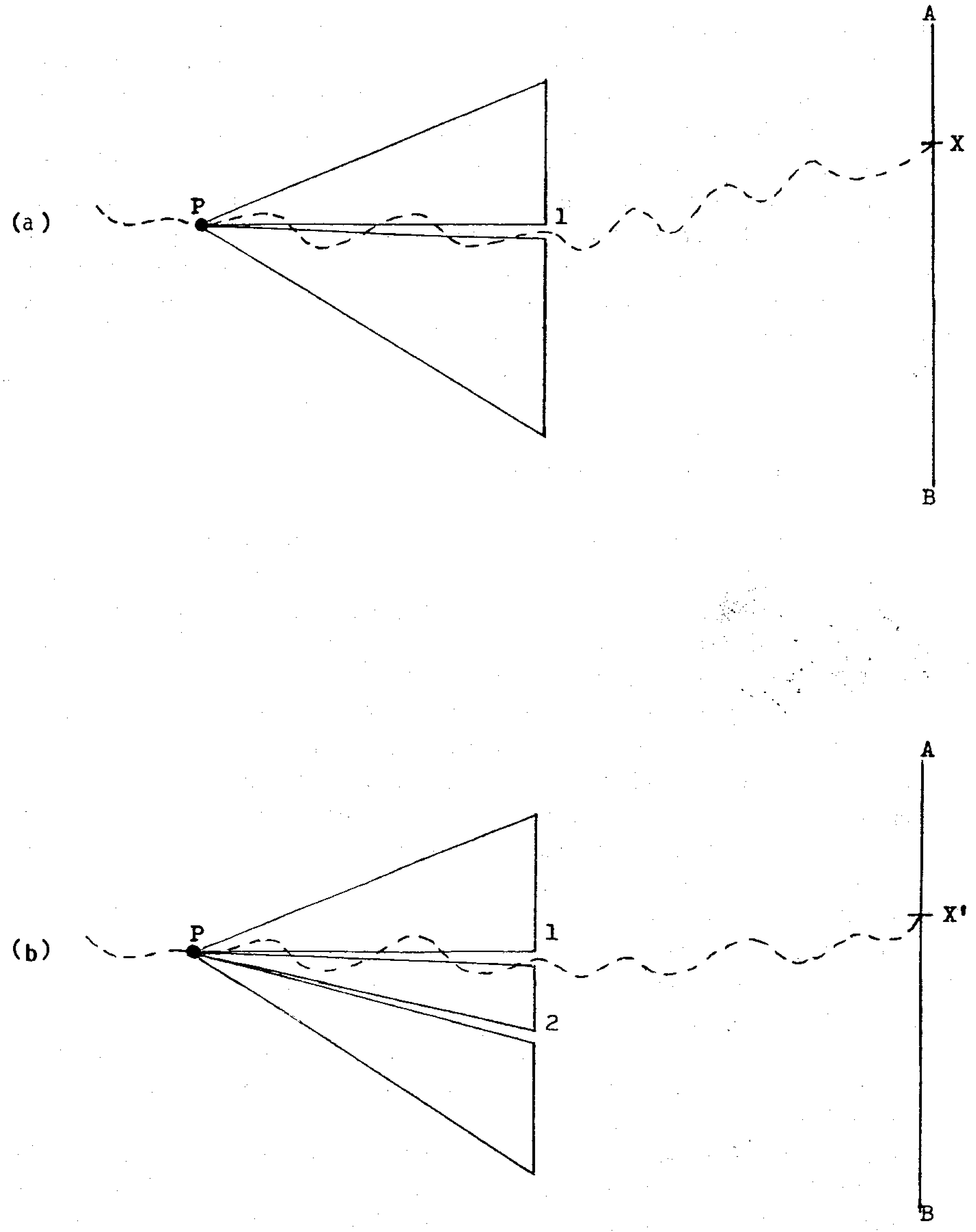

FIGURE 3 Interpretation of the two-slit electron diffraction experiment using the idea of a centre of perception. (a) slit 1 open and slit 2 closed; (b) both slits open. (In this and Figure 4, the trajectory of the centre is represented as an irregular, dashed line to indicate that the successive positions and momenta of the centre are hidden variables and that the precise form of the trajectory is unknown.)

