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PHYSICAL ASPECTS OF PSYCHIC PHENOMENA

Einstein once said that telepathy 'has probably more to do with physics than with psychology'. Recent experimental results are now allowing psychic phenomena to be quantified and models to be constructed in which consciousness plays an active part in establishing reality

Psychic phenomena have fascinated people throughout all recorded history. Yet the orderly scientific search for verification and understanding of such processes dates only to the founding of the Society for Psychical Research (SPR) in 1882 by a group of eminent scholars, who attempted to bring critical scientific methodology to bear on these controversial topics. Continuing research efforts over the past century have been hampered by the elusiveness of empirical effects, lack of viable theoretical models, dearth of institutional and financial support, vulnerability of the field to exploitation by unethical sensationalists, and incessant attacks by an unusually vocal and aggressive critical community. These difficulties have discouraged all but a few qualified investigators from continuing to pursue the topic.

Perhaps most prominent among these were J B and Louisa Rhine from Duke University, USA, in whose laboratory were spawned many of the basic concepts, protocols and vocabulary of modern psychic research. The Rhines and their parapsychological progeny have tended to approach the topic from the perspectives of academic psychology, and to focus more on the characteristics of the human subjects involved in the studies than on the physical aspects of the phenomena.

Nevertheless, the contributions from a number of physicists have provided important counterpoint in the evolution of the field. Sir William Crookes' early psychic experiments were cited by the founders of the SPR, and many prominent physical scientists of the 19th and 20th centuries, including Lord Rayleigh and Sir J J Thomson, recognised the implications of these phenomena for their own intellectual domains. Planck, Bohr, Heisenberg, Pauli, de Broglie and Schrödinger addressed these and closely related metaphysical topics quite explicitly, and even Albert Einstein acknowledged that telepathy 'has probably more to do with physics than with psychology'. However, their interests tended to be more philosophical than practical, given the lack of quantitative physical data available at that time.

More recently the sharp increase in the sensitivity and sophistication of modern information processing equipment has added a new pragmatic dimension to this issue, in terms of the potential vulnerability of modern microelectronic circuitry to anomalous influences from the consciousness of its human operators. At the same time, the capacity of such devices for very sensitive and rapid data acquisition offers new opportunities for experimental access to domains of human-machine interaction where such subtle effects may be studied more replicably and systematically.

Nomenclature

Psychic phenomena (sometimes termed psi or ψ) are usually divided into two major categories:

- extrasensory perception (ESP) - the anomalous acquisition of information from sources inaccessible by known sensory means; and
- psychokinesis (PK) - the anomalous influence of consciousness on physical or biological systems.

ESP can itself be divided into

(i) telepathy - detection of another person's thoughts;

(ii) clairvoyance - anomalous acquisition of information about remote objects or events; and

(iii) precognition and retrocognition - perception of future events or of past events not accessible by normal recollection.

PK includes a broad range of disturbances, ranging from microscopic changes in atomic-scale physical processes, through macroscopic distortion or movement of small objects, to drastic 'poltergeist' effects. Inexplicable biological phenomena, such as psychic healing, might also be included in this category.

Beyond these two major categories a number of miscellaneous anomalies are often included, such as the family of 'out-of-body experiences', or phenomena associated with spiritual survival of bodily death, such as mediumship, apparitions and reincarnations. This article, however, will concentrate only on controlled research into basic physical aspects of ESP and PK phenomena, using examples drawn from the Princeton Engineering Anomalies Research (PEAR) Laboratory at Princeton University, USA.

Modern ESP research

While the earliest controlled ESP studies tended to focus on simple tasks such as guessing numbers, colours or symbols with predefined probabilities of occurrence, it soon became clear that efforts including aspects of real-life spontaneity or holistic context were generally more successful, although more difficult to quantify and analyse. For example, 'free-response' protocols, where individuals generate verbal descriptions of unknown targets, have become popular, especially the so-called 'remote perception' or 'remote viewing' format.

In a remote perception protocol, one participant (usually termed the 'percipient') aims to acquire impressionistic information about an unknown remote geographical target scene at which a second participant (called the 'agent') is stationed at a given time. Such experiments have been performed with a large variety of percipient/agent pairs, using a broad range of targets over distances up to several thousand miles. One example of a percipient's response transcript drawn from the PEAR database at Princeton is shown in figure 1, in comparison with a photograph of the target he was trying to perceive.

