Four-Dimensional Physics, Nonlocal Coherence, and Paranormal Phenomena

C.W. Rietdijk

Abstract

1. We note that, as soon as retroaction and nonlocality (in an ordered way) interfere with physical phenomena, we may get the impression of "miracles" (paranormal phenomena) from a local causal point of view: the latter cannot explain them.
2. We start from some well-known processes, such as Young's double-slit experiment and EPR, in order to extend relevant feedback processes and nonlocal coherence to living organisms and their influence on the environment.
3. We explain how retroaction emanating from living organisms may take the shape of goal orientation and make psychokinesis (PK) and clairvoyance easier to understand. We discuss concrete models of PK and clairvoyance and of striking coincidences and telepathy.
4. Our physical model joins with the "observational theory" that dominates in professional parapsychology.
5. We investigate how far such a model implies humankind to be a four-dimensional organism up to a certain degree, taking into account hitherto unknown interindividual unconscious communications.
6. In all, our theory implies a change of paradigm, which also leads to an integration of deterministic "God does not play dice" and antireductionist "A microprocess acts as a whole." That is, it introduces nonlocal determinism in which the psychological dimension is inherent.

Key words: microphysics, EPR, nonlocal, consciousness, paranormal, observational theory, psychokinesis

If the paranormal makes sense, it tends to show the world to be *more* rational — defined by comprehensive laws — rather than less, with the coherence effected by these laws going radically beyond the scope of local causality.

In other words, "God does not play dice" on the more than local level either.

1. INTRODUCTION; EARLIER RESULTS

It appears more natural to think of physical reality as a four-dimensional existence, instead of, as hitherto, the evolution of a three-dimensional existence.
Albert Einstein

1.1 The World Is Realistically Four-Dimensional

Einstein was right, as can be rigorously proved. In various different ways — by using the constancy of the velocity of light and its consequences for the reality of "now-at-a-distance," by closely considering the Lorentz contraction of measuring rods, as well as by a thought experiment considering a rotating belt in two inertial systems — we demonstrated the universe to be realistically four-dimensional.[1–4] The future "already" existing, this implies determinism.

Also, we gave various proofs that *retroactive influences* are operative in some experiments[3,5–7] (see also Section 1.2). This means that in some cases (and within the "uncertainty" margins Δ with respect to relevant variables) *the future influences the present*. Such activity can hardly be imagined without the future "already" existing, in agreement with Einstein's above idea.

A realistically four-dimensional "block universe" has various radical consequences as to how we look at

nature and the laws seeing to its coherence. In view of events (processes) rather than objects now becoming the "stuff" the world is made of, we should also expect *natural law to mutually relate and order events rather than objects*, e.g., forces and influences merely being three-dimensional representations of four-dimensional symmetries and the "architecture" of the "lattice" L of all events that four-dimensional reality is. We will see below that abandoning our prejudices about three-dimensionality solves various "paradoxes," *inter alia*, about nonlocality, the "impossibility" of coherent models in microphysics, and the role of an observer in the "collapse" of a wave-packet.

Remark: This paper is primarily a physical argument. Still, philosophers and alpha scholars may be interested too as far as they can understand it. The way of thinking, however, is that of beta science. Up to now, the world has appeared to be so consistent and coherent that sound arguments from one discipline (say, philosophy) never contradict sound arguments from another (say, physics). In case of contradictions, at least one course of reasoning cannot but be wrong, because otherwise two correct arguments would be mutually contradictory. Therefore the author is suspicious of possible nonphysical reasoning that purports to demonstrate, say, the fundamental contingency of the future *without finding fault* in the arguments of the references of this subsection.

This does not imply my considering philosophical arguments and commonsense counterconsiderations with respect to my relevant demonstrations to be less important. They only cannot be assumed to contradict sound physical reasoning *and*, *conversely*. For two sound arguments will not mutually contradict. For example, in a conflict between physical and logical argument, one of them can be expected to be wrong. Neither, say, can sound chemistry and biology be mutually contradictory. The above means that "a merely physical proof" or a merely philosophical one is in principle sufficient, e.g., to demonstrate the idea of a block universe.

Still, some may feel Einstein's idea and my proofs about a "block universe" to be so counterintuitive that they continue to have doubts in spite of the proofs being virtually unchallenged. For them too, however, it cannot but be relevant if four-dimensionality of both the universe and its laws *as a working hypothesis* were in a position of explaining such intriguing phenomena as consciousness and the "paranormal." Also note in this context that, among others, Feynman accepted realistic four-dimensionality at least implicitly as a working hypothesis in his considering "particles travelling backwards in time (coming from the future)." (For the rest, Ref. 11 of the present paper contains with its Fig. 2 an outline of a demonstration of realistic four-dimensionality that is easily accessible to readers of this journal.)

As to the relation of my work to the research of others I can be rather brief. As far as I know, neither psychologists, nor philosophers, *nor even other physicists* have hitherto researched their domains from a consistently realistic four-dimensional point of view. Indeed, if on the Internet you look for the combination "microphysics" and "understandable model(s)," or "microphysics" and "imaginable model(s)," you get about 30 hits. If you look for "string theory" and "physics," you get 736,000! The above may help to explain why, as in various previous publications, my references refer to my own work to a disproportionate extent. In consistently pursuing the block universe position — apart from new explanations about consciousness and the paranormal — I found indeed explanations and understandable models relating to the wave-particle "dualism" and nonlocality, to an understandable four-dimensional picture of the quantum of action, to a physically relevant "action metric," to a "Mendelejev system" for elementary particles, to retroaction, and as regards new light on the Bohr–Einstein controversy about micro-processes constituting a whole and about hidden variables (HVs).

It may very well be that both Einstein's preference and my demonstrations had so little follow-up in the shape of concrete physical research and explanations because the block universe concept is contrary to various emotional preferences about such things as free will, fatalism, and the (subjective) idea of our "traveling in the time direction" (see also below).

1.1.1 Some More Relevant Philosophical Considerations

The above by no means makes it superfluous to discuss some important philosophical and commonsense counterconsiderations with respect to four-dimensional realism.

1. To begin with, this point of view at first sight seems to imply that — "the (or my) past still existing" — the Holocaust and all horrors of history *would not really be over yet*, but would continue to exist (for many distant observers as now at a distance).

Solipsism would be a "cheap" way out, but it creates many problems. In my opinion, a much less far-fetched solution is possible, which I briefly enunciate now.

In the conventional model of reality — a present that is progressive in time and also separates two ontologically different parts of the four-dimensional Minkowski world: a defined past and an intrinsically contingent future — the transition "pre-Holocaust" → "post-Holocaust" (or rather, pre and post some point-like event P of it) is an objective transition from P being future (and contingent) to P being past. This would also end the relevant suffering for good. All distant observers would agree that such an ending corresponds to the *ontological* transition future → past of P. P only appears once, though various distant observers will locate it in their ("private") distant past, present, or future, according to their locations and velocities.

On the contrary, in the block model, neither are the myriad transitions future → past of an ontological nature (*inter alia*, as to "fuzziness" or contingency), nor are the many future → past transitions an observer's world-line consists of ontologically mutually different, as understood by other observers. The crucial point is now that each event P is experienced as transient by the conscious organism C experiencing it, as an ontological characteristic of this very experience, apart from the question of whether distant observers locate it in their past, present, or future. If a distant observer O (distant with respect to P) modifies his velocity so that it first corresponds to "P is past for him (O)" and subsequently corresponds to "P is present for him," this does not undo the fact that C still experiences P inherently as transient and nonrecurrent by the very causal and other coherences of C's existence. That is, such transience is part and parcel of the way C at P, as a conscious entity, experiences the world.

In short, though all subjectively transient experiences P of all observing consciousnesses C are ontologically real and defined (noncontingent), *this does not alter the fact* that all C's, by their very nature of experiencing things in the four-dimensional world only partially (i.e., three-dimensionally), in an order also defined by causality, experience all P's as transient and nonrecurring. P may "return as present" for a distant observer; it does not for the consciousness that once experiences it. The vital point is that consciousness never experiences more than one point event on its world-line, within the scope of its three-dimensional "horizon" and a largely logical and causal order of the relevant experiences. C may realize: many distant observers will now (for me) locate "my past P" as "now at a distance (for them)," but this does not change the order in which I experience my life, and the transience of everything for me, because of my inherently limited horizon.

2. A second counterconsideration with respect to the block idea is related to the above, that is, the intriguing question of how, in a static block universe, all of us "dynamically" experience our "movement" in the $+t$ direction. This problem may be brought nearer to a solution by our hypothesizing that it could be inherent to the integrated cooperation of natural laws and processes that results in conscious experiences, that such consciousness has as an aspect a time-like order of its experiencing the world. Such order may be inherent to how logic and causality work. This would mean that logic and causality, and the role they play in conscious organisms, imply that such organisms, as an inherent aspect, experience their lives in an order of the sequence of events on their world-lines that "seems the most logical to the organisms," also by joining with causality. Thus the special role of time direction in conscious experiences would correspond to the way natural laws function and to how they generate consciousness in the first place. (Note that the way consciousness experiences time is a mere aspect of the way it experiences the world.) We generally ascribed consciousness to *natural laws in action* (see Section 1.5 and the reference there, particularly point 1). Now it would join with this idea if, in such laws "bringing about something," their "conscious features" would experience this "bringing about" indeed as some development in time, which would bestow a particular status on time among the other dimensions. Time has a special relation to "causal effects" and, therefore, to (the conscious features of) natural laws. That is, only in experiencing the four-dimensional world in the time direction may consciousness experience it as logical and causal and thus undergo the *Aha-Erlebnis* that is vital in our general theory of consciousness (see again Section 1.5).

3. Many will feel a block universe to be counterintuitive by the circumstance that people will feel like they have free will, so that the future should be contingent to a considerable degree. Here the solution seems rather simple: the idea of free will could be purely subjective. This has even been experimentally established by Benjamin Libet (University of California; for further reference see *Der Spiegel* of 15 April 1995, p. 190). Libet found that, one third of a second prior to specific "free-will decisions," brain-measuring apparatuses could already establish what decision would "emerge" subjectively one third of a second later.

4. In a way, the block universe can better be harmonized with "religion without sorcery" than our traditional model starting from local causality completed by mere probability, which implies much contingency of the future. For, simply formulated, "God would play dice with tragedy" if my and others' destiny were indeed fundamentally contingent rather than defined according to four-dimensional laws that refer to results too and that may enforce so much nonlocal coherence that harmony and justice might eventually follow without "divine sorcery." "God" would be in the coherence of natural laws. On the other hand, determinism and the absence of any truly free choice would also contrast with many people's idea of religion, which supposes us to be responsible for our own lives and free decisions. The latter are indeed problematic in a block universe.

5. Four-dimensional realism radically contrasts with what may be called a *major current paradigm* that is characterized by the concepts of relativism, uncertainty, coincidence, fuzziness, observer-dependence of phenomena, or even subjectivism. Elsewhere I called this the *RU paradigm*. Note the following:

a) It is a moderate generalization of postmodernism.
b) It refers to philosophy, social science, and the psychological domain, as well as microphysics and the meaning of life, as associated with a possible macro-coherence of the world. In all, it dominates current thinking in general. (As regards microphysics, think of positivism that is not interested in or even rejects definite models and accepts much ontological uncertainty and fuzziness.)

The block universe idea, implying an unequivocal existence of all events and their possible relations, cannot harmonize with the RU paradigm and, probably, is not popular for that reason. Determinism and four-dimensional natural laws that also imply nonlocal coherence cannot match well with uncertainty, coincidence, fuzziness, etc. With respect to such four-dimensional and partly nonlocal natural laws, I refer to many sections below. In a way, four-dimensional reality and corresponding laws amount to "superrationalism," whereas the RU paradigm implies the opposite. In any case, the block idea allows both retroactive and nonlocal influences in addition to "classical" local causality (see in particular Sections 1.2, 1.3, and 1.4). Such additional influences and corresponding laws *tend to increase nature's coherence* and to reduce chance and mere probability. (Also compare Ref. 11, where we found retroaction to be in a position to act as an HV.)

Concluding the above "philosophical excursions," I feel that the least thing that has been added to our knowledge by the demonstrations of Refs. 1 to 7 is that they imply more coherence (unifying power) and simplicity as to our model of the world. In my opinion, not much more at all can be done to make an argument scientifically convincing. I know that some — physicists, philosophers, and others — do not share this opinion. Still, if they oppose the "pretension" of my arguments, they have an obligation to produce cogent reasoning that allows a simpler and more coherent model of the world than my proofs correspond to. (Also compare my earlier remark about a *working hypothesis*.) This is the more so in view of the circumstance that the realistically four-dimensional model offers a real possibility of contributing essentially to an explanation of such fundamental phenomena as consciousness and the paranormal.

More fundamentally, we may argue that what fits best with a model of the world that offers optimum coherence and simplicity is "preliminary truth." In actual fact, we do not have any more objective standard of truth than this. Therefore the impact of, say, a physical demonstration of the coherence and simplicity of a particular model transcends the merely mathematical and "technical" level. Hence it is also philosophically important if Refs. 1 to 7 show four-dimensional realism to imply more coherence and simplicity than conventional three-dimensionality.

For those readers who want to go more deeply into various philosophical aspects, pros, and cons of the idea of a realistically four-dimensional nature of the world (block universe), I refer to some thorough treatments that are accessible via the internet. Yahoo gives about 60 hits on the relevant word combination <Rietdijk Putnam Penrose argument>. Among them:

1. "Being and Becoming in Modern Physics" (*http://plato.stanford.edu/entries/spacetime-bebecome/index.html*), where many pages from the *Stanford Encyclopedia of Philosophy* about the problem of realistic four-dimensionality are directly accessible.
2. "Consciousness Studies: the Philosophical Problem" — Wikibooks (*http://en.wikibooks.org/wiki/Consciousness_studies:_The_philosophical_problem*). See particularly Section 3.2 — "Presentism and Four-Dimensionalism" — and the following sections. One quotation: "This experiment [of Lindner et al., 2005] is remarkable because it provides direct evidence that time exists in a similar fashion to the way that space exists."