open, an electron passing through P perceives the slit system as shown in Figure 3a and eventually produces a mark at X. When slit 2 is opened, the electron's perception of the slit system from P alters, and this altered perception affects its trajectory so that it eventually arrives at X′ instead of X (Figure 3b).

Another experiment, apparently inexplicable from a classical point of view, which can be elucidated using the idea of a centre of perception is the interferometer experiment described by Dirac (1958). An incident beam of photons is split by a half-silvered mirror into two perpendicular beams (Figure 4). After being reflected normally by two, equidistant, plane mirrors, the two beams are recombined by the half-silvered mirror and a photoemulsion records the distribution of photons in the recombined beam. One of the plane mirrors is permanently fixed, whereas we suppose that the other can either be fixed or instantaneously released so as to be freely moveable.

When the releaseable mirror is freely moveable, there are no interference effects. When both mirrors are fixed, the distribution of photons on the photoemulsion shows an interference pattern. If the photons are conceived as having continuous trajectories, it follows that their trajectories when the releaseable

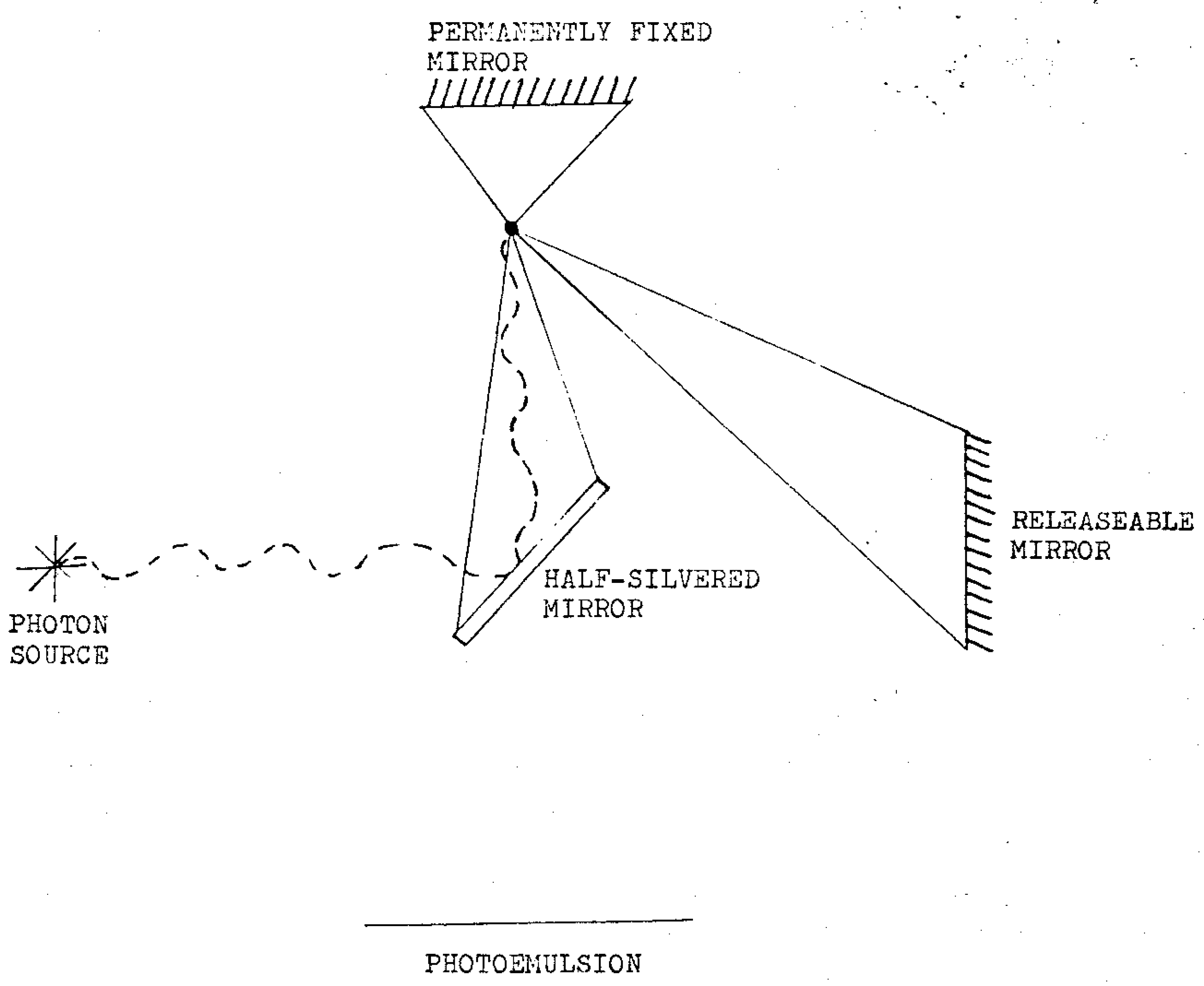

FIGURE 4 Interpretation of the interferometer experiment using the idea of a centre of perception.

mirror is moveable must be different from those they follow when it is fixed. In particular, the trajectory of a photon in transit to the permanently fixed mirror when the releaseable mirror is moveable must be immediately affected if that mirror is instantaneously fixed.

Here again, as in the electron diffraction experiment, if the photons were localised classical particles, it would be difficult to understand how their trajectories could be affected by changes to distant parts of the apparatus with which they have not interacted by any known forces. If, however, they are conceived as centres of perception, it follows that they can immediately take account of any changes to the experimental arrangement. Making the releaseable mirror fixed, or moveable, can immediately affect their trajectories.

