

IS PHYSICS AN OBSERVER-PRIVATE PHENOMENON LIKE CONSCIOUSNESS? (1998)

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**Abstract:** If objective physics is dependent on observer properties as Einstein showed, physical reality becomes an 'interface reality'. Einstein's principle of observer-relativity is extended to micro motions in the observer. The resulting 'micro relativity' can be studied using model universes. In a classical billiard universe, the interface is (under certain conditions) characterized by 'micro time reversals'. These time reversals cannot be 'edited out'. They perturb (in conjunction with the observer temperature) every small-mass object to be observed. And (in conjunction with the observer diameter) they perturb every fast-moving object to be observed. The implied 'action noise' and a 'velocity limit', respectively, are reminiscent of Planck's constant ( $\hbar$ ) and the speed of light ( $c$ ), in the real world. To check whether there exists a connection with the real world, the observer temperature can be inserted into the two fundamental constants  $\hbar$  and  $c$ . This leads to a specific value for the 'observer diameter' (7.39 micrometers). Search for a cell class clustered around this size in the brain would amount to a 'Privacy-of-Physics test'. Four such 'PoP tests' can be indicated so far. The idea that certain relational properties of the world may be as observer-private as consciousness, is therefore falsifiable.

'Quantum mechanics is above all an extended kind of relativity.'

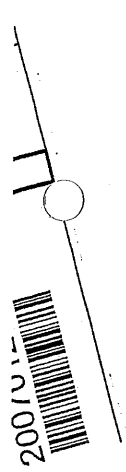
David Finkelstein (1996)

**I: Introduction**

One of the driving forces in modern thinking is chaos theory. Its 'attractors' and 'boundaries' have brought the continuum back into physics. The beauty combined with transfinite accuracy of these fractal objects (Mandelbrot, 1982) has a 'brain-washing' effect. Is the philosophy of the continuum only a useful tool like the continuum theory of sound or does it reflect an element of physical reality?

If the accuracy of the continuum is an element of physical reality the fundamentals of physics will be re-shaped. A deterministic hidden-variables picture then returns on the micro level. A programme in this direction is endophysics — physics from within (Rossler, 1987). The Greek name was suggested by David Finkelstein (personal communication, 1983). The advice not to use the spelling 'end-o'-physics' stems from Norman Packard (personal communication, 1987).

The idea to use a continuous microscopic Newtonian theory as an explanation of nontrivial observer-private properties of physics goes back to Roger Joseph Boscovich, a theologian-cum-scientist of the eighteenth century whose 1758 textbook not only anticipated features of quantum mechanics and relativity (like solidity and covariance) but also summarized the contemporaneous knowledge of the workings of the brain. Most important, he saw that 'the impressions generated in the mind' are invariant under certain transformations of the world (see his seminal 1755 paper 'On space and time as they are recognized by us'). Boscovich is the inventor of the notion of the interface in the modern sense.



A major obstacle to any deterministic hidden-variables picture is Bell's theorem. Bell (1964) showed that no classical theory can ever explain one key feature of quantum mechanics, 'nonlocality'. Nonlocality refers to the fact that a measurement performed on one of a pair of 'correlated particles' changes the measurable state of the other at a distance. This new quantum property of nature is incompatible with 'separable predetermination', Bell (1964) showed. The consensus today is that Bell's result marks the end of any classical-local hidden-variables approach to physical reality. Since Boscovichian endophysics is a classical-local hidden-variables approach to physical reality, an impasse appears to have been reached.

Unexpectedly, endophysics is *not* affected by Bell's theorem if one takes Boscovich's interface idea seriously. Nonlocality then is not an (exo-) objective property of the world any more but only an endo-objective one — a property of the observer-specific interface (Rossler, 1989). Objective physical reality, the world, thereby becomes a one-man's (or woman's or child's) business.

The same proposal has been made once before by Hugh Everett (1957). Everett's theory is 'observer-relative' (observer-consciousness-relative). The main difference to endophysics is that the exo world was assumed to be nonclassical by Everett — being governed by the Schrödinger equation of quantum mechanics. We shall see that as soon as one accepts the interface idea, such differences lose their significance. The prediction common to both cases is that the micro interface (unlike the macro interface of relativity) cannot be left by the observer. Not even memory provides for an escape (Everett, 1957; Rossler, 1989).

The question which now poses itself is whether or not a 'roundabout way' can be embarked upon in order to 'unmask' the interface-dependence of reality and thereby the existence of the interface itself, if it does exist.

In the following, first the basic idea of endophysics will be introduced. Then three features of a classical interface in a computer universe will be 'transplanted' to the real world in a heuristic fashion. They will suggest the existence