3. "STR: The Lorentz Distortions" (*http://www.twow.net/ObjText/OtkCaLbStrC.htm*).

1.2 Outline of a Demonstration of Retroaction

We summaries one of our demonstrations of retroactivity, viz. that of Ref. 6. See Fig. 1, which shows a variant of Young's double-slit experiment in which, this time, we have the following:

a) The scale is so large that momentum carriers from A and B need an hour to move from S to the T region.
b) An observer O with T may decide to remove T 1 min before the bulk of the momentum carriers arrives. Such possible removal exposes plates P, Q, R, …. Because the latter's produced parts all pass through C on S, wave elements from A can only hit the upper sides of P, Q, R, …, whereas elements from B will only be absorbed by the plate's lower sides. This means that if O indeed removes T in time, not much interference of the A and B waves near or on the plates will occur, which implies a rather *even distribution of momentum carrier arrivals as to their corresponding y momenta.* Evidently, *this has consequences as regards the y momenta of the carriers that result from their interactions with S* (or the slits A and B).

On the contrary, if O had decided to leave T in its place, the well-known Young interference fringes on T would have appeared. This, however, would have corresponded to a specific clustering of the directions in which the carriers move from A and B to T. Hence we cannot but have an even distribution of the y momenta of carriers starting from S if — 59 min later! — O chooses to remove T, and "clustering" if he decides to leave T in its place. That is, many momentum interactions in A and B are retroactively influenced by the physical result of O's choice 59 min later!

A formulation of this state of matters that will appear to be important in what follows is this: in order that, in the T region, the three laws below *are all fulfilled at the same time*, it is necessary that the uncertainty margins Δp_y of the wave-like momentum carriers in the S region are filled in two quite different ways according to O's two alternative choices as to T, 59 min later (i.e., an hour minus the last minute before the carriers hit T):

1. conservation of momentum,
2. the superposition principle,
3. the $P = |\psi|^2$ probability law.

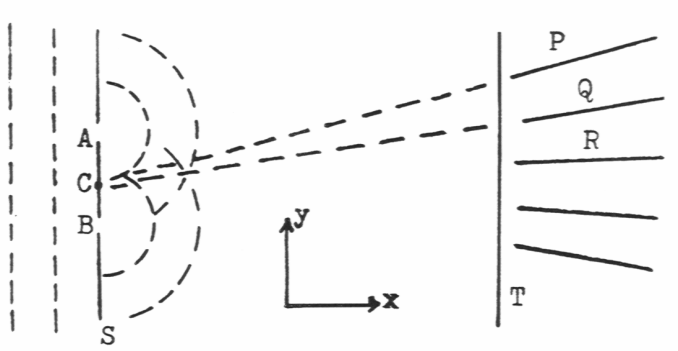

Figure 1. In a variant of the double-slit experiment, conservation of y momentum would be violated if no retroaction appeared.

In other words, physical laws 1 to 3 jointly retroactively "coordinate" to some degree the fillings-in of many relevant Δp_y margins 59 min in advance of O's decision. Note here that conservation of momentum requires that — particle-like or wave-like — momentum carriers on their way through the vacuum from S to T cannot change their y momentum after their last physical interaction, i.e., with S. Realize in the above context that only the violation of momentum conservation of the relevant momentum carriers can avert our conclusion that retroaction appears, and that such a violation not only has never been found experimentally but is also theoretically impossible on account of Noether's theorem.

Positivists may object that considering momenta (i.e., those of the carriers on their ways) that cannot be measured without disturbing the experiment does not make physical sense. Our answer is that this position — viz. only reckoning with and arguing about what can be measured — in many cases sacrifices the essence of real *understanding*: coherent models of reality. Hence, if we want to stick to these models, retroaction cannot be done without.

To be more specific, we add some remarks about the concept of truth as relevant to physical thought and argument.

In the first place, physicists will have no difficulty recognizing as "realistic phenomena" things that can actually be observed. However, the back of the Moon, the big bang, or temperatures at the center of Earth still belong to physical reality, simply because we need them in a coherent and consistent picture of the world. Therefore we "extrapolate" much of directly observed reality. We do not see any physical or philosophical reason why it would be problematic to

continue such "extrapolation" in microphysics. For example, we should consider as equally "real" as the back of the Moon such momenta and general behavior of momentum carriers as are required by conservation or other laws. It is not a good starting point in physical argument — e.g., the one referring to Fig. 1 — if we assume physical law to be no longer complied with as soon as we cannot look without disturbing the experiment.

In microphysics, positivists will posit that aspiring to understandable models and concomitant specific values of observables "leads to paradoxes" and, therefore, should be abandoned. My own position is that the "paradoxes" (Michelson–Morley, ultraviolet catastrophe, etc.) eventually leading to special relativity and quantum theory were answered in a more productive way, viz. by our abandoning some important prejudices that prevented us from integrating various observed phenomena into consistent models of "what really happens." In earlier papers referred to (see especially Refs. 3 and 8), I showed that — in a similar way — the quantum "paradoxes" (e.g., arising from our consistent arguing in detail about microphenomena) disappear if we make our models four- rather than three-dimensional and correspondingly look in new ways at distance, nonlocality, the quantum of action, the wave/particle problem, the Einstein–Bohr controversy, and various other concepts and phenomena. In all, realistic four-dimensionality restores coherent models without our having to invoke "fundamental fuzziness" or the positivistic abandonment of details and real understanding (i.e., models).

We addressed these partly philosophical problems, not because we really need their solution in what follows, but because we feel it to be advisable to consider this work in a somewhat broader context.

1.3 Action Metric Can Explain EPR and Nonlocality in General, as Well as Retroaction

In earlier work[3,8] we introduced the concept of the *action metric* as relevant to the relations between (four-dimensional) *events* rather than (three-dimensional) *objects*. It differs from the Minkowski metric (which *to some degree* also refers to the "block universe" of Section 1.1) by consistently defining the "action distance" between two elementary events A and B as the amount of action needed to transform A into B.

Consider Fig. 2, which sketches in Minkowski space (Mi) the world-line *ict′* of a freely moving particle S, whose four-dimensional (monochromatic) wave-packet consists of slices 1, 2, 3, ….

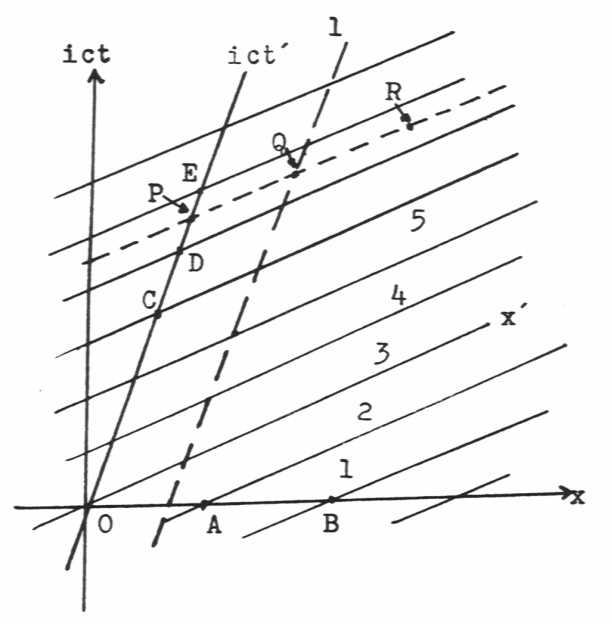

Figure 2. *ict′* is the world-line of a freely moving particle; slices 1, 2, 3, … are four-dimensional pictures of the matter waves going with its movement; and OA is their wavelength as experienced by an observer at rest in (*x*, O, *ict*).

For this simple case we now introduce the action metric as follows. As shown in our references, sections such as CD and DE correspond to one de Broglie clock tick on *ict′* of $\Delta t' = h/(mc^2)$, m being S's rest mass.

Further, the amount of action going with CD or DE is $e \times \Delta t'$, e being S's rest energy. Hence $e \times \Delta t' = mc^2 \times h/(mc^2)$, one quantum of action. On the other hand, the action corresponding to P, Q, and R (reckoned from O) is 4 1/2 h. For instance, reckoned from A it is 5 1/2 h because, say, A and P make a difference of 5 1/2 slices. Most relevant to our further arguments is the circumstance that *the action going with P, Q, and R is the same*, their mutual action distances being zero. That is, the action — or "amount of occurring" — needed to change the event "S passes P in its movement" into "S passes Q" *is zero*. Now we take action distances to be physically very relevant as to how nature works, e.g., in the sense that "the action distance PQ is zero" actually means "P and Q are physically mutually contiguous; they do not differ essentially as physical situations." *Inter alia*, this means that S covering *ict′* or *l* does not make a physical difference, at least *as far as our process of the moving S is at stake*.

As argued in our references, the concept of the action metric also solves the nonlocality paradoxes in

quantum mechanics. For example, it solves how "S covers *ict′* and *l* at the same time." Or how, in Fig. 1, "a momentum carrier passes A" and "it passes B" are physically equivalent in terms of the (local) action.

Figure 3 shows a simplified explanation of EPR (for a more thorough explanation see Refs. 3 and 8). Arguing as with Fig. 2, the action (reckoned from the common emission event E of the correlated particles 1 and 2) is 3 1/2 h at measurement events A and B, respectively. Hence the action distance of A and B as events is 3 1/2 h – 3 1/2 h = 0, which, from the standpoint of both the Euclidean and Minkowski metrics, amounts to a nonlocal phenomenon as far as the results of measurements A and B *"influence" each other from "a distance."* Action-physically, however, they are mutually contiguous: their distance ACB is zero. Small wonder, then, that we have such influencing or correlation!

In Ref. 8 we also gave a detailed explanation (an understandable model) of *retroaction* by means of the concept of action distances.

For the rest, note that retroaction as discussed with Fig. 1 also amounts to nonlocality (i.e., in a time-like direction from the T region to the S one, if we use massive particles). The general explanation of Ref. 8 also refers to how a *feedback* of causal and retroactive influences can appear in various processes via world-lines (such as those of the particles in Fig. 1).

1.4 The Nonlocality of EPR Is Just the Tip of the Iceberg

We somewhat elaborate an example of Ref. 9 (Section 7.2) to the effect that conservation of momentum (and other variables) requires that nonlocal correspondences such as between A and B of Fig. 3 "abound in nature."

Consider an emission, say, of a particle A from point event E (see Fig. 4), with which the emitter B experiences a recoil. If B is found at B_1, A's corresponding location is at A_1. A_2 and B_2 could also have been corresponding options. At possible measurements, or by other interactions, A and B are further transferred, say, to A′ and B′, respectively, and so on by other collisions, etc. Because of the four-dimensional definiteness of the world, A and B (and other momentum carriers) actually cover definite proper paths that all imply definite choices within location and momentum uncertainty (Δ) margins. Moreover, the mere conservation of momentum requires the velocities of A, B, and other particles to correspond to such choices "within" Δ margins that comply with *x*, *y*, and *z* total momenta to be constant. The implication of the EPR-like nonlocality of such

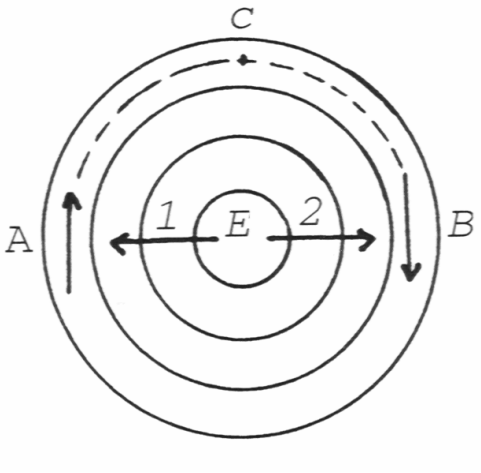

Figure 3. Three-dimensional picture of EPR. The action distance ACB is zero so that measurement events A and B are action-physically contiguous and can mutually influence each other.

choices appears as follows. For a while, looking away from particles other than A and B, it would be impossible for A and B at A′ and B′ to make their choices as to filling in Δp_x so as to correspond to the maximum combined value of p_x, say, after having done so corresponding to a minimum combined p_x at A_1 and B_1! For — still looking away from other particles — conservation of *x* momentum would have been violated. It is clear from the above that additionally implying 1, 2, or *n* particles in the argument would not detract from its essence: the fillings-in of myriad momentum Δ margins should mutually correspond nonlocally (in all inertial systems) in view of conservation. That is, the many momentum carriers in some EPR-like way *should not make their mutually distant choices as to Δ-fillings-in independently, but mutually coordinatedly*, also as to all other conserved variables. Figure 4 illustrates the relation to EPR nonlocality.

Conclusion: Just as with EPR, some instantaneously operative feedback channels cannot but appear between mutually distant "HV choices," say, at A′ and B′, on pain of the violation of conservation laws.

1.5 Some Remarks on Consciousness, Referring to Earlier Results

As we will try to explain the paranormal from various features of natural law, and especially from the functioning of consciousness, we first summarize some earlier results about the latter. For an elaboration see Ref. 10. Our explanation of consciousness from coherences in the complex of natural laws concentrates on the following points:

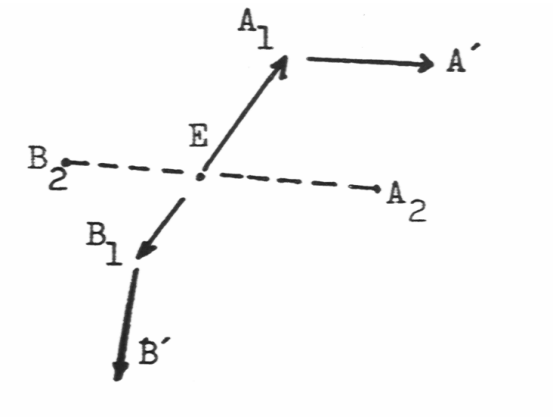

Figure 4. B recoils from E to B_1 after emitting A to A_1. B_2 and A_2 are alternative choices within relevant uncertainty margins. Subsequent collisions may bring B and A to B′ and A′, respectively. The A_1 and B_1 conditions are nonlocally interdependent; so are (in a more complicated way) those at A′ and B′, as is inevitable in view of conservation, *inter alia*, of momentum.