Many other examples could be illustrated, displaying similar impressionistic character to this one. The accuracy of such perceptions ranges from virtually photographic descriptions, through varying lesser degrees of correspondence, to apparently irrelevant statements. In general, aesthetic aspects like colour, shape, degree of activity, order, confinement or noise level tend to be more accurately perceived than analytical details such as number, size or relative positions. Features which are impressive or central to the agent are not necessarily so to the percipient, and vice versa. Errors in scale or arrangement of key items are common, and percipients occasionally even identify items outside the agent's circumscription of the target.

Besides acquiring basic data, the primary aim of such research is to establish suitable analytical procedures for quantitative comparison of the percipient responses with the target details. Early experiments employed human judges who ranked the transcripts impressionistically against the targets, but this was found to be both inefficient and subject to vagaries in evaluation styles. A more standardised analysis method has recently been developed that uses a specified list of about 30 simple descriptors, such as whether the target is indoors or outdoors, whether it is light or dark, whether people are present, whether it is noisy or quiet etc.

The target is encoded by the agent in terms of these descriptors, as is the free-response description by the percipient, providing two ensembles of digital data which can be compared and processed by suitable computational algorithms. The

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array of numerical scores for all experimental trials can then be compared with appropriate chance score distributions to give quantitative statistical merit to the original data.

Results of the PEAR database of 334 remote perception experiments are shown in figure 2. Line (a) is an empirical chance distribution of scores from purposely mismatched target-perception responses in 42000 possible permutations, compared with line (b), the distribution of scores for the 334 matched target-perception pairs. Line (c) is the subset of the matched target distribution having the same maximum value as the chance distribution, and (d) is the residual distribution after (c) is subtracted from (b), indicative of the extent of information acquired by anomalous means. The likelihood of this magnitude of distortion occurring by chance is calculated to be 10^{-11}.

Of particular physical interest is that the fidelity of the perceptions seems insensitive to how remote the target is, up to several thousand miles. Perhaps more bemusing is a similar independence of the results from the time interval between the perception effort and the agent's visit to the target. Most of the data contributing to figure 2 involved perceptions recorded several hours – in some cases several days – before the target was actually visited, indeed before it was even selected! The example transcription shown in figure 1 was dictated some 24 hours before target selection.

Similar research has been performed at a number of other laboratories. Some studies at SRI International at Menlo Park, California, USA, had no human agent at the target, which was specified only by map coordinates. The Mobius Group in Los Angeles, California, has applied similar techniques to archaeological exploration, and various law enforcement agencies have conducted missing persons and contraband searches in this way.

Modern PK experiments

Random physical processes that can be conditioned into a digital output are the most common bases for physically orientated PK experiments. For example, microelectronic noise diodes may be conditioned by appropriate logic circuitry to produce random sequences of binary events that can be readily displayed, recorded and analysed. The overall system can be protected meticulously against technical artifact or deliberate fraud. Human operators then try to distort the distributions of these outputs in pre-stated directions, under various conditions.

One such random event generator (REG) used in the PEAR laboratory presents a preset number of randomly alternating binary pulses, counts the number of pulses that conform to a regularly alternating $+,-,+,-,+,-,\ldots$ sequence, and displays the results with digital LEDs. After stating and recording his intention, the operator attempts to influence the machine to produce an excess number of high counts (PK^+), an excess number of low counts (PK^-), or he simply generates a baseline (BL). For sufficiently large databases, systematic deviations from the theoretical mean are often found to emerge above the inherent stochastic fluctuations, constituting statistically significant departures from chance expectation.

Data showing the cumulative deviation from the chance mean can be compounded for each operator and are found to vary substantially from one individual to another, yet to be individually quite consistent. Some operators achieve in only one direction, some in the other. Some do not exceed chance in either direction; some invert one or both of the efforts from the intended direction. Some operators' results may also be sensitive to secondary parameters of the experiment, such as the counting rate, the number of bits per trial, the procedure for establishing the direction of intention, or the nature of the feedback provided. Nonetheless, when the results of the entire group of more than 30 operators are combined, the overall effects in both directions are still significantly beyond chance expectation (figure 3).

