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| Literature Review (Cont.): Connections with quantum Physics:  The foundation of the assumption that morphic fields are not subject to spatial decay �proof the existence of non-locality.  The hypothesis of formative causation describes certain aspects of morphic fields that have a kind of non-locality. This concept of non-locality is one, which is, as yet, unaccepted by the scientific community at large and thus, it serve as one of the major points of the hypothesis of formative causation that make it highly objectionable to many present-day scientists. Therefore I feel it necessary to dwell on it in order to give some arguments to satisfy these objections. Although non-locality is not an accepted theory, there is experimental evidence which proves its validity, which is in fact recognized by the scientific community as an �exception� �for lack of a better word� to the rule. And it is suspected that the properties of morphic fields, of relevance, are in fact related to these recent developments in Quantum Physics. Albert Einstein played an integral role in the development of the Quantum theory and at the time of his death he felt there was still much more to be understood about this field than we yet know. He disliked the concept, implied by the quantum theory, of �spooky action at a distance.� The implications of these recent developments are such that they rescind much of the assumptions of classical physics. They are very paradoxical in nature and represent an aspect of science that is highly unintuitive. In general, parts of a past quantum system seem to retain instantaneous connections in the present even when no longer in each other�s proximity. At the Center for Quantum Computation (CQC) the concept of quantum entanglement was explicated using the unorthodox analogy of a bank robbery. In the day-to-day world that is well described by classical physics, we often observe correlations �simple correlations between regular every day objects. Now, imagine you are observing a bank robbery. The situation is the following: the bank robber is pointing a gun at the terrified teller. From this one can deduce quite logically that by looking at the teller you can tell whether the gun has gone off or not. The following relationship or correlation can be deduced: If the teller is alive and unharmed, one can be sure the gun has not fired. If the teller is lying dead of a gunshot wound on the floor, one knows that the gun has fired. This is elementary detective work. On the other hand, (again based on the deduced premise that if the gun has fired the teller is dead) by examining the gun to see whether it has fired, one can find out and conclude whether the teller is alive or dead. Therefore we could say that there is a direct correlation between the state of the gun and the state of the teller. 'Gun fired' means 'teller dead', and 'gun not-fired' means 'teller alive'. We assume that the robber only shoots to kill and he never misses. But in the world of microscopic objects described by quantum mechanics, things are not always so simple. Imagine an atom which might undergo a radioactive decay in a certain time, or it might not. We might expect that with respect to the decay, there are only two possible states here: 'decayed', and 'not decayed', just as we had two states, 'fired' and 'not fired' for the gun or 'alive' and 'dead' for the teller. These seemingly simple correlations in the Newtonian/Classical world give the illusion of determinism. However, in the quantum mechanical world, there is an alternative situation, it is also possible for the atom to be in a combined state 'decayed-not decayed' in which it is neither one nor the other, but somewhere in between. This is called a 'superposition' of the two states, and is not something we normally expect of classical objects like guns or tellers. Two atoms may be correlated so that if the first has decayed, the second will also have decayed, and if the first atom has not decayed, neither has the second. This is a 100% correlation. But the quantum mechanical atoms may also be correlated so that if the first is in the superposition �decayed-not decayed�, the second will be also be �decayed-not decayed�. Quantum mechanically there are more correlations between the atoms than we would expect classically. Classically, there is only a relation of 100% correlation, meaning the states of the atom are as follows: decayed and decayed, or not-decayed and not-decayed. However, in the quantum mechanical world there are several intermediate states (�super-positions�) for the atoms. (E.g. �decayed-not decayed� and �decayed-not decayed�) This kind of quantum 'super-correlation' is called 'entanglement'. Schrodinger a German physicist was one of the first people to realize how strange this concept of entanglement really was. Entanglement was originally named in German, by Schrodinger, as 'Verschrankung'. The paradoxical aspect arises here: Imagine it is not the robber but the atom which determines whether the gun fires. If the atom decays it sets off a hair trigger which fires the gun. If it doesn't decay, the gun doesn't fire. But what does it mean if the atom is in the superposition state 'decayed-not decayed'? Then can it be correlated to the gun in a superposition state 'fired-not fired'? And what about the poor teller, who is now dead and alive at the same time? This state of �inbetweeness,� of super-position is more easily understood when merely thinking of inanimate atoms at a microscopic and perhaps even inapplicable level. But what when the cumulative influence is considered. Upscale the effects. Consider it in the classical world and you�ve got a mind bending seeming impossibility. For example, consider the predicament Schrodinger faced here: he was worried by a similar situation where the victim of the quantum entanglement was a cat in a box where the decaying atom could trigger the release of a lethal chemical. The problem is that in the everyday world we are not used to seeing anything like a 'dead-live' cat, or a 'dead-live' teller, but in principle, if we expect quantum mechanics to be a complete theory describing every level of our experience, such strange states should be possible. So the next logical question which demands to be answered is �Where does the strange quantum world stop and the ordinary classical world begin?� These are problems which have now been debated for decades, and a number of different interpretations of the quantum theory have been suggested.  