1. We see psychological phenomena as *natural law in action*, as we reject magic. Within this scope, *inter alia*, we do not delegate intelligent goal orientation to something like "free will" or "creativity" but locate it in natural law and processes. Even writing Newton's *Principia*, in one way or other, will ensue from deep coherence in the principles that made them "conspire" to the book's production.

On many occasions, natural laws and processes deal with (organized) "chunks" of matter or information; compare chemical and biological processes dealing with molecules or cells as wholes. We also consider those laws, etc., that order entities of the psychological category — feelings, strivings, associations, … — in line with this. In this context consciousness plays a part in ordering, say, observations and association complexes as chemical laws do with molecules. (Of course, we should at the same time explain associations, strivings, etc., *in the first place*.) In this capacity consciousness *is part and parcel of the coherent complex of natural laws*.

2. We do not assume the process of consciousness to be produced by dead atoms from the latter's cooperation in the shape of electric currents or flows of chemicals in the brain, or by computers that become ever more complicated. *Consciousness anyhow having to be introduced in nature*, on a certain level, we chose the more fundamental way to do so via hypothesizing a far-reaching coherence in natural law rather than by means of such "technical" phenomena as the relevant currents and flows.

3. In order to be more specific, we should first note that Einstein, in discovering and "recognizing" relativity, got various *Aha-Erlebnisse*. Now realize that in making nature function coherently according to relativistic principles, physical laws and processes themselves should also be in a position to do something like what Einstein's mind did in his *Aha-Erlebnisse*: recognize each other in order to cooperate. We now *locate (elementary) consciousness on this very level*: as an aspect of the coherence, mutual recognition, and cooperation of natural laws and processes. Within this scope, (elementary, primary) consciousness is *introduced by us into natural phenomena* as being inherent to the "well-considered" functioning and cooperation — which require mutual recognition — of natural laws and processes. (That is, it is just as inherent to nature as space-time and energy.) It is a dimension of their coherence. Einstein's conscious experience of recognizing aspects, functions, and consequences of natural laws and processes, in their mutual coherence, in our theory or model, is just a focused, "intense," and high-level specimen of the mutual recognition, intelligence, and coherence that natural laws and processes show *in the first place*. That is, these laws and processes conceived and made relativity work intelligently and coherently, *whereas Einstein "merely discovered" it afterwards*! The integrated complex of natural laws, as to the mere mutual recognition needed for coherent cooperation, even "outwitted" the more "passive" Einstein as to some vital psychological faculties such as primary recognition, creativity, and originality!

Partly summarizing, our theory contains that, each time that, in a process of nature, two or more natural laws, forces, or other entities cooperate so as to produce coherent, logical, and nonparadoxical results — on account of their relevant mutual recognitions and coherence — they apparently "sense" what they should do to make many things correspond correctly. Such sensing, we hypothesize, is at the basis of consciousness, *it being a "micro-prototype" of Einstein's experiencing the Aha-Erlebnis in his sensing things (laws, processes, results, …) to tally* in his theory.

4. We hypothesize that *living organisms* are specimens of a very specific cooperation and coherence of physical processes and laws so as to integrate them in such way that more primary (subsubconscious) elements of consciousness — which are inherent to mutually recognizing and cooperating natural laws and processes according to point 3 above — in such organisms integrate into the more "intense and

coordinated" forms of consciousness that characterize higher organisms. That is, in line with natural laws being so much mutually attuned as to be in a position of producing "material" compounds (from elementary particles), such as atoms, molecules, cells, and organisms, *their coherence extends to their integrating elements of consciousness* within the same scope. As an example we could think of various natural forces integrating into what we experience as "striving."

Generally, we see an increasingly subtle and coherent mutual "recognition" and ensuing cooperation of laws and processes in nature's production of atoms, molecules, cells, and organisms. In the latter, subconscious or self-aware variants of consciousness (such as a sense of wellbeing) amount to a *prerequisite "exchange" for the mutual recognition and cooperation of laws and processes* that allows them (such recognition, etc.) to attain the level needed for managing processes like, say, a horse race, *that apparently are consequences of natural law*. This need of an "exchange" is answered by the above integration of elements to higher forms of consciousness.

5. As is clear from the foregoing, we should accept four-dimensional natural laws to have causal and retroactive features. The latter also embody the HVs by defining how relevant Δ margins have to be filled in at measurements.[11] Now our fundamental hypothesis is that *consciousness is such a specific aspect of (the coherence, mutual recognition, and cooperation of) natural laws and processes that — if circumstances allow, as in living organisms — refers to the coordinated filling-in of many* Δ *margins*, that is, filling them in so as to define various physical variables in such an intelligent way that (via their directing the organism) they are jointly attuned to making happen something specific, such as increasing the wellbeing of the relevant organism. This means that, in our model, such Δ *coordination*, or systematic HVs, is a specific feature of the coherence of natural laws, particularly referring to its retroactive (HV) side and to "purposes." Such coordination, retroaction, and purpose, jointly with consciousness and wellbeing, *manifest themselves as it is* in the universe (e.g., purpose and consciousness do so in humans). *Well, we locate them as described* (and as more extensively discussed in Ref. 10).

6. In Sections 1.2 and 1.4 we discussed specimens of "three-dimensional" natural laws — the superposition principle, conservation, and the $|\psi|^2$ probability law — that jointly enforced some bias (or "loose" coordination) in relevant Δ-fillings-in in Fig. 1, and something similar in Fig. 4. These are simple examples of *laws and processes (nonlocally) cooperating so as to include* Δ *coordinations*. Note that in the case of Fig. 1 the three laws simply could not jointly have been satisfied without the Δ biasing or coordination discussed! In living organisms our theory hypothesizes such coordination to occur on a much more subtle and comprehensive level, relevant mutual recognitions and integration sometimes "accumulating" to the stage of human consciousness.

In our model the *feedback* of causal and retroactive influences, which is apparent from our discussion of Figs. 1 and 4, in the context of consciousness especially corresponds to such cooperation of laws and processes that the Δ coordinations implied are attuned to results corresponding to the optimum wellbeing of the organism in question.[10] Note that again *recognition* — in principle having conscious aspects in our theory — plays an essential part here, *inter alia*, in discriminating the optimum Δ coordination from other alternatives. We can also say that consciousness is such a feature of natural laws cooperating coherently via Δ coordinations that contributes the phenomenon of recognition and *Aha-Erlebnis* if such coordination is correct, i.e., if it is the one complying with all laws. If the situations of Figs. 1 and 4 were sufficiently "organic," relevant recognitions would attain the quality of wellbeing at the correct Δ-fillings-in. In particular, note that consciousness *is not some separate instance managing* Δ *coordinations* but that the latter are part and parcel of the coherent cooperation of natural laws and processes. At the same time, the psychological aspect — consciousness — of such cooperation, in turn, is inherent to its aspect of the (also nonlocal, feedback-like) mutual recognition of laws and processes *in order to cohere and cooperate*.

7. In all, we see consciousness as the increasingly sophisticated integration of elementary recognitions and *Aha-Erlebnisse* that — particularly as to feedback interactions also including the correct Δ coordinations — appear in managing the series of ever more complex physical compounds that atoms, molecules, cells, primitive organisms, and humans constitute. Managing the laws and processes in our brain — in a feedback context — requires much more integrated and comprehensive recognitions, *Aha-Erlebnisse*, and "consultation" (in order to bring about "the entire network tallies, Δ coordination included") than doing so with respect to a molecule! The relevant integrated network of elementary recognitions (etc.) that jointly manage our organism coherently *constitutes con-*

sciousness as we experience it. It is inherent to nature as part and parcel of natural processes that intelligently "apply laws and all the relevant logic and mathematics." And it grows to a higher level in conjunction with corresponding relevant physical systems like organisms, which require subtle recognition and "mutual consultation."

Consciousness, in its capacity of recognition with respect to coherently operative laws and processes, may be acuminated to *such recognition that especially refers to the aspect of the coherence and feedbacks that consists of* Δ *coordinations and their (nonlocal) pattern generation* and consequences in general, that is, to the faculty of nature to recognize more subtle aspects of L's symmetries and architecture. It is our three-dimensional way of experiencing the conception, design, and direction in the background of L.

2. EPR AS THE TIP OF THE ICEBERG: THE FOUR-DIMENSIONAL FEEDBACK NETWORK

On a certain level, natural law cannot be less coherent than symphonies, because it produced them.

For example, it may be that evolution is not managed by goal-oriented influences, but many laws appear to cohere in such way that the result is actually the same.

2.1 Causal, Retroactive, and Goal-Oriented "Influences," as Well as Strivings, Reflect Four-Dimensional Natural Laws; the Role of the Observer in Microphysics

It is obvious that in a realistically four-dimensional universe the elements will be (four-dimensional) events rather than objects, and that natural laws will refer to order, or coherence, as regards such *events*. That is, they will refer to symmetries, or even "architecture," of the four-dimensional lattice or structure L of all events. Our action metric of Section 1.3 is a mere instance of such starting from events rather than objects.

Further note that in a static four-dimensional block universe the concept of "influence" changes meaning. For example, causal influences merely reflect how we — experiencing reality as a three-dimensional one evolving in the time direction — "feel" the future to come logically about. This experience is one of the ways we get information about the order of L. On the other hand, retroaction, as an "influence" in the $-t$ direction, to some degree is a natural complement of causal influences in a block universe. Our senses and intelligence are attuned to perceive and think about reality in terms of "influences" that "bring about" things.

In Ref. 3 we discuss EPR from an even more clearly four-dimensional point of view than we did with Fig. 3. That is, we show the world-lines EA and EB of particles 1 and 2 in Minkowski space (Mi, see Fig. 5). E is their common emission event, and A and B are the two measurement events (say, of their polarizations). As discussed in Ref. 3, we can explain the "instantaneous" correlation of A and B by a feedback $A \rightleftarrows E \rightleftarrows B$, which is made up of the causal influences $E \rightarrow A$ and $E \rightarrow B$ and the retroactive ones $A \rightarrow E$ and $B \rightarrow E$.

Within this scope it is clear how, in Fig. 4, we can similarly argue about the EPR-like feedback between A_1 and B_1, or even A' and B'. In the latter case an instantaneous correlation of "proper momentum" should exist because of its conservation. (Actually, the situation is complicated by various other particles contributing to the total momentum.) Still, the only way to make A_1 and B_1, etc., jointly satisfy conservation is hypothesizing similar feedbacks between them as in the simple specimen in Fig. 5. We can also say that, in order to conserve momentum (etc.), A_1 and B_1 (etc.) should witness somehow *corresponding* mutually distant Δ-fillings-in, as a generalization of the EPR phenomenon. Conservation simply cannot hold if relevant Δ margins of two or more particles could be filled in independently (e.g., randomly) at mutual distances. EPR is indeed the tip of the iceberg. Note here that in a block universe A_1, B_1, etc., should correspond to definite momenta, etc.

In this context we can explain the role of an observer in quantum mechanics. It is a direct consequence of realistic four-dimensionality and retroaction or of the feedback of causal and retroactive influences.

For consider the filling-in of a Δ margin by an HV, which implies retroaction, as elaborated in Ref. 11. This can also roughly be seen by noting that in a simple picture of L (Fig. 6), e.g., the world-line *a* of a particle P between its emission A and absorption B cannot completely be defined by causal influences such as from A, as to direction and velocity, because then the process would not always comply with the requirement that an integer number of action quanta fit in between A and B. For example, P on its way to a screen S should land so as to complete an integer number of quantal "trajectories" on *a*, such as CD and DE in Fig. 2. Hence some feedback between emission and absorption events is needed by the very atomicity

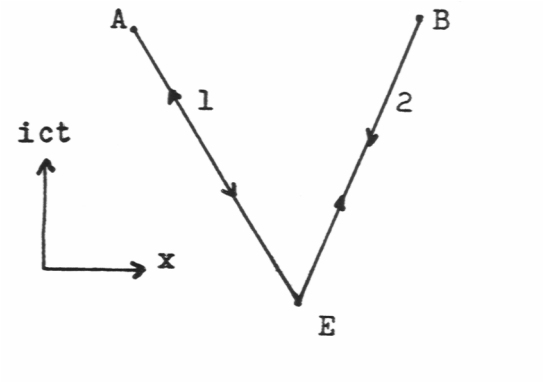

Figure 5. Four-dimensional sketch of EPR. EA and EB are world-lines of correlated particles 1 and 2, jointly emitted at E. A and B are measuring events.

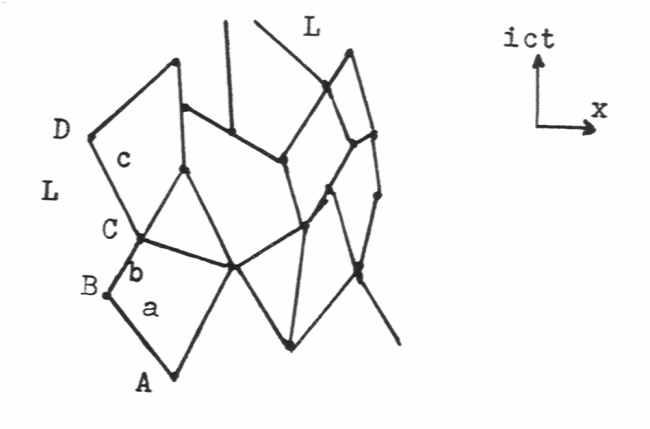

Figure 6. In order to complete integer numbers of action quanta "on" world-lines a, b, c, … between junctions (interactions) A, B, C, …, Δ margins cannot be filled in arbitrarily. Many absorbers cast their shadows before.

of action, viz. to attune both P's velocity and its direction of movement, which implies retroaction. Generally, the fact that quantum measurements will result in eigenvalues stems from such atomicity, *just as all failures of classical theory do* (see Ref. 12, p. 42). Above, we gave a simple model of why this theory, and mere causality, fails here.