Curiously, individual operator results seem relatively insensitive to the particular device employed. Similar experiments using different microscopic random physical sources yield quite comparable results. Replacing the noise diode with an array of 32 microelectronic shift registers that produces a deterministic pseudo-random binary string of 60 hour duration also does not seem to inhibit the effect. In fact, very similar behaviour has been observed using quite macroscopic devices. In the 'random mechanical cascade', 9000 ¾ inch spheres trickle vertically through a 5 foot × 4 foot quincunx array of pegs, scattering into 19 collecting bins in a good approximation to Gaussian distribution. Individual operator efforts to shift the mean of this distribution to the right or the left are found to compound to cumulative deviation signatures, much like those attained on the REG and pseudo REG.

Similar results have also been found in research in the USA at the Mind Science Foundation and the Science Unlimited Research Foundation in San Antonio, Texas, at the University of Delaware, Lewes, Delaware, at the Foundation for Research on the Nature of Man at Durham, North Carolina, at SRI International, Menlo Park, California, at the Psychophysical Research Laboratories, Princeton, New Jersey, and elsewhere (see further reading list).

Theoretical formulation

Many theoretical models of psychic phenomena have been proposed, ranging from efforts to correlate effects with psychological or physiological parameters, to attempts to apply various established physical, mathematical and statistical concepts. The latter three include applications of electromagnetic theory, statistical thermodynamics, quantum mechanics, geophysical wave mechanics and hyperspace models, but none of these direct transcriptions has proved adequate, and the most recent efforts have been forced toward more radical approaches.

It now appears that such anomalous consciousness-related phenomena will only be accommodated comfortably within a more expansive physical perspec-

Figure 1 Precognitive remote perception: target photograph and percipient transcript

Target: Danube River, Bratislava, Czechoslovakia. The percipient was in Wisconsin, some 5600 miles away. The perception, generated 24 hours precognitively, reads, in part:
'I have the feeling that the (agent) is somewhere near water. I seem to have the sensation of a very large expanse of water. There might be boats. Several vertical lines, sort of like poles. They're narrow, not heavy. Maybe lamp posts, or flag poles. Some kind of circular shape. Almost like a merry-go-round or gazebo, a large round thing. It's round, on its side, like a disk; it's like a round thing, flat on the ground, but it seems to have height as well. Maybe with poles. Could possibly come to a point on top. Seeing vertical lines again. Seems to be a strong impression, these vertical lines ... Predominant colours seem to be blue and green ... Water again ... Some very quick impression of a fence, a low fence ... Steps seem to go up to some kind of ... fence. It's a dark fence, and it's along like a walk sort of at the top of the steps. The steps sort of lead up to like a path or walkway. Like a boardwalk. And there's a fence along it. There's people walking along it, and there's vertical lines along that walkway ...'

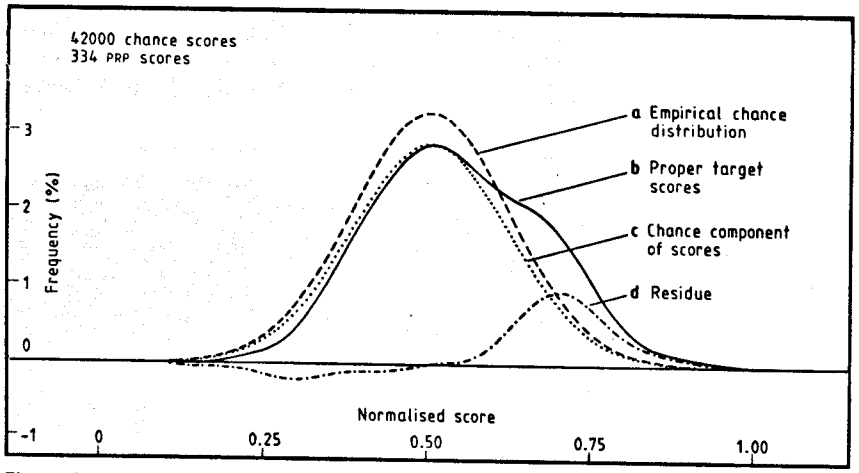

Figure 2 Precognitive remote perception score distributions

tive that acknowledges consciousness as an active component in the establishment of reality. This possibility, widely discussed by the early quantum physicists but left fallow in the absence of an adequate body of credible data, may now, in the light of recent experimental results, become more viable.

As one example of this approach, we have proposed a model in which consciousness is allowed the same wave-particle duality found useful in numerous physical applications. The traditional Western view of consciousness may be said to be strictly 'particulate' in nature, in that individual experience is presumed to be sharply localised in space and time, and to be mediated by a well defined physical brain. If, however, the possibility is allowed that in some situations consciousness may also possess a wave-mechanical character, it acquires the capacity to access remote sources of information and to influence its remote physical environment via a variety of free and standing wave processes such as diffraction, interference, barrier penetration or resonant bonds, not available to its particulate counterpart.