Figure 4 represents a photon, conceived as a centre of perception, in transit to the permanently fixed mirror. It is immediately evident from this figure that, because the photon is a nonlocal centre of perception in immediate perceptual contact with the apparatus, its behaviour can be immediately affected by the state of the other, distant mirror.

The picture of microphysical objects as centres of perception outlined above is merely qualitative. Whether anything more mathematically precise can be made of it remains to be seen. However, whether a mathematical theory is developed or not, the idea of a centre of perception provides an alternative to the wave-particle concept, enabling us to visualise microphysical objects in a unitary and intuitive way.

5. APPLICATION TO PARAPSYCHOLOGY

Within the terms of classical physics it is difficult, if not impossible, to devise mechanisms capable of explaining paranormal phenomena. It seems that the most obvious candidate – the electromagnetic field – is eliminated by the apparent independence of distance in the known effects, and by their continued occurrence even when electrical screening is employed. Given the completely localised character of classical physical objects, it is hard to conceive how paranormal phenomena, apparently involving immediate, or near immediate, connections between widely spearated events, are possible at all. A major obstacle in attempting to apply modern quantum theory to understanding paranormal phenomena is the lack of a clear picture, from physics itself, of the nature of microphysical objects themselves, in terms of which we can attempt to formulate parapsychological theories. The orthodox wave-particle concept is not visualisable, and does not emphasise the novel feature of microphysical objects which seems most likely to prove useful to parapsychology, viz. nonlocality. The centres of perception idea developed above, though it adds no new mathematical results to physics itself, does provide us with a definite, visualisable picture. In the remainder of this essay, a model of ESP in terms of this idea is tentatively outlined.