Note the relation to *goal orientation* of the above retroaction and feedback: actually, the latter attunes the emission process to some purpose, i.e., completing action at the absorption. Generally, *the object is retroactively attuned in this way to the measurement event*, to "the observer," as one will say. In actual fact it is the instrument (or rather, the measurement event) that acts as absorber and, say, retroactively attunes a path covered (proper path) or observable value measured (eigenvalue) to action completion. *We can compare this with the retroaction and feedback in Fig. 1.*

In our four-dimensional model, including retroaction, Bohr's proposition that one cannot separate an observed micro-phenomenon or micro-object from the instrument and observational conditions is explained by the fact that interactions between them also amount to a four-dimensional feedback of causal and retroactive influences *emanating from the object (its development) and measurement (event), respectively*.

In Ref. 10 we hypothesized goal orientation to be operative on a much higher level than attuning separate retroactive influences (HV) to the completion of action at a later event. That is, we consider it to be an essential faculty of living organisms that consciousness operative at E (see Fig. 7, comparable to Fig. 6 in Ref. 10) in this way can coordinatedly fill in Δ margins at A, B, C, … so that the corresponding precisely defined variables are attuned to making certain things happen that are desired by (the consciousness at) E (also compare point 5 of Section 1.5). Such Δ coordination, in our theory, is the essence of living organisms and of the interference of consciousness on all levels of intensity. For the rest, we take such coordination — systematically filling in many relevant Δ margins — to be a (highly retroactive) inherent aspect of the coherent cooperation (and mutual recognition) of four-dimensional natural laws and processes, comparable to how the frequent cooperation of "merely causal" laws is such an aspect too.

Our model is also characterized by the following:

1. Strivings result from cooperating natural laws and forces that in the sense of Section 1.5 also integrate many elements of consciousness to some level of self-awareness.
2. Just as other ("dead") forces, such as Coulomb ones, do, conscious forces tend to change things in their direction.
3. As a rule, the object of the forces we experience as strivings is optimizing wellbeing.
4. These forces can further this by a Δ coordination as in Fig. 7, with which conscious E (via feedbacks) senses what specific coordination corresponds to the optimum actions (of its organism and beyond) as to resulting in optimum wellbeing.

We make one more suggestion:

5. In Fig. 3 the action distance (via C) between events A and B is zero. Additionally, we argued in Ref. 11 that there is also an action distance zero between two alternative micro-processes — from which an HV makes a choice — consisting of a particle approaching and hitting a screen via two different paths. Now we might extend this to the more complicated HV intervention embodied by E's coordination of many Δ-fillings-in at A, B, … of Fig. 7. That is, the action distance between the processes corresponding to each couple of alternative coordinations could be zero too, in line with the above cases. In particular, this would make it "physically easy" for E to compare all of them and "shift" to the optimum one as to wellbeing.

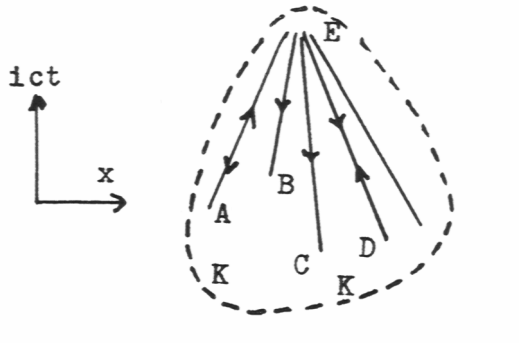

Figure 7. Conscious activity from E retroactively (or in feedback) coordinates Δ-fillings-in at A, B, C, …. Consciousness, Δ coordination, and results are mutually attuned in living organisms.

Note in particular that the feedback coordination process of Fig. 7 (feedbacks AE, BE, …) only differs from those of Figs. 1, 3, 4, 5 in that

a) it is more complicated in the sense of more variables being involved;
b) consciousness (optimizing wellbeing) is at stake; this makes the process to be *experienced* as goal oriented rather than merely retroactive.

Keep in mind that, in the simple action-completion case as well as in more complicated ones, goal orientation no less than causality "merely" reflects symmetries of L, that is, four-dimensional laws. Also, the very coherence of the world implies complicated nonlocality in the case of Fig. 7 no less than in that of Fig. 4, as a specimen of cooperating laws resulting in L's symmetries or, rather, the reverse. In Fig. 4 the "goal" is conservation; in Fig. 7 it is optimizing wellbeing.

Generally, feedback interactions in L's "branches," such as *a* and *b* in Fig. 6, are our way of quasi-three-dimensionally explaining L's four-dimensional symmetries. In Fig. 7 complication and integration attain an organic level so recognition and Δ coordination show "psychological" degrees of subtlety and cooperation. Organisms may have "keyboards" K where A, B, … are especially attuned to feedback with E as indicated.

In all, our model adds a radically *new dimension (or degree of freedom) of order and influence* to those of objects, fields, local causal laws, and even retroaction and nonlocality, i.e., a Δ coordination that represents *order and coherence as regards filling in "uncertainty" margins too*. This dimension of L's symmetries and architecture is closely connected with the organic and consciousness, and with their subtlety, intelligence, and goal orientation. In this capacity our hypothetically extending coherence in nature and its laws — which also contains many results *as such* to be governed by law and coherence — is an alternative to sorcery as an explanation.

One possible way of coherence of causal and retroactive laws might be the following:

1. Within the scope of a defined block universe, its hyperplane H_0 corresponding to the big bang as well as some hyperplane stage H_1 in the distant future both exist, as defined by natural law.
2. There is a coherence as to this law to the effect that everything in L can be derived (in a three-dimensional picture) from the mere cooperation of causal processes and laws starting to work from H_0 in the $+t$ direction, and retroactive ones starting from H_1 in the $-t$ direction (and operative only within Δ margins).
3. We may further assume various master laws to correspond to L's major architectural principles, whereas more detailed symmetries and features of it are "hierarchically subordinated" to this architecture. (Compare the principle of least action and the equations of motion, and Noether's theorem and conservation.)

2.2 Unorthodox Paths of Communication in Four-Dimensional L; an Extension of What Coulomb's Law, EPR, and Retroaction Teach Us

In particular, our argument about Fig. 4 makes it inevitable that some four-dimensional feedback

communication network exists in L. For in the myriad filling-in choices as to myriad Δ margins the mere fact that many variables have to be conserved means that generally mutually distant fillings-in cannot be independent, as we earlier discussed. This holds independently of whether their distance is time-like or space-like. If the direct environments of Δ_1 and Δ_2 were free to fill them in independently, the relevant observable would not be conserved, but its total value would vary by a term proportional to $n^{1/2}$, n being the increasing number of "independent choices" in the course of time. Hence a feedback communication of an EPR type should appear between any Δ_1 and Δ_2 regions to obviate this violation of conservation. Note that the simplest assumption as to an understandable model of this is that world-lines like those of the momentum carriers in Figs. 1 and 5, or paths like PQ in Fig. 2 and ACB in Fig. 3, may convey the information exchange necessary between the regions of Δ_1 and Δ_2 and all others. Actually, we already had to call on feedbacks via the paths in question in order to explain the relevant (thought) experiments. In short, we need far more (imaginable) nonlocal communication than just the EPR one. Note in the above context that in a block universe "proper paths," eigenvalues, and Δ-fillings-in in general cannot but appear so massively that it is impossible to evade our argument about Fig. 4 and conservation by saying that most relevant uncertainties need no filling in at all. In a block universe everything is definite.

Thus far we have only attributed to the feedbacks some overtly conspiratorial or goal-oriented function in the process of Fig. 7. However, the common element in their acting "simply" (Figs. 1, 3, 4, 5) *and* conspiratorially is that in both cases they ensue from coherently cooperating natural laws and processes. In Fig. 7 (higher organisms) this is extremely subtle and involves categories such as wellbeing and others to do with psychology.[10]

Note that, if Δ coordinations as in Fig. 7 appeared outside living organisms too, things like telepathy and psychokinesis (PK) would no longer be mysteries. For then, e.g., A and B may be in another organism than C and D, so that attuning A, B to C, D via E might transmit a message or effect a coordination of actions with respect to those organisms.

A special and remarkable specimen of nonlocal feedback can be found in Coulomb interaction. In Fig. 8, a Minkowski picture of the interaction between charges A and B, virtual photons like P arrive from A at B via C, their momenta and energies being attuned to the location of B at their arrival *after* their

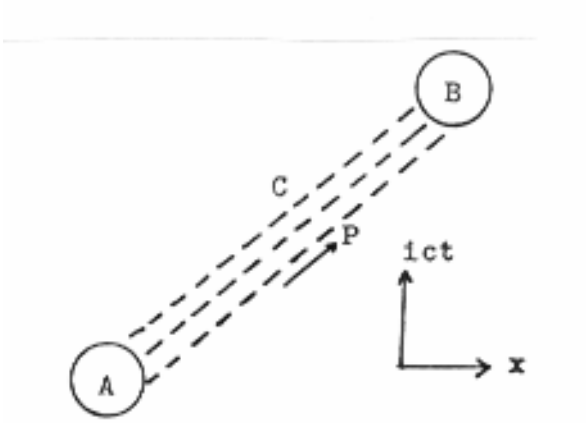

Figure 8. Virtual photons and their waves travel from A to B and can "miraculously" find the latter, even if it moves rapidly.

departure from A. They adjust to, say, a situation in which the distance between A and B is rapidly increasing, or B moves perpendicularly to AB. Still, the momentum carriers *find B and have the correct Coulomb energy*. Things are retroactively attuned to a possibly *altered situation* at P's arrival as compared to its start at A. Compare here the course of matters in Fig. 1 and an altered position of screen T. In the case of Fig. 8 the process is more "spectacular" in a macro sense than with the subtlety of Fig. 1, but it is not retroactive in a rigorous way because even the *Minkowski* distance s between P's emission from A and its absorption at B is zero rather than time-like. In any case the Coulomb process illustrates clearly and abundantly what the action metric of Fig. 2 and EPR demonstrates more "exotically": that our concepts about "distant in space and/or time" can be very misleading as regards the appearance of physical influences, feedback included. For events at A and B "know something about each other" because the momentum carriers they exchange can find the other charge in a correct way, being adjusted even to the last-minute ("future") state of matters.

Note that, with respect to some of our thought experiments, neopositivists will say, "We should only argue about measured or measurable results and formulas, not about what should happen in between to make some model rational and coherent, and not about 'counterfactuals.'" We answer that, in abandoning coherent models, we abandon the *Aha-Erlebnis*, true understanding, and explanation that are vital to science in its transcending algorithms, predictions, and technical procedures. We are not prepared to

make these sacrifices, which also imply striking paradoxes of current thinking to be swept under the carpet. Think of free will, nonlocality, wave-particle "duality," and the role of the observer. Even worse, abandoning understandable models *is to the detriment of the essence of science, which is insight*.

Therefore we conclude, *inter alia*, that a coherent and, therefore, understandable functioning of the processes of Figs. 1, 4, 5, 6, and 8 requires feedbacks in the sense of the cooperation of causality and retroaction. In a realistically four-dimensional universe, retroaction — as a three-dimensional manifestation of some of L's symmetries — is no more "strange" than causal "influences" are.

2.3 The *Aha-Erlebnis* ("Things Tally") as the Essence of Elementary Consciousness; Sub-Patterns of L Recognizing Each Other Via Feedbacks as an Aspect of the Coherence of Natural Law

Advancing toward a model of the paranormal — nonlocal communication and influences referring to psychological phenomena such as striving, association, and striking coincidence — we elaborate some aspects of consciousness as discussed above and in Ref. 10. We do so in coherence with a further discussion of nonlocal coordination of the fillings-in of Δ margins as we found them in situations like those of Figs. 1, 4, 5, and 8.

A vital point is "coincidental" relations between events (of a psychologically relevant kind) that *defy causal explanation* (e.g., as to their space-time connections). Apart from the psychological factor and their relative simplicity, phenomena in Figs. 1, 3, 4, 5, and 8 may already pass for specimens of PK (Figs. 1 and 4) and telepathy (Figs. 3 and 5), whereas Figs. 4 and 8 also show elements of "clairvoyance."

An important question is how we can "extend" the myriad "recognitions" by natural laws and processes that appear in the field of objects and forces — in the three-dimensional domain think of atoms, molecules, living cells, … — to the four-dimensional level. That is, if nature truly functions (or coherently exists) on this level, we should introduce four-dimensional entities (corresponding to objects and forces) that "know what to do" (in order to produce the correct interactions), this time in the four-dimensional sphere. This means that we should now speak of symmetries, configurations, and architectures of L as a lattice of events. We have to find models of or mechanisms by which such entities — results of laws and processes — indeed "recognize" each other in order to correctly mutually correspond in jointly embodying L in agreement with all natural laws, logic, and mathematics that exist.

Our solution is to call on the unorthodox paths of communication, i.e., nonlocal feedback channels as at stake in Section 2.2 that play a part in various situations discussed. That is, we make the guided guess — guided in view of such situations — that, via those channels, various parts of L sufficiently communicate with and "sense" each other in order to recognize whether or not things correctly correspond in L in view of joint laws, i.e., four-dimensionally, whether all symmetries, patterns, etc., of L appear. Also recall that such recognition (referring to the entire complex of all coherent natural laws!), in our theory, implies elementary consciousness.

By the way, note here that such symmetries and patterns cannot be completely explained ("caused") by either merely causal or merely retroactive laws and forces, that is, from a three-dimensional point of view. Only causality in coherence with retroactive fillings-in of "uncertainty" margins may reproduce L and its four-dimensional order and features. It was our three-dimensional prejudices, abandoned in the foregoing, that hitherto prevented the explanation of, *inter alia*, nonlocality, retroaction, consciousness, and, as will appear below, paranormal phenomena. Nature and its laws and coherence transcend three-dimensional local causality in mere "ingeniousness" as regards L's architecture and nonlocal coherence.

Concretely, the feedbacks of causal and retroactive "influences" operative on world-lines or other paths (in Fig. 1 on those of the momentum carriers, in Fig. 3 on ACB, in Fig. 4 on $A'A_1EB_1B'$, in Fig. 5 on AEB, and in Fig. 8 on ACB) *sense whether things correspond correctly or not*. (In the latter case the relevant L configuration simply does not appear.) Again recognition is crucial. For instance, in Fig. 1 nature "recognizes" Δ coordination at A and B to correspond to a correct compliance with conservation, superposition, and the $|\psi|^2$ law in the T region. Such recognition also represents very elementary consciousness that, in other configurations (i.e., in living organisms, see Section 1.5), jointly with other elements, may integrate into true self-awareness.