To formulate such a model, the 'probability-of-observation' wave mechanics of quantum theory has been extended to a more general 'probability-of-experience' mechanics of consciousness, characterised by eigenfunctions of experience, wave-mechanical bonds of interaction, quantum mechanical principles of behaviour, and quantum statistical ensemble effects that can accommodate the observed phenomena as normal, rather than anomalous, consequences of the interaction of consciousness with its physical environment.

Applications and implications

Experimental results like those described above, while indicating the existence of consciousness-related phenomena that lie outside our current representation of reality, constitute only the most primitive specification of the nature of the processes involved, the conditions under which they happen, or the extent to which they affect the physical world. The subject remains quite obscure and highly controversial within the scientific community, and the difficulties involved in establishing appropriate research facilities, obtaining adequate funding and attracting competent investigators are sufficient to discourage most interested scholars from addressing their talents to this topic.

For all these reasons, any attempts toward pragmatic application of the effects should properly proceed with considerable caution. Notwithstanding (as often occurs in the evolution of scientific understanding), numerous efforts have already been made to exploit such processes for practical purposes. For example, various remote perception protocols are being applied in varying degrees in areas such as national security, law enforcement, missing persons searches, natural resource location and archaeological prospecting, and a variety of training programmes for cultivating these skills are commonly advertised.

In the PK category, the immediate implications seem more defensive than helpful, but are nonetheless seriously considered in various industrial and military sectors. The noise diodes, sampling circuits, counters and display units of the types used in the basic PK experiments are common elements in a host of contemporary information processing and control gear. It is therefore reasonable to question whether such systems, when intimately linked to human consciousness, are totally immune to performance aberrations like those already demonstrated. Given the growing reliance on integrated computational circuits and delicately poised microprocessor-controlled systems, some elements of which switch at only a few quanta of energy and tolerate far less binary error than the bits-per-thousand deviations that have been systematically demonstrated in the PK experiments, a substantial technical problem may conceivably be lurking. In a longer and more positive view, opportunities may also be envisaged for enhancing the efficiency and range of application of microelectronic systems by tuning their characteristics and functions to match the consciousness of their human operators.

Underlying all of these potentialities, and perhaps more consequential in the long run, are the possible implications of the demonstrated effects for evolution of the scientific paradigm, its methodology and the knowledge it can provide, and for yet broader issues of the human perspective of itself, its fellow man and its relation to the cosmos ■

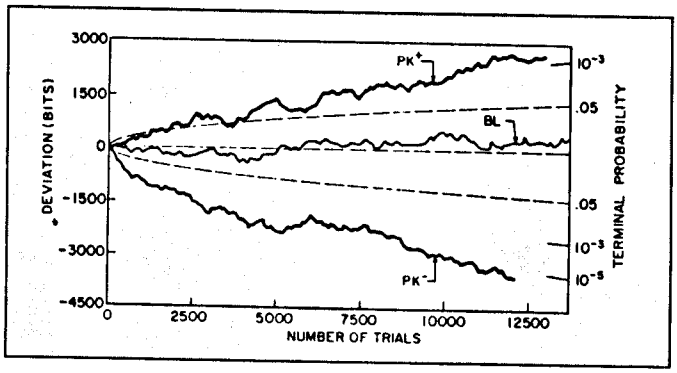

Figure 3 Random event generator cumulative deviations from chance mean

Further reading

Margins of Reality R G Jahn and B J Dunne 1987 (San Diego: Harcourt Brace Jovanovich)

'On the quantum mechanics of consciousness, with application to anomalous phenomena' R G Jahn and B J Dunne 1986 *Foundations of Physics* **16** (8) 721–72

'The persistent paradox of psychic phenomena: an engineering perspective' R G Jahn 1982 *Proceedings IEEE* **70** 136–70

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Handbook of Parapsychology B B Wolman (ed) 1977 (New York: Van Nostrand Reinhold)

'Meta-analysis of psi ganzfeld research: a response to Hyman' C Honorton 1985 *Journal of Parapsychology* **49** 51–91

'Replication in random event generator experiments: a meta-analysis and quality assessment' D I Radin and R D Nelson 1987 *Technical Report HIPG 87001* Human Information Processing Group, Princeton University, Department of Psychology

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