If we accept the centres of perception picture of microphysical objects, it follows that all the constituent particles of the brain and nervous system are such centres, each having an immediate perception of all other centres in the universe in a unique perspective. These perceptual contacts are at the microphysical level, i.e. they are perceptions *by* microphysical objects *of* other microphysical objects. However, suppose that somewhere within the human nervous system (either locally in some particular region or extensively throughout the system) forms of organisation of the constituent microphysical objects exist capable of amplifying, selecting, and combining the perceptions of the individual objects, so as to give rise to perceptions of patterns in the micro-level perceptions, corresponding to distant objects and events. Thus, although each individual microphysical object does not respond directly to a distant macro-object, but rather to each of its constituent particles individually, forms of organisation may exist in the brain capable of detecting patterns in the micro-perceptions corresponding to distant macro-objects.

The eye and brain function in this way in relation to the locally received flux of ambient light. Of course, each individual photon received does not contain a picture of the distant object which reflected it to the eye, but it does have some characteristics (e.g. wavelength and direction of motion) associated with the object. Sensory processes in the eye and brain identify and combine these characteristics and by selection and emphasis create a picture of the distant object. It is proposed here that analogous, 'sense-like' processes occur in the nervous system capable of detecting patterns corresponding to distant objects and events in the flux of immediate perceptions of the system's constituent particles. These processes constitute a kind of 'sixth sense' which picks up information about the distant environment from the immediate perceptions of the particles.

Just as human consciousness is associated with the functioning of certain specific areas of the brain, so too we may assume that the contents of the unconscious mind are associated with processes occurring more extensively throughout the brain and nervous system. Hence, it is conceivable that the unconscious mind has access, via the postulated sense-like processes in the nervous system, to 'extra-sensory' perceptions of events occurring simultaneously at a distance, whether they be ordinary physical events or the mental processes of another individual. The conception of microphysical objects as centres of perception thus establishes the physical possibility of an 'unconscious immediate knowledge' of distant states of affairs, such as is postulated, for example, by Jung (1955). In principle, the extent of this unconscious knowledge is unlimited for, according to our hypothesis, the particles which make up the brain and nervous system to which the unconscious mind has access are centres of unlimited perceptual contact with the universe around them. However, in fact, the scope and form of this knowledge will be determined by the particular forms of organisation and activity of the postulated sense-like processes in the nervous system.

The immediate knowledge of the surrounding universe possessed by the unconscious mind only rarely becomes conscious. We may suppose that the conditions under which this occurs are similar to those under which unconscious contents in general become conscious, e.g. in dreams, states of emotional excitement and at critical times in the individuation process. Swedenborg's famous dream of the fire in Stockholm, the well-known correlation between the success rate in telepathy experiments and the degree of emotional expectation of the participants, and Jung's experience with a scarab beetle whilst treating a patient (Jung, 1955), are examples of each of these conditions respectively.

References

Bohm, D. A suggested interpretation of the quantum theory in terms of 'hidden' variables. I and II. *Phys. Rev.*, **85**, 166–193, 1952.

Bohm, D., Hiley, B. On the intuitive understanding of non-locality as implied by quantum theory. *Found. Phys.*, **5**, 93–109, 1975.

Dirac, P.A.M. *The Principles of Quantum Mechanics*, Chap. 1.3, Oxford, 1958.

d'Espagnat, B. *Conceptual Foundations of Quantum Mechanics*, Section 7.3, Benjamin, Reading, Mass., 1976.

d'Espagnat, B. Quantum theory and reality. *Scientific American*, **241**, 128–140, 1979.

Hiley, B. Ghostly interactions in physics. *New Scientist*, **85**, 746–749, 1980.

Jung, C.G. Synchronicity: An acausal connecting principle. In *The Interpretation of Nature and the Psyche*, Bollingen Series LI, Princeton University Press, New Jersey, 1955.

Margenau, H. The exclusion principle and its philosophical implications. *Phil. Sci.*, **11**, 187–208, 1944.

Villars, C.N. Quantum nonlocality. *J. Psychophysical Sys.*, **4**, 15–23, 1981.