In a three-dimensional picture the trial and error of Δ coordinations in our relevant figures continues until the natural processes (laws) in question get an *Aha-Erlebnis*: "everything tallies." The above is by no means paradoxical: if natural laws and processes can sufficiently recognize each other three-dimensionally so as to "know" how to act, they can do so four-

dimensionally too. That is, they can recognize configurations of events (event patterns and symmetries) in L in order to know whether they correspond to natural law.

The information transmitted via feedback paths may be complicated. For compare here the role of electromagnetic (EM) waves that are part and parcel of L. It ought not necessarily be impossible for other L configurations and corresponding Δ coordinations too to be sometimes constituted as to "mimic" EM waves with respect to the amount of subtle information stored and transmitted by them. This might also allow the recognition of "intelligent" L patterns elsewhere. In this context we refer to the discussion of Fig. 10, which shows that EM waves may also transmit Δ coordinations retroactively.

2.4 Recognizing Patterns and Essence; Goal Orientation, Association, and Memory

Figures 1, 3, 5, and 8 made it clear that many paths exist in L along which causal and retroactive "influences" result in feedbacks that see to it that conservation and other laws are fulfilled, even in a nonlocal way and via both space-like and time-like physical trajectories. We now make the guided guess that *all* natural laws, the more subtle ones and those relevant to psychological phenomena (such as consciousness) included, can be complied with via this "communicating-vessels" mechanism as far as nonlocality requires it. That is, from a three-dimensional point of view, causal and retroactive influences at various instances require nonlocality as indicated in order to jointly (re)produce the symmetries and patterns of L that embody truly four-dimensional natural laws and processes. Recall that retroactive influences such as HVs concentrate on filling in Δ margins in a sometimes coordinated (more than stochastic) way. In both versions (three- and four-dimensional) the operation of laws should sometimes include nonlocal recognition of mutually distant configurations. For example, in Figs. 1, 3, 4, 5, and 8 it is clear that situations at S and T, A and B, …, *should recognize each other* and be recognized by the relevant "influences" in order for all laws to be satisfied. Again, we see myriad elementary variants of Einstein experiencing *the Aha-Erlebnis about how parts or aspects of reality cohere*.

Note that laws and forces operative in the feedback channels sometimes have to deal with very complicated L configurations, e.g., if in the context of Fig. 8 many charges jointly have to "find out" how to define the movements (or, say, impacts) of any separate one among them. Or consider Fig. 4: Somewhat vaguely speaking about "fields" is no solution from the standpoint of imaginable models! Still, no paradox is in sight. For if we conceive the amount of information potentially transmitted by EM (or matter!) waves, it is far from implausible that subtle variants in Δ coordination in this way correspond to equally subtle variants of L configuration so that all laws implied by the latter can be "effected" by the feedback "influences" too (i.e., by their causal and retroactive nonlocally effective components). Jointly these make L "articulate," which means that its joint laws precisely correspond to its four-dimensional configuration. In the context of this paragraph, think of the L configurations at A′ and B′ in Fig. 4 and of the feedbacks between them that enforce conservation. All of this means that nonlocal pattern recognition is inherent to how nature works. In Figs. 4 and 8 some feedback scanning between mutually distant situations is part and parcel of this functioning, as a somehow three-dimensional picture of four-dimensional reality. Within this scope Δ coordinations at different locations can attune to each other just as many other features of the world will do, to comply with all natural laws. Such attuning is part and parcel of their coherence!

It is *a priori* evident that the above also refers to the special variant of natural phenomena and laws we call psychological, categories such as consciousness, goal orientation, associations, memory, and strivings included. We add some points to what has been discussed in Ref. 10 about this.

First, note that if in Fig. 7 some conscious instance E retroactively coordinates Δ-fillings-in at A, B, C, … so as to optimize wellbeing at E (via appropriate consequences — say, organic actions — of the coordination), this coordination from the standpoint of region K (A, B, …) *takes the shape of goal orientation* (working in the +*t* direction).

Second, some might object that, e.g., as to Fig. 7 and other cases of feedback, in which a future event E retroactively coordinates A, B, C, … so as to make them "causally conspire" to codefine this very E, this is an argument looking like one pulling oneself up by one's shoelaces. However, recall Fig. 1: some processes in the T region (the choice of an observer) are independent of those in the S region. Still, these processes were caused by natural laws anyhow, just like everything else, i.e., by "the whole line-up of laws and situations." What happened could not have been different. The only thing retroaction of Fig. 1 does is *make various processes coherent*, so that — the choice as to T having to appear anyhow — this choice and its consequences *do not violate one of the*

three relevant laws (conservation, superposition, $|\psi|^2$). One can similarly argue about other "shoelace cases."

Third, we already hypothesized about the particularly integrated and "well-connected" part of L a human organism constitutes that many integrations of subsubconscious elements jointly may result in true self-awareness. Such integration may also be effected via (organic) feedback paths as discussed. Paths like these may cause some psychological entities to be mutually connected more than others, which produces phenomena like association and recollection. As examples, compare A and B in Figs. 3 and 5 or, in Fig. 1, how two elements of a particle world-line are more closely connected than two point events on S and T, respectively.

2.5 The Potential Source of the Paranormal: Coherent Retroaction; the Crossword Analogy

As implied earlier, the essence of the paranormal is phenomena transcending well-known space-time relations, in addition to some participation of conscious observers as a (surmised) source of the anomaly.

In Ref. 11 we discussed HVs, leaving three options about how the relevant retroactive fillings-in of Δ margins may come about. In doing so we left aside conscious phenomena. On the other hand, we found various phenomena — such as those of Fig. 1 and EPR — that showed a violation of "well-known space-time relations" without any role of the psychological fitting in rationally. Still, the discussion in Ref. 10 made it obvious that the phenomenon treated with our Fig. 7 (Fig. 6 in Ref. 10), i.e., organized time-like feedbacks, is inherent to conscious phenomena in living organisms. Refs. 10 and 11 did not indicate how we might relate explanatorily to living organisms nonlocal phenomena transcending one organism, such as PK, telepathy, and clairvoyance. However, various phenomena, models, and arguments discussed before allow us in principle to expect something like the paranormal.

In the first place, *everything that is not explainable by causal laws appears to us to be a "miracle,"* that is, a "paranormal" phenomenon. If it is firmly integrated in physics, such as EPR, we content ourselves by merely calling it "paradoxical." If not even physical formulas or repeatability can be found with respect to the relevant violation of "well-known space-time relations" — in practice, when it seems to be associated with the psyche — we call it truly "paranormal."

Now it is clear that retroaction and feedback — in the shape of Δ coordination if they work according to coherent laws — are not much less than a *sine qua non* for natural law to be truly four-dimensional: transcending local causality. Also it is rather obvious *a priori* that, if Δ coordination is part and parcel of coherently operative four-dimensional laws that govern feedbacks as we see in organisms (Section 1.5), we may logically expect such coordination to be sometimes an aspect of coherent cooperations outside living organisms too. Actually, *we saw this already in Figs. 1, 3, 4, 5, and 8 for simple cases*. Generally we see that feedback communication — transmission of information rather than energy or particles! — which allows four-dimensional laws to frame L's symmetries, introduces some nonlocal features of L that suggest the "paranormal." Such communication is needed to make natural law consistent by implying order in Δ-fillings-in too, so as to make nonlocal and other details fit in L's major order.

Remark: It might be that no finite set of principles ("axioms") and four-dimensional laws is in a position of explaining L completely, just as no finite set of axioms and theorems can explain all properties of the simple series 1, 2, 3, … (Gödel's theorem of number theory). L's coherent architecture might transcend them all: those of classical physics, of QM, of four-dimensional physics including Δ coordination, and so on.

We preliminarily conclude that, as retroactive influences that obey laws, *show order*, actually appear, which are also inherent to conscious phenomena by our argument of Section 1.5 and Ref. 10, phenomena can be expected to appear that

1. cannot be explained by mere causality,
2. transcend "conventional" HVs by showing order as to filling in Δ margins,
3. are associated with nonlocality, and
4. play some part in the functioning of living organisms.

Such phenomena have something of "miracles" from our current point of view that merely reckons to science what can be explained by (local) causality, to a certain degree completed by "uncertainty," that is, by random fillings-in of Δ margins. Note further that it is *a priori* improbable for retroaction and Δ-fillings-in, in contrast with causality, not to obey orderly laws. It is more obvious that, *by their very order, they can produce noncoincidental macro-phenomena that defy local causal explanation*.

Once we accept causal and retroactive influences to cooperate in feedback interactions, we may compare their joint definition of L to filling in a crossword. (In both cases there is actually only one correct option, but one might conceive that there are more.) In the analogy we imagine causal forces to see to the horizontal "words" being filled in correctly ("according to natural law"), whereas the retroactive ones govern the vertical words. Jointly they define "crossword" L completely in accordance with correct "language" (natural laws). Then it is clear that, if some retroactive influence — say, emanating from an observational act — has already "filled in some vertical words," *this intervention will constrain (or bias) other joint causal and retroactive alternative interventions* (horizontal and vertical fillings-in, respectively), just as causal interventions (filling in some horizontal words) will do. That is, retroactive no less than causal interventions into "crossword" L will make a difference as to the other words still outstanding or as to other variants still possible as to L's configuration or "lattice." We will give concrete instances in Section 3.

Note that our crossword analogy even applies as regards the circumstance that in the last resort both L and the crossword, as to the initial retroactive intervention and filling in a few vertical words, respectively, have no degrees of freedom other than the only one left by the laws of nature and those of language (words). This implies determinism in both cases but does not detract from the fact that some "interventions" — retroactive as well as causal — and fillings-in, respectively, *have as consequences the exclusion or implication of many others* because of consistency as to the laws of nature or the existence of words. Recall in the above context that we should construct an understandable and coherent model of L in terms of logical consequences and causal or retroactive "influences" or implications.

For the rest: if we can causally influence our environment systematically, *why should we not be in a position to do so via retroaction too*, once such influences have been demonstrated (though only within tiny "uncertainty" margins)?

Prior to going into concrete paranormal phenomena, we discuss one more feature of retroaction to be expected. That is, if in Fig. 9a cause A (say, an explosion) can result in effects B, C, D, …, which can only be physically understood (their coherence included) via A, why, then, in Fig. 9b, can source P of retroaction not in such a way coordinatedly influence Q, R, S, … that their joint appearance can only be physically understood via P? Retroactive laws, not less than causal ones, *increase order and coherence in the world*. From a causal point of view, any "retroactive coherence" of Q, R, S, … will seem to be miraculous, "paranormal." Even more striking from a causal standpoint, and also associated with our "uniform movement through Mi in the *+t* direction," some retroactively induced coherence of Q, R, S, … could *show elements of goal orientation* in view of (Q, R, S)'s mere collective feedback relation with P, which they seem to (partly) cause in our *+t* way of thinking!

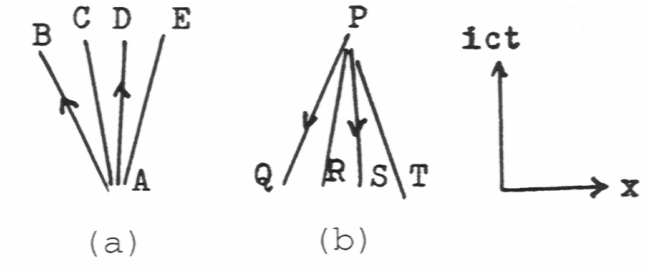

Figure 9. In (a) causal influences from A (say, an explosion) effect various mutually related events B, C, D, …. Similarly, in (b) "retroactive causality" from P may do something analogous: bringing about "strange" physical relations among Q, R, S, ….

We could also expect a striking-coincidence-fostering tendency of retroaction in another way. That is, if many micro-interactions actually involve feedback, both emission and absorption as events should give the green light to such interaction. If then the causal contribution A in Fig. 9a produces various concomitants of an AB feedback in the shape of AC, AD, … feedbacks, we may assume P of Fig. 9b to act somehow similarly: its "green light" to, say, a QP feedback may statistically facilitate ("elicit") feedbacks RP, SP, … if R, S, … show similarities to Q. This would result in Q, R, S, … manifesting themselves at P "strikingly coincidentally."

Finally, we may expect a relation between the following phenomena:

1. the feedbacks as in Fig. 9b;
2. the much more subtle analogue of Fig. 7 we hypothesized in living organisms;
3. the integration, via many feedback channels, of elements of consciousness into a central self-awareness of an organism as a whole.

3. PK, STRIKING COINCIDENCE, CLAIRVOYANCE, TELEPATHY, AND RETROACTIVE INFLUENCES EMANATING FROM OBSERVATIONAL ACTS

Even the most impressive human performance, such as writing Newton's *Principia* or composing a symphony, is natural law in action.

3.1 How a Falling Die May Be Influenced by PK from an Observer

In Fig. 1 we saw how it is actually the absorption events on T or the plates that manipulate retroactively or in a feedback way the fillings-in of various Δp_y margins to attune the p_y's to the locations on T or the plates where the momentum carriers should land in accordance with conservation, superposition, and the $|\psi|^2$ probability law.

Furthermore, we saw in Fig. 7 how in a living organism conscious striving from E — via in principle similar feedbacks — coordinates Δ-fillings-in at A, B, C, … in order to jointly attune them to the relevant observables, having values that make them cooperate in bringing about what E wants. The latter means that just as in Fig. 1 the three relevant laws (conservation, etc.) jointly enforce by retroaction (feedback) the coordinated biases as to the Δ-fillings-in in the S region, we see in Fig. 7 that the natural laws or forces W that result in E's striving S *perform a similar thing as to coordinating Δ-fillings-in at A, B, C, …*. In the latter case S, as resultant of W, is served: things proceed in accordance with W and S (at least inside the relevant organism that, say, starts action), which is a more complicated analogue of the case of the three laws in Fig. 1. In Ref. 10 we discussed this extensively as being essential to living organisms.