The problem was brought into focus by a famous paper in 1935 by three of the most well known physicists, Einstein, Podolsky and Rosen (known as the EPR paradox.). They argued that the strange behavior of entanglement (what Einstein called �spooky action at a distance�) meant that quantum mechanics was an incomplete theory, and that there must be what came to be known as 'hidden variables' that have not yet been discovered. From this arose alternative theories to quantum mechanics known as hidden variable theories. This produced a famous debate between Einstein and Niels Bohr (another well known name in physics), who argued that quantum mechanics was complete, and that Einstein's problems arose because he tried to interpret the theory too literally. However in 1964, John Bell pointed out that for certain experiments classical hidden variable theories made different predictions from quantum mechanics. In fact he published a theorem which quantified just how much more strongly quantum particles were correlated than would be classically expected, even if hidden variables were taken into account. This made it possible to test whether quantum mechanics could be accounted for by hidden variables. A number of experiments were performed, and the result is almost universally accepted to be fully in favor of quantum mechanics. Therefore there can be no 'easy' explanation of the entangled correlations. The only kind of hidden variables not ruled out by the Bell tests would be 'non-local', meaning they would be able to act instantaneously across a distance.  More recently, from the beginning of the nineties, the field of quantum information theory opened up and expanded rapidly. Quantum entanglement began to be seen not only as a puzzle, but also as a resource for communication. Imagine two parties, Alice and Bob who would like to send messages to one another over a distance. In 1993, Bennett et al. showed that if Alice and Bob each hold one of two particles which are entangled together, a quantum state can be transmitted from Alice to Bob completely by sending fewer classical bits than would be required without the entanglement. This process has been called 'quantum teleportation'. It involves not only bits for sending information, but 'e-bits', or entanglement bits, which consist of a maximally entangled pair of particles. Other ways in which entanglement can be used as an information resource have also been discovered, for example, dense coding, cryptography and applications to communication complexity. Entanglement was found to be a manipulable resource. Under certain conditions, states of low entanglement could be purified into more entangled states by acting locally, and states of higher entanglement could be 'diluted' to give larger numbers of less entangled states. Meaning entanglement can be reduced or increased.  Investigation of quantum entanglement is currently a very active area. Research is being done on measures for quantifying entanglement precisely, on entanglement of many-particle systems, and on manipulations of entanglement and its relation to thermodynamics. In Paris in the 1980�s a repeatable and conclusive experiment was carried out proving the existence of non-local influence. Alain Aspect et al performed the Paris Experiment in 1981. Einstein�s fear�s had come true and this experiment heralded the advent of Quantum entanglement. The experiment had the following parameters. Two photons, (by definition travelling at the speed of light) moving in opposite directions from a central atom that has emitted them retain an immediate non-local connection. This correlation between the two photons is such that if the polarization of one was measured the other will instantaneously have the opposite polarization. This occurs even though the polarization of the photons was not determined until the instant the measurement was taken. (Proof of quantum entanglement, non-local influence, and �spooky action at a distance.�) The two parts of the same quantum system are separated in space but are linked by a quantum field. The complications arise once again (as in morphic fields) when attempting to determine the properties of these fields. The quantum fields are not ordinary fields in space like magnetic fields, but they are rather represented mathematically as a multidimensional space of possibilities. A location or region where there are several possibilities (super-positions) for it�s constituent elements determined by this quantum field is known as a quantum system. And this link of possibilities is mathematical in nature and can act instantaneously and non-locally. Like atoms and molecules in a quantum system, the members of social groups share a system. This is obvious in their physical correlations: they share food, breath the same air, interact continually and now we say they are interconnected through their minds and senses. When they are separated like the elements of a quantum system, these parts of one social system may retain a non-local and possibly non-separable correlation comparable to that observed in quantum entanglement. The theoretical proof of morphic field�s non-local influence lies in quantum entanglement and its effective evidence comes to light in my experiment. But, I merely investigate the outward manifestations of this phenomenon and a step that physics may well need to take would be to make an extension of the quantum theory to the degree that it covers biological systems and social organization. (For further reading on the topic of Entanglement and non-seperability read the work of David Bohm; for further reading on its connection with the hypothesis of formative causation, read the works of Amit Goswami and Hans-Peter Durr.)  ([Intro1](http://docs.google.com/introduction.html))([Intro2](http://docs.google.com/intro2.html))(Intro3)([Intro4](http://docs.google.com/intro4.html))    [Home](http://docs.google.com/home.html)][[Introduction](http://docs.google.com/introduction.html)][[Hypothesis](http://docs.google.com/hypothesis.html)][Procedure][[Data](http://docs.google.com/data.html)][[Conclusions](http://docs.google.com/conclusions.html)][Bilio/Links]  [2002 Projects](http://docs.google.com/AP2002/index.html)][[2001](http://docs.google.com/index.html) ][[2000 Projects](http://docs.google.com/AP2000/index.html)][[1999](http://docs.google.com/AP99/index.html) ][[1998 Projects](http://docs.google.com/AP98/index.html)] |
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