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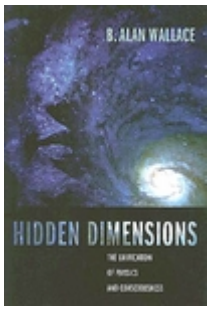

Mechanisms of Nonlocality and Its Implications to Physics and the Study of Consciousness

A Review of

Hidden Dimensions: The Unification of Physics and Consciousness
by B. Alan Wallace
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Reviewed by

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Hidden Dimensions: The Unification of Physics and Consciousness is an apt title for this thought-provoking and critical text. B. Alan Wallace, director of the Santa Barbara Institute for Consciousness Studies, is a scholar of Buddhism with credentials in quantum physics and quantum cosmology. I am neither an authority on religious or spiritual matters, nor an authority on quantum physics. However, I can speak to some of the issues dealing with the implications of his treatise for the conduct of scientific experiments pertaining to consciousness and the implications for understanding the observer in relation to neuropsychological experiments.

Nonlocality at Microscopic and Macroscopic Levels

By way of example, Gilbert Chauvet was a French mathematical neurobiologist who in addition to establishing the *Journal of Integrative Neuroscience* was among the first to demonstrate nonlocality or action at distance between long-range cerebellar networks and the prefrontal cortex (Chauvet, 1993). His primary thesis was that such effects result from hierarchy in the function and structure of the brain (which certainly is not an entirely new concept), however, it meshes with the natural philosophical notion of supervenience or the basic idea that psychological properties can be multiply realized in physical properties of the brain. These principles also apply equally well to social institutions, economics, and aesthetics.

Nonlocality has also been convincingly demonstrated at the level of quantum mechanical observations. Tittel and colleagues at the Group of Applied Physics at the University of Geneva only very recently demonstrated violation of Bell's inequality at a distance spaced six miles apart a decade ago (Tittel, Brendel, Zbinden, & Gisin, 1998). Yet, none of these significant empirical findings have received much in the way of serious scrutiny or scientific

theorization about what such findings could mean in terms of the design of specific psychological experiments pertaining to consciousness. Wallace's treatise is that the cognitive sciences are stuck in an antiquated 19th-century classical physics paradigm of either eliminative materialism or nontenable dualism that sees behavior and verbal reports as the only means of testing scientific hypotheses. Wallace convincingly argues that well-established, systematic, and rigorous methods of introspective and meditative training used by Buddhists for centuries could be one means by which such phenomena could be profitably studied.

Methods and Theory Associated With Measuring Nonlocality

Arguably, advanced case study methods have been available since the 1970s with which to study such introspective, subjective, and first-person introspective reports. What is often not known about case study research is that a single case can and often does reliably and validly allow for the deduction of generalizations about how social systems or the brain functions and that these observations with appropriate sophistication in design principles allow for generalizations to be made to the population at large. The six traditional sources of evidence in such designs include such tools as documentation, archival records, interviews, direct observations, participant observations, and physical artifacts. Methods of analyses include pattern matching, explanation building, time-series analyses, and, increasingly, program-logic models suitable for multivariate qualitative analysis (Yin, 1994).

These methodological considerations aside, Wallace has a gift for giving clarity to difficult conceptual and mathematical concepts pertaining to essential quantum mechanical and cosmological principles without diluting their meaning. The principle of locality assumes in parsimony with classical physical views that local phenomena cannot be influenced by events located at distant points. Insofar as the functioning of complex social and economic systems is concerned, this deeply held assumption by social scientists is becoming increasingly nebulous and tenuous. Nonlocality, then, as an offshoot of quantum mechanical theorizing, suggests contrarily that it is not possible to treat widely separated systems as independent and that a physical theory is said to exhibit nonlocality if it possible to violate Bell's inequality. Bell's theorem showed that Einstein's attempt to complete quantum theory with a new deterministic local theory cannot in principle function.

Wallace shows us how the Copenhagen interpretation model of reality postulated that the quantum world reduces to and only would find *meaning* in terms of classically observable phenomena and not the reverse scenario. Both Wallace and Byrne (2007) have shown that the Copenhagen interpretation privileges the external observer by placing that observer in the classical realm that is distinct from the quantum realm of the object that is to be observed. Princeton quantum cosmologist Hugh Everett (Byrne, 2007), in contrast, merged the microscopic and macroscopic worlds and thereby addressed the measurement problem such that large objects that are observed can also exist in quantum superposition. This "many worlds" interpretation places both the observer and the observed world into a single quantum system, as both Wallace and Byrne note.