Subsequently, consider Fig. 10, which refers to an observer whose psyche is E that tries to influence a falling die D by PK. D interacts with many molecules M at throwing, in the air, and at falling on the table. In our four-dimensional picture, A is the organic observational apparatus of E, say, her eyes and optic nerve. She strives after a bias to 6 of D. B is the world-tube of joint photons transmitting relevant information from the D, M region to the A, E one.

How may we explain a 6 bias of D in a PK experiment? Consider a few steps, also comparing Figs. 1 and 7:

1. E, striving after 6, retroactively tries to make A "hallucinate," observing a 6 result.
2. Subsequently, A tries to fill in relevant Δ margins so as to corroborate its "hallucination," viz. Δ margins referring to the light rays (B). It does so in the sense of coordinating their fillings-in at A in a special way that has precise repercussions in the D, M region because of mere conservation and the constancy of the velocity of light *c*. That is, Δ coordinations at A — as regards the observables' momentum, time of arrival of the photons, and their polarization — translate into similar ones in the D, M region. This refers to influencing momenta, polarizations, and times of emission (collision) as to many photons starting from D, M, *and to molecules M interacting with them.*
3. A, E attunes the Δ coordination and its effects at D, M to a bias of 6, just as in Fig. 1 the T region adjusted the S one as to biased Δ-fillings-in, and as in Fig. 7 E attuned A, B, C, …. Accordingly, we get a model in which — analogously to how *causal* interventions can influence the course of events — retroactive interventions can do so too, within the scope of retroactive Δ coordinations having consequences, just as in Figs. 1 and 7. The difference between our die case and the latter two is more complication and extra-organic coordinations, respectively.

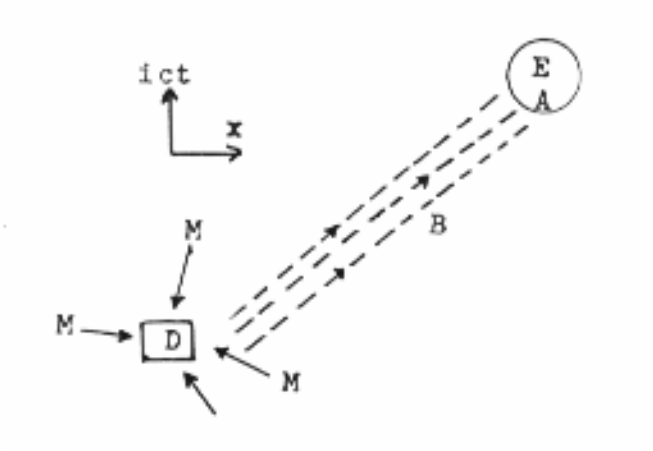

Figure 10. Conscious entity E "molds" its observational apparatus A that in turn via B (i.e., light rays) retroactively influences various collisions of molecules M with die D by biasing Δ coordinations in the D, M region.

In influencing collision momenta and collision times as to M and D, E and A "simply" retroactively try to adjust reality to A's and/or E's "hallucination" so as to make everything tally according to natural law. Δ coordination smartly intervenes, *not violating any causal law but only contributing its own "biasing" influence*. E, A biasing D, M is not really more

"magical" than T or the plates doing so with S in Fig. 1: it refers to orderly retroaction that appears in coherence with causality. In Fig. 1 three laws (conservation, …) constrained various fillings-in; in the PK case those laws resulting in E's striving after a 6 bias did so. All natural laws tend "to have their way," so why not those trying to adjust the environment to A's "hallucination" about 6? Still, whereas in Fig. 7 E's strivings had an adequate organic instrument at their disposal (such as K), in the PK case this is lacking, at the same time as many competing and perturbing influences "in the open seas" are interfering with the "hallucinations" that have so subtle a task. (Also, in view of the nonlocal aspects of retroaction and feedback, the relevant perturbations should be taken very seriously.) Hence PK will seldom succeed. It is more easy for E to adjust A in starting to fake a 6 observation than it is for A to adjust the environment of the relevant organism according to both the "faked" experience and natural law.

Generally note that filling in Δ margins — coordinatedly or not — *always* has retroactive consequences. For instance, if an "ordinary" HV defines (the location or velocity with respect to) a particle's impact, it also codefines its emission event, on pain of violating conservation.

Two peculiar results of parapsychological research[13] can be explained by our above argument.

1. It does not make a real difference as to results if we modify our PK experiment in the sense that the observer O only sees a film of such results, the proper throwing of the die and its filming having occurred earlier than O's looking *and wishing the bias*. We may explain this by realizing that, if O now and then succeeds in biasing vital Δ coordinations in the D, M region, he may similarly do so with respect to Δ coordinations codefining relevant interactions of the material of the film and, thus, codefining the pictures that are so induced to show a bias for 6. Once this now and then succeeded, say, at time t_1, the mere consistency of natural laws would require that the film at time t_0 of the throwing and filming ($t_0 < t_1$) agree with its condition at t_1. That is, biasing it at time t_1 implies biasing it at t_0 on account of mere natural consistency. Again, retroaction is the vital point, i.e., O's faculty to retroactively influence history — either the dice or the film — as far as Δ coordination can. The rest is a question of adjusting things accordingly "by conventional laws," e.g., so as to make the film be the same at t_0 and t_1. In essence, the gist of our explanation is that from our deterministic block-universe point of view it is not more difficult for natural law to define the film at time t_0 from its condition at time t_1 than doing the reverse, if we argue from a three-dimensional point of view — via "influences."
2. The other peculiar result of parapsychology at stake is the so-called diametric effect, to the effect that the success of PK (or other parapsychological experiments) does not depend on the complication of the *causal mechanism* via which it may be imagined to come about. As to PK, we can explain this as follows. Reconsider the crux of Fig. 10: once things in the A, E region truly correspond to a hit 6 because of some successful Δ coordination, the only thing to do for natural law is retroactively adjust an environment such as D, M to this. This need not be more difficult according as the *causal* mechanisms by which one hitherto imagined to possibly explain any PK influence on D (or paranormal phenomena at all) get more intricate! That is, as PK and other paranormal phenomena *are essentially due to retroaction and (biased) Δ coordination*, the complication of whatever causal processes may not be very important as to their appearance. For example, note in this context that neither A, E influencing D, M nor any adjustment of the relevant film at time t_0 to the (biased) stage at time t_1 has primarily to do with causality (apart from possible feedbacks).

3.2 How an Observer May Bring About Striking Coincidences

Consider Fig. 11, where we see world-tube *l* of an observer O and causal chains PA and QB (that may be world-lines), which result in the experiences A and B, respectively. Now our problem is how O may possibly via PK "cause" A and B to more often coincide than mere causal laws statistically imply (striking coincidence). Some relation to the die case is obvious.

Again, the vital point is retroaction or feedback from some observational experience(s) of an observer, i.e., O on *l*. This may codefine some Δ-fillings-in at P and Q so as to coordinate them in a sense that a bias appears toward A and B to coincide. Collate the cases of Figs. 1, 7, and 10. In our present case, compared with that of the die, "starting hallucinations" at A and B contain their coincidence. Subsequently — compare the retroactive tendency from A, E in Fig. 10 to harmonize events in region D, M with those in A, E — retroaction from (a finite trajectory of) *l* or from A and B tends to harmonize previous events

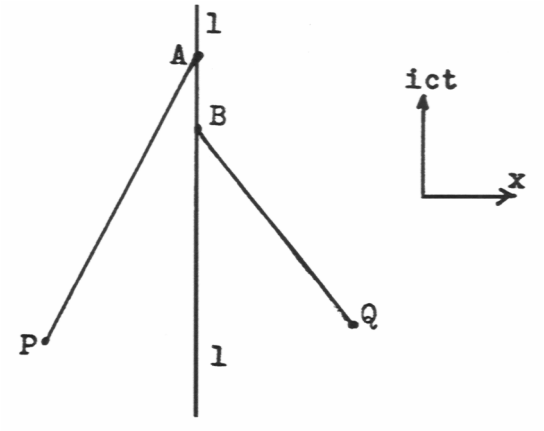

Figure 11. *l* is the world-line of an observer; PA and QB are causal chains (e.g., also world-lines) that lead to experiences A and B effected by P and Q, respectively.

at P, Q (and elsewhere, as far as natural laws require) with the "hallucination" to become true. O's striving in question may be unconscious, or a more "standard" kind of hallucination might be responsible.

The crucial argument is that, once we accept some kind or other of retroaction that obeys orderly natural laws, and in particular does so in coordinating various fillings-in of Δ margins, such retroactive influences *can be expected to similarly "mold the past" as causal ones do with respect to the future*. Of course, both influences do so coherently, by feedbacks, in order to jointly comply with L's symmetries and architecture: four-dimensional laws. In any case, the course of matters will sometimes be "miraculously" different from the case in which the retroactive contribution would have been lacking, however tiny the Δ margins of freedom and the more-than-randomness of the coordination of the fillings-in will be as a rule.[11] Accordingly, the paranormal will be rare and unimpressive. Still, retroaction will generally *contribute to order in the universe, as will the paranormal*.

Retroaction's appearance cannot but make a difference. The paranormal is an aspect of it.

Note that our explanation of PK and striking coincidence with Figs. 10 and 11 agrees with the *observational theory* that most parapsychologists think to hold true, i.e., the idea that paranormal phenomena have as their source some (unknown) effects emanating from observational acts of a living being.[13] We will see below that such agreement also applies to paranormal phenomena other than PK and striking coincidence.

Particularly in view of our earlier remarks about the relation of (orderly) retroaction and goal orientation (compare Section 2.4), we may even go so far as to surmise that, (systematic) retroaction once (now and then) emanating from observational acts, it may somehow be (very mildly) functional in fostering humankind to attain goals more generally. In all, our conceiving L as a network of feedback channels — the seemingly dynamic feedbacks corresponding to L's four-dimensional laws and structure — while this also functions just as intelligently and coherently as natural laws appear to do in the first place, may have radical consequences for our model of nature. Figures 1, 3, 4, 5, 7, and 8 are just the tip of the iceberg.

Just as in the case of the die, our model suggests distances and complication not to be very relevant as to striking coincidences. That is, what O does in Fig. 11 is not at all something so complicated as retroactively "transferring some Δ coordination pattern from A and/or B to P and Q." The A, B configuration should perform an easier task, viz. trying to adjust relevant Δ coordinations in O's organism so as to observe ("hallucinate") the desired coincidence and, subsequently, "wait and see" whether or not the rest of the universe — especially what happens at P and Q — and joint natural laws succeed in making everything consistent, that is, in adjusting it to O's internal bias. One may even suggest that the more complicated the setup is and the more distant P and Q from A and B, the more degrees of freedom "the rest of the universe" has to indeed adjust to O's retroactive "impulse." For the rest, something similar to the above happens with causal interventions (to be compared with O's retroactive one in the A, B region): e.g., if I want to move a stone that is too heavy, the environment will not adjust to my striving, or to my initial action or "hallucination."

3.3 Precognition, Clairvoyance, and Telepathy

In our model, precognition can be seen as connected with a more far-reaching form of retroaction than operative in Fig. 7. That is, we hypothesize that in precognition retroaction extends beyond its normal organic pattern indicated by the figure, just as it does so, *inter alia*, in the cases of Figs. 10 and 11. Hence it is correspondingly rare. Concretely, precognition appears if information in a conscious form is transmitted, say, from a later stage A of a clairvoyant C's world-tube *l* to an earlier stage B (see Fig. 12). A retroactively casts its shadows before to B, farther than from E to A, …, in Fig. 7. The explanation need not fundamentally differ from earlier ones. More concretely, C at A in Fig. 12 may make an (un)conscious

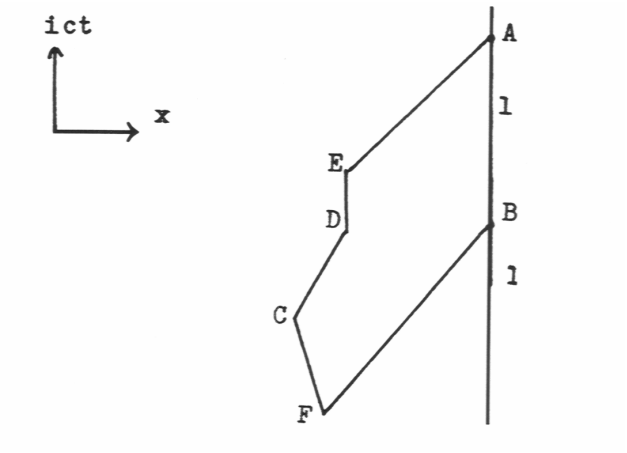

Figure 12. Clairvoyant C (world-line *l*) gets an impression of some experiences of my (living or deceased) father F at B. The possible correctness of it is verified at A via normal causal chain FCDEA. FB is the world-line of an "inductor," say, my father's watch. C may get his impression at B retroactively from A.

endeavor to "simulate" or "hallucinate" *the experience of recognizing a former precognition at B*. Analogously to Figs. 10 and 11, the environment (natural laws and prevailing conditions) adjusts or does not. In the rare cases it does, consistency requires the precognized event to have actually taken place: C at A truly remembers a precognition P at B of what he now actually witnesses at A. If P did not really appear at B in spite of A's remembering it from B, consistency would be lost (apart from C's brain not functioning well). In fact, C similarly influences B from A as A, E in Fig. 10 influences D, M. In short, C tries to retroactively send from A some information to B, in the way indicated above, while the environment consistently adjusts or does not. In the latter case the precognition fails to occur.

We further consider Fig. 12 as an illustration of general clairvoyance (not merely precognition). Imagine C wants to get paranormal information about my father F whose watch W (world-line FB) I gave to him as an "inductor." It is verified at A whether possible "paranormal" impressions of C at B are correct. The relevant information about F is quite normally transmitted to A (that is, C) via FCDEA. Note here that clairvoyance should be corroborated (at A, which is later than B) in order to be accepted as a real case. Now we need only use precognition as discussed in order to explain C's possible success: we only need precognition at B in consequence of A's casting its shadows before by retroaction.

How may W facilitate the process (as is widely believed)? Well, most of the time many (half- or un-) conscious impressions will "flood" C (at B or elsewhere), one of them possibly being the retroactive one from A. Then, if the latter impression contains something about W, C at B will *more probably "recognize" it consciously* because of W in his presence that "reminds" him of the A impression! It could be a test of the latter part of our theory if it appeared that, statistically,

1. W did not facilitate clairvoyance if the corroborating information arriving at A was unrelated to W and
2. W still facilitated the clairvoyance in case it was not the watch of F but only a similar one.

From a somewhat different point of view we can say that C at B similarly by feedbacks "senses" the A reality, as in Fig. 1 the Δ coordination at A and B does so with respect to the T condition via the world-lines of the momentum carriers.

Note that within organisms feedbacks as in Figs. 3, 4, 5, and 7 abundantly and efficiently appear, making possible the mutual recognition of L subconfigurations, particularly with the functioning of association and memory. Living organisms are especially attuned to many laws and processes to cooperate — i.e., L configurations by feedbacks recognizing each other to be correctly related — and Δ coordinations playing an important part in the subtle coherence making up the organism.

In Fig. 10, E strives to experience 6 coming in. Similarly, in Fig. 12 A strives for "my sensing at B to be corroborated." In both cases the natural laws resulting in such strivings may sometimes produce a bias in "their" direction, be it retroactively this time instead of the well-known causal case. In the case of Fig. 12, B, in a way, may seek information about F — this time via a channel like BAEDCF — in principle similarly to how she can also seek it from her memory. Feedback channel A $\rightleftarrows$ E $\rightleftarrows$ B of Fig. 5 is somewhat prototypical of the relevant unconventional paths allowing nonlocal feedbacks as are at stake here.

If neither a verification nor an inductor takes part in a clairvoyance experiment, we assume things to proceed largely as in the above die case of Fig. 10: C's striving to "observe" something about F, which retroactively emanates from B, now substitutes that of the A, E organism to observe 6. Verification and inductors could merely facilitate the communication.

No "hit" appears in either case if the environment cannot adjust to the retroactive impulses from the relevant persons, just as the emission at E in Fig. 4 would have been absent or would have occurred with different momenta if, in A′, B′, etc., no adjustment to conservation or other laws had been possible.

To discuss telepathy, consider Fig. 13, where *l* and *m* are the world-tubes of two individuals P and Q who at A and B experience corresponding mental events (pictures, thoughts, …). In a similar way as with clairvoyance we may explain this by retroaction from later events that corroborate the telepathy. Say, P learns about Q's B event at E via the normal information path BE, and/or Q learns about P's A experience at F via AF. In such or analogous cases retroactions like E → A and E → B could explain the telepathic experience in a way similar to how C's clairvoyance in Fig. 12 could be explained via the retroaction A → B. Just as with Fig. 12, we may also call on the PK mechanism of Fig. 10, viz. on human (un)conscious strivings playing a part in the telepathy-inciting retroaction. That is, P at E and/or Q at F may have some wish to get some information from their friend. If we also apply this to Fig. 12, we get a common model of the three cases of Figs 10, 12, and 13 of A, E wishing 6 (Fig. 10), C at A (and B) striving after the experience "my impression at B was correct" (Fig. 12), and P or Q wanting to learn at E or F "I got the right information, which I needed" (Fig. 13). Or, in the latter case, P or Q got the correct message anyhow, without verification.

The above general explanation would agree with the idea among many parapsychologists that PK from an observer is the common cause of most paranormal phenomena. In all cases the environment can or cannot (according to natural laws) adjust to a retroactive impulse from an observational act guided by a complex of laws resulting in an (un)conscious striving. Compare how the environment may or may not give in to a complex of *causal* forces that, say, tends to move a big stone, as we indicated earlier. (Still, causal *and* retroactive influences tend to make the environment give in to some degree.) In the second case (no adjustment) the wish or retroactive influence is unsuccessful in starting up a feedback leading to wish fulfillment. In all three above cases the "wishers" roughly know what kind of experience they want and act via corresponding retroactive Δ coordinations. In principle, this occurs as in Figs. 1 (the "wishing" laws now being conservation, superposition, and the $|\psi|^2$ rule) and 7 (everything happening within an organism this time).

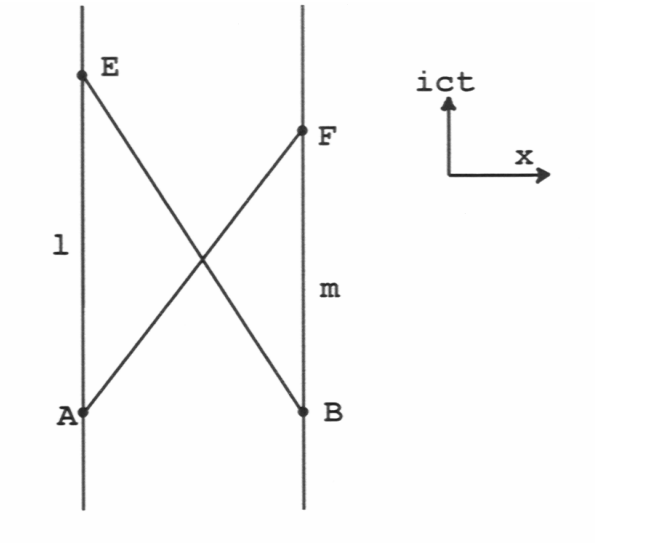

Figure 13. Telepathic communication between observers P and Q with world-lines *l* and *m*, respectively. At A and B some similar thought or feeling may become conscious in them. This could be corroborated at E or F, where information may be normally exchanged by them via causal paths BE and/or AF. Then E or F may retroactively coordinate A and B. Compare Fig. 9b in which Q, R, S, … were anyhow coordinated by retroaction.

In the above context it would fit that people generally influence each other paranormally, such as by telepathy and PK. This may also explain why many paranormal phenomena by no means increase the wellbeing of the people in question (even apart from the appearance of neurotic or other unconscious wishes). Actually, it is rather obvious that competition and strife among us is continued on the level of paranormal "strivings" and interactions, once these appear. Some "voodoo" — precisely to the detriment of the victims — as well as massive conformism may be explained by this.

For the rest, corroborating events such as A in Fig. 12 and E and F in Fig. 13 may often appear quite independently of any personal wish or consciousness, but just because they fit in major patterns of L like, say, the observer's removal of T in Fig. 1 may do, regardless of its retroactive consequences near S or any human preference (it may be decided on by a computer).

3.4 Further Arguments on the Paranormal and the Coherence of Natural Law

We now discuss various additional points in connection with the foregoing.

1. Precisely because complicated Δ coordination, especially of the goal-oriented kind, will not find outside organisms instruments like senses, muscles, memory, association (channels), and the like, so as to truly intelligently act, most paranormal phenomena are abortive from a standpoint of attaining goals. Within this scope compare the simple goal orientation of the general HV of Ref. 11 that only serves the purpose of action completion (again via retroactively filling in Δ margins, as to a mere one observable so as to produce an eigenvalue), which is always accomplished. Within organisms and within the scope of the paranormal, on the other hand, many coordinated fillings-in should be accomplished at the same time: many observables should be mutually attuned in their definition. This is a far more subtle variant of the feedback at stake in measurements, also as to *what* eigenvalues should be preferred by the feedback.

In particular the role of *recognition* (consciousness!) is different in the simple "dead" circumstances as in Figs. 1 and 5 as compared with the subtle feedbacks of Figs. 7, 10, 12, and 13. In both situations, however, the recognition winds up as some (in the first case primitive) *Aha-Erlebnis* to the effect that it is sensed that "things tally as to what natural laws should accomplish." In the organic case optimum wellbeing functions as a guide for the relevant organism's own (goal-oriented) contribution to making them tally. Further, the recognitions in the feedback processes will refer to L configurations (and associated Δ coordinations): they will recognize each other via the channels of nonlocal feedback. Note also the sense of finding relevant interactions to agree with natural law or not, the feedback "changing course" in the latter case. (Note that L configurations or symmetries and natural laws are each other's translations.) The simplest case is action completion; intermediate are those of Figs. 1, 5, and 8; and most complicated are those of Figs. 7 and 10 to 13, which imply conscious optimization of wellbeing.

2. In Fig. 10 we saw some Δ coordinations at A, E being mimicked at D, M because of the constancy of the velocity of light. We can add that vibrations in material objects too might transmit Δ coordinations as they also correspond to certain velocities and energies so that Δ coordinations enforced at their absorption should retroactively have repercussions on corresponding ones at their emission. This could expand the degrees of freedom for nature to produce ordered retroaction and paranormal phenomena, these transcending disordered, stochastic Δ-fillings-in corresponding to "standard" HVs.

3. Note the similarity of Figs. 7, 11, and 13 on the one side and Fig. 5 on the other. The former three essentially correspond to reflections of Fig. 5 in a now-hyperplane of Mi, while indeed their feedback mechanisms are more complicated. In Fig. 9, (a) is to be compared with EPR and (b) with the other three figures. E of Fig. 5 is an analogue of E, (A, B), and E or F in the three others, respectively.

In Fig. 5, E connects the feedback channels EA and EB so as to make A and B sense each other's experiences (corresponding measurements) via such channels *that now more directly connect them by natural law*. Analogously, not only may E of Fig. 7 maintain this kind of connection among A, B, C, … that Δ margins can be filled in coordinatedly in them, but additionally E — via AEB, BED, etc. — may connect A, B, C, … so as to make them similar to A and B in the "mirror image" EPR in Fig. 5. A, B, C, … may be, say, psychological complexes or items of the organism's memory. This point of view contributes to explaining association. The "mirrored" Fig. 5 connection is also relevant to Figs. 11 and 13 as regards the coordination of P and Q and A and B, respectively.

We can see E in Fig. 7 as a kind of (recognizing) exchange seeing to the appearance of efficient feedbacks among recollections, associations, etc. (A, B, C, …). This is a complicated analogue of the feedback between A and B in Fig. 5. We have far less efficient specimens in Figs. 11 and 13. Still, more general feedbacks, recognitions, and influences among L configurations constitute the very essence of natural processes and the four-dimensional implementation of natural laws, as already required by mere consistency (recall Fig. 4).

The feedback channels and recognitions allow "the language of nature" (also compare point 4 below) to be operative, a language whose essence is (L) pattern recognition. Note that in L configurations we understand all Δ margins to be filled in with respect to all variables.

4. An essence of our model can be summarized by realizing that, just as in Fig. 4 extensive nonlocal feedbacks are needed to make conservation be complied with, *such feedbacks via L's physical paths (e.g., world-lines) cannot but appear more generally in order that many other natural laws be satisfied too*. Extensive Δ coordination is part and parcel of the relevant nonlocal adjustments and coherence. *This is highly relevant to both consciousness in general and the paranormal in particular*.

The relevant feedbacks play an important part in mutual recognitions. We know the latter also from "chunk recognition," such as the mutual ones of atoms, molecules, cells, …, needed for interactions at all. The feedbacks may extend this to the more general chunks of information embodied by (partly standard) L configurations and associated Δ configurations. Within this scope nature may apply a whole language in which such atoms, molecules, cells, …, and more complicated L configurations act as letters, words, sentences, …, and arguments. The appearance of such "language," and corresponding recognitions, could make the universe much more subtle, coherent, and "organic," with consciousness as well as the paranormal playing inherent parts. Figures 1, 4, and 5 are simple specimens; organisms and their associations and recollections are sophisticated analogues. *The category of "intelligence" too would appear on a primary level of natural law*. In any case, "chunk" recognition and manipulation on a four-dimensional level would cause the ordering faculties of natural law to increase substantially. Realize that entities of the psychological category such as pictures, concepts, and wishes will probably be treated as (complicated) chunks by natural law and "language," and by relevant processes. They may be recognized as such like, say, (the world-line of) an oxygen molecule, viz. via certain L configurations or L symmetries associated with them.

Note in the above context that the mutual recognition of laws and processes, which is essential in our model of consciousness, actually amounts to the recognition of L configurations and symmetries that embody such laws and processes four-dimensionally. All this culminates in living organisms, even leading to the *Principia*, which boils down to coherently operative natural laws rather than vague concepts like "creativity" or "free will."

In the paranormal cases of Figs. 10 to 12 the "stable wiring" and feedback channels (nerves, memory, associations, …) that make recognitions and subtle Δ coordinations easier in living organisms are largely lacking. This causes the relevant recognitions, *inter alia*, in Figs. 11 and 12 to be rare.

5. A mechanism of precognition additional to those discussed, among other things, with Fig. 12 (e.g., PK from A to B), might be that, within the scope of its sensing distant L configurations in general, a conscious organism may also sometimes sense one in the absolute future, so that, in this figure, B may sometimes sense information from the L configuration at A.

4. HOW FAR IS HUMANKIND AN ORGANISM?

Man is a message.
Norbert Wiener

4.1 On the Four-Dimensional Aspects of Interindividual Communication

In Section 3 we discussed various kinds of extraorganic and interorganic communication or influence, such as telepathy and PK, in which Δ coordination and time-like feedback played a part. Generally, one can expect four-dimensional laws — such as often implemented by time-like feedbacks — to refer to events rather than objects, forces, and three-dimensional distances. *This may in principle hold for humans and our experiences too*. Then some hitherto unknown relations could exist between causal and retroactive influences on such experiences, to the effect that, in a feedback way, four-dimensional laws would also connect our situation with what comes to us from outside, that is, in a sense that our destiny as such becomes more coherent than mere causality could bring about. Analogously to the way we discussed telepathy, this might be effected by causal communication via language, pictures, etc., being completed by retroactive complements, making the processes four-dimensional. For example, light waves that transmit information causally may in the way of Fig. 10 transmit retroactively acting Δ coordinations too, this time, say, to the sender of the message rather than the die. Telepathy, clairvoyance, and PK could in principle integrate humankind so much as to their working also in the service of collective purposes and/or their continuing competition and strife among us to the paranormal level. In their four-dimensional capacity they may contribute to certain outcomes or even our destiny. This would make us an organism to some degree. Note that once the paranormal appears, it could be expected to be *functional* to some degree and to radically transcend the individual domain. Just as more generally feedbacks increase nature's coherence and the subtlety of L's symmetries, a similar thing may apply to us and our destiny, and to humankind as a whole. All of this would imply that, from a three-dimensional point of view, subtle Δ coordinations could very "deeply" codirect human affairs. To some degree an individual psyche in the collective might be compared with an association complex as part of one person.

In this context there may be a function for a "world mind." In mathematical language it would amount to "the formula of everything": such an integration of all natural laws, logic, and mathematics so that — within the scope of their coherence — a comprehensive consciousness or psyche arises *comparable to what*

happens in the human organism. This would mean that "God" as a central "exchange" would no more violate natural law, logic, or mathematics than we humans do so in our conscious processes and organism that are part and parcel of such laws, etc., and inherent or concomitant to their coherence. The world mind would be the consciousness of the organism the universe as a whole could amount to, viz. if some of our above hypotheses were correct. God would be one more feature of the coherence of natural law, which appears anyway.

Even apart from the above increase of coherence and (partial) integration of the world one should realize that the mere circumstance that relativistic distances on the world-lines of free photons are zero — this making their emission and absorption events contiguous — contributes much to such integration. Also compare Fig. 8.

Somewhat paradoxically, the above "step to bridge the gap between science and religion" would not result from any concession of the former but from its becoming even more consistently rationalistic and deterministic, the nature of natural law also obviating chaos and the "nonscientific" to the utmost. *God is coherence*.

A few points may complete our hypothesis that the paranormal somehow implies "group minds":

1. Once we recognize nonlocal Δ coordination in Figs. 1, 4, and 5 — outside organisms — it is no longer a miracle if orderly nonlocal influences are operative interorganically too, effecting more ("paranormal") order than implied by mere local causality.
2. Experimental or spontaneous specimens of the paranormal might be (rare) variants of the more functional kind suggested above. The latter — just as in the "normal" collective or social dimension of life — may have dark sides too; think of conformism and "voodoo," say, damaging dissidents.
3. One more consequence of a possible more-than-local integration of human experience may be that various developments show "abnormal" inertia: an incomprehensible resistance to change. For, in our "organic" nonlocal model, such changes may have more repercussions than in the classical, local-causal picture.
4. Our model implies that an individual's inner attitude — the latter's retroactive observational consequences — may influence what comes from outside, apart from the normal causal mechanisms. One more point of relations between science and religious intuitions may appear here.
5. To a large degree, normal communication via language, light waves, etc., already makes humankind an organism in the social sense. Δ coordination, as (retroactive) part and parcel of the cooperation of laws, can be expected to complete the "causal" communication, as indicated. Joint causal and retroactive aspects of four-dimensional law may cause such a law to be so consistently four-dimensional that it primarily refers to *events* also in the sense of experiences and destinies of relevant individuals.
6. We may consider a series of increasingly complicated "chunks" that are partly treated as a whole by (four-dimensional) natural laws. Think of (world-lines or experiences of) elementary particles, atoms, molecules, cells, organisms, and their psychological aspects (complexes and what they live through). Rational laws may be rational far more than merely "half" in the sense that they "do not play dice" four-dimensionally — as regards events and results — either. They may control not merely details but also major results, human destinies and evolution included. Seeing to relevant coherence may not be too much for laws that also produced "the general theory" and da Vinci's works. Managing chunks as such, from this point of view, might make the task of macro-ordering more feasible. The foregoing joins with our general ideas on the roles of consciousness, Δ coordination, and four-dimensional coherence. *Not only "theoretical logic and mathematics" but also their practical translation into the real world may show deep macro-architecture*, major chunks obeying macro laws as, say, whole organisms do to some extent. Their being *recognized* as such is a start.

4.2 Four-Dimensional Reality and Group Minds Shed New Light on the Problem of Survival

In Section 4.1 we saw that the paranormal and realistic four-dimensionality correspond to a picture of humankind like Fig. 14, in which individuals as four-dimensional complexes are indicated by A, B, C, …, and their (para-) normal communications by a, b, c, …. We omitted world-lines, the duration of a life being the time-like extension of A, B, ….

The problem of death gets another meaning from a four-dimensional point of view in the first place. For example, if, say, C dies, he does not cease to exist four-dimensionally. In more detail, we can approach the problem of possible survival after death via a number of points:

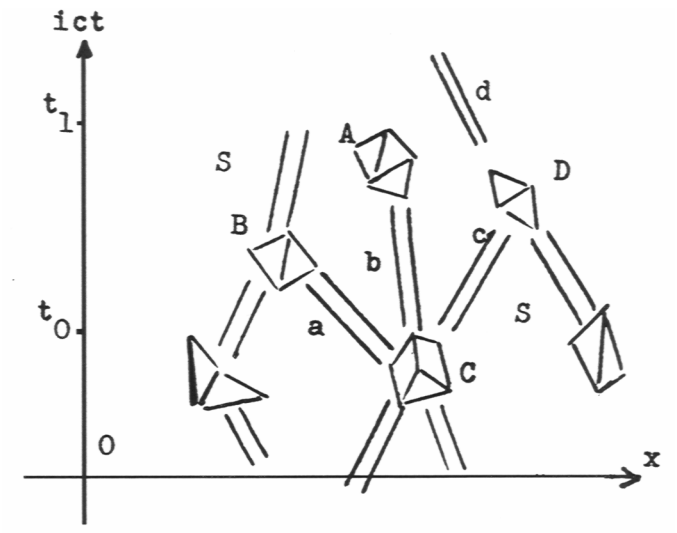

Figure 14. Separate individuals A, B, C, … are mutually connected by causal or feedback channels a, b, c, …. The individual lives are represented as complexes of experience in Mi, without world-lines being separately sketched.

1. The entire complex S (A, B, C, …) of individual existences — A, B, C, … being connected by causal and feedback channels a, b, c, … — is somehow comparable with one individual and her "complex parts."
2. Channels a, b, … can be compared with, say, the one between A, E and D, M in Fig. 10, also as to possible time-like feedbacks operative via them.
3. The possible analogy of Fig. 14 and a picture of the complexes of one individual (that are also bounded in time) may be vital to the survival problem: at time t_1 after C died (at t_0), later parts of S may "remember" experiences of C (via a, b, c, d, …) just as an individual may recollect previous experiences in his life. This may or may not be integrated into a coherent model and might be conceived as *a variant of reincarnation*: later parts of S receive (parts of) the "message" C corresponds to. Also compare individual memory and a clairvoyant "remembering" parts of my father's life in Fig. 12. It will depend on the actual communications and integration of S whether any true survival could be explained by our theory. It may ultimately be the "world mind" that "remembers" a deceased person, say, in the latter's quality of positive contributor to the four-dimensional world. Within this scope the processes in S may show coherence and order that are attuned to the relevant four-dimensional psychic integration.
4. In our model chance is highly substituted by psychological laws such as referring to Δ coordination. Also, the paranormal in general may be conceived as (psychological) processes in "organism" S, thus making it much more functional and less chaotic.
5. Again, some relation to religion appears:

   First, S showing some similarity to a world mind, our psyches might end up in being integrated in it.

   Second, the ways he thinks, feels, and acts may influence how "welcome" an individual C and his "complexes" will be to A, B, D, … and the world mind. It could be that "how much we are remembered" *will depend on the quality we represent*, i.e., on how this fits in structure L and its psyche ("God"), which ultimately correspond to the laws of nature and their coherence. Human destiny — like everything else — could appear to be less chaotic than we thought, also because the psychological is a dimension inherent to natural law.
6. Our theory may solve the problem of why "God is so powerless against abundant evil." For it takes "God" to be an evolving entity too, just as the universe He animates. In the stage now within our horizon, both are still rather primitive. Still, some retroactive signals from later and higher stages may reach us, to some degree.

5. A CHANGE OF PARADIGM; INTEGRATING "GOD DOES NOT PLAY DICE" AND "A MICROPROCESS ACTS AS A WHOLE"

Newly acquired insights are at first only half understood by the one who begets them, and appear as complete nonsense to all others … Any new idea which does not appear very strange at the outset, does not have a chance of being a vital discovery.

Niels Bohr

Paranormal phenomena apparently do not fit in current science. Neither, essentially, does nonlocality in general. In actual fact, the quantum phenomena as a whole continue to defy our explanatory imagination, and the difficulty of integrating them with relativity is a symptom of this. This may be a signal that some of our concepts (or "paradigm") need revision. In our work we made an endeavor, which we now summarize:

1. We demonstrated realistic four-dimensionality of the universe.
2. As a consequence, retroaction is no longer paradoxical; we demonstrated its actual appearance.

3. The introduction of a metric based on action differences appeared to be in a position to explain nonlocal phenomena.
4. Retroaction, even if it appeared not to accomplish anything more than seeing to the completion of action to integer quanta, can act as an HV.
5. Coordinatedly filling in Δ margins as part and parcel of four-dimensional natural laws, which are satisfied by both causality and retroaction, amounts to a new degree of freedom for nature as to ordering the world; retroaction indeed complies with laws just as causality does.
6. We found this degree of freedom to be associated with the phenomenon of consciousness.[10]
7. In the present paper we tried to extend the relevant explanation (of consciousness via Δ coordination) to paranormal phenomena too, essentially by showing what noncausal phenomena may be produced by retroaction emanating from observational acts.

Particularly note that the above complex of paradigm revisions also allows us to reconcile the two pronouncements in the title of this section. For, as is clear from the foregoing, especially in conjunction with Refs. 3, 8, and 11, Einstein's HVs, which exactly define all Δ-fillings-in — chaotically or orderedly — *are precisely the (nonlocal) physical influences (feedbacks) that integrate micro-processes to the wholes Bohr had in view*.

That is, only a four-dimensional point of view, containing retroaction and nonlocality (because of the action metric), can explain "uncertainties" to be deterministically defined by the *very complete whole* a relevant process is, rather than by local details.

Attuning this in more detail to our problems of consciousness and the paranormal, we get this picture.

In Fig. 5 (EPR) we see the processes at A and B integrated (or mutually influence each other) via a feedback path containing E. In Fig. 11 we have something similar, viz. P and Q being attuned to each other by conscious processes (an "exchange") in the A, B region. Special feedback communication is crucial in both cases, while our two situations illustrate "processes being a whole." (Also recall Fig. 7 and how E may make A, B, C, … into one intra-organic complex, which is one more psychological specimen of microprocesses acting as wholes.)

In this context a psyche and its consciousness — *inter alia*, in their striving to optimize wellbeing (or self-preservation) — constitute a macro-specimen of a microprocess (nonlocally) acting as a whole, without God anyhow playing dice in the subtle and coherent cooperation of laws that — in also managing *results* — even transcends Einstein's variant of determinism.

As indicated at the end of Section 2.1, we may get much coherence and simplicity if we hypothesize that the hyperplanes H_0 and H_1 introduced there define the four-dimensional world completely via causal and retroactive influences, respectively, that cooperate in feedbacks. This model may be generalized by assuming that all four-dimensional physical domains R_4 in the universe are completely defined by R_4's joint boundaries via inevitable logical principles such as coherence and simplicity. (Do not make an obvious mistake: no four-dimensional R_4 can be bounded by mere vacuum!) This model would integrate Einstein's and Bohr's views quite clearly: four-dimensional deterministic coherence and nonlocal "vagueness" from a merely three-dimensional causal point of view. Also note that it might be a (radical) generalization of the principle of least action.

Received 13 April 2005.

Résumé

1. On note qu'aussitôt que la rétroaction et la nonlocalité (dans l'ordre) interviennent dans les phénomènes physiques, cela donne l'impression de « miracles » (phénomènes paranormaux) d'un point de vue local et causal; la nonlocalité ne pouvant expliquer cela.

2. En partant de processus bien connus comme les trous de Young et EPR, on étend les processus d'action en retour et de cohérence non locale aux organismes vivants et à leur influence sur l'environnement.

3. On explique comment la rétroaction en provenance des êtres vivants peut prendre la forme d'une orientation vers un but défini, en rendant la psychokinèse et la clairvoyance plus compréhensibles. Quelques modèles sont discutés concrètement ainsi que les coïncidences remarquables et la télépathie.

4. Le modèle physique décrit rejoint la théorie observationnelle si importante en parapsychologie professionnelle.
5. On étudie jusqu'où un tel modèle implique que l'homme soit, jusqu'à un certain point, un organisme quadridimensionnel en tenant compte des transmissions inconscientes entre individus, transmissions méconnues jusqu'à présent.
6. Finalement, notre théorie implique un changement de paradigme englobant le « Dieu ne joue pas aux dés » déterministe, et le « Tout microprocessus agit de façon entière » antiréductioniste. Ce faisant, elle introduit le déterminisme non local auquel la dimension psychologique est inhérente.

References

1. C.W. Rietdijk, Philos. Sci. **33,** 341 (1966).
2. *Ibid.* **43,** 598 (1976).
3. *Idem*, in *The Wave–Particle Dualism*, edited by S. Diner, D. Fargue, G. Lochak, and F. Selleri (D. Reidel, Dordrecht, 1984), p. 433.
4. *Idem*, in *Courants, Amers, Écueils en Microphysique*, edited by C. Cormier-Delanoue, G. Lochak, and P. Lochak (Fondation Louis de Broglie, Paris, 1993), p. 361.
5. *Idem*, Found. Phys. **8,** 615 (1978).
6. *Ibid.* **11,** 783 (1981).
7. *Idem*, Ann. Fond. Louis de Broglie **16,** 91 (1991).
8. *Idem*, Found. Phys. **10,** 403 (1980).
9. *Idem*, Phys. Essays **15,** 264 (2002).
10. *Ibid.* **19,** 200 (2006).
11. *Ibid.* **16,** 43 (2003).
12. A. Messiah, *Quantum Mechanics* (North-Holland, Amsterdam, 1961).
13. J.M. Houtkooper, *Observational Theory: A Research Programme for Paranormal Phenomena*, doctoral thesis, Utrecht (Swets & Zeitlinger, Lisse, 1982).

C.W. Rietdijk
Pinellaan 7
2061 LH Bloemendaal
Netherlands

e-mail: cw.rietdijk@quicknet.nl