Wallace then shows how at the moment of measurement the wave function describing the superposition of alternative worlds gives way to any one member of the superposition and banishes all other alternatives. One perceived weakness of this excellent text that appears

plainly would be the lack of an attempt to postulate functional neuropsychological or neurophysiologic mechanisms supporting this observer–observed mutual interaction. A second weakness is suggested by the fact that no attempt is made to distinguish what type, if any, of innate specialization in abilities might undergird the achievement of advanced Buddhist meditative states or in underlying the observer–observed interaction. Given the close nature between the Buddhist meditative state of *vipaśyanā*, or what is termed *insight* in Western psychology, there could well be some interesting parallels between the study of individual differences and brain function and differences in the ease with which different people achieve such higher Buddhist meditative states.

Wallace alludes to several types of studies moving in this general direction. Functional mechanisms by which nonlocality could become manifest would be whole-brain coordinative functions in which local high-frequency modules located in the posterior sensory cortices are nested within lower frequency frontoposterior temporal encoding. Single neurons within the frontal poles that encode intuitive processes or immediate sensing without reasoning associated with encoding archetypal figure-ground object background configurations would be another such mechanism. Perhaps other types of socioemotional archetypes manifest in social institutions at even lower frequencies could then become enmeshed with observer knowledge-based systems through the social lens of mirror neurons and would result in Gestalt alignment, amodal completion, grouping, and segregation of object features.

Furthermore, Wallace does not show how basic neurophysiological processes associated with human brains such as elasticity, electrical conductivity, and ionic conductances have already been shown to possess the necessary characteristics to yield quantum computational capabilities (Schwartz, Stapp, & Beauregard, 2005). Moreover, Wallace shows that features of consciousnesses that are notoriously subjective such as qualia could well be the source of such nonlocalities. Qualia are "the way things seem to us" and are characteristically independent of the (a) effects on behavior or of the (b) physical circumstances that give rise to them and are (c) manifestations of simple or multisensory experiences.

In agreement with Wallace, Schwartz and colleagues, and Kinsbourne (1996), the source of these generators of consciousness could be the basal forebrain in its interaction with posterior and subcortical zones through reentrant hierarchical feedback. In coordinating between the brain and the environmental total field, alignment and synchronization can occur, and this becomes manifest without any necessarily propositional knowledge or visual imagery via vector completion. That is, vector completion is neither pictorial nor verbalizable as, for example, an apple and a tree are both coextensive in a semantic possible world scenario.

A Future Revolution in the Mind Sciences?

These theoretical and empirical considerations aside, *Hidden Dimensions* is an extended meditative insight into what Wallace describes as the fourth scientific revolution, in which consciousness will be recognized as a force of nature with concomitant effects on matter, energy, space, and time. Wallace suggests that in time Copernican, Darwinian, and Einsteinian revolutions will give way to a fourth revolution that shows that consciousness is the critical medium between the observer and the object of observation. Many physicists who study string theory and quantum cosmology are already of the opinion that Everett's interpretation is essentially correct and now, due to the success of recent quantum

computation experiments, these speculative questions are no longer purely academic and have given rise to secondary interdisciplinary theoretical and empirical considerations (Byrne, 2007, p. 78).

It is perhaps interesting to note that these quantum effects of consciousness are emanating from physicists, not psychologists; Wallace would argue that this is a direct result of the idolization by psychologists of the core unstated assumptions associated with the classical physical view so that they are not cognizant of contemporary quantum physical and cosmological views.

Clearly the future is ripe for further empirical and theoretical development of this perspective with the use of proven methodologies and new paradigms. What is the nature of such observer–observed interactions? When, how, and under what conditions do such phenomena become manifest? How large are such effects in practice to measure? How does one begin to measure such effects? These are only a sampling of some of the questions that future researchers involved in this area may begin to want to consider.

References

Byrne, P. (2007, December). The many worlds of Hugh Everett. *Scientific American*, 72–79.

Chauvet, G. A. (1993). Non-locality in biological systems results from hierarchy. *Journal of Mathematical Biology*, *31*, 475–486.

Kinsbourne, M. (1996). Models of consciousness. In M. S. Gazzaniga (Ed.), *The cognitive neurosciences* (pp. 1321–1330). Cambridge, MA: MIT Press.

Schwartz, J. M., Stapp, H. P., & Beauregard, M. (2005). Quantum physics in neuroscience and psychology. *Philosophical Transactions of the Royal Society of London: B Series*, *360*, 1309–1327.

Tittel, W., Brendel, J., Zbinden, H., & Gisin, N. (1998). Violation of bell inequalities by photons more than 10 km apart. *Physical Review Letters*, *81*, 3563–3566.

Yin, R. K. (1994). *Case study research: Design and methods*.London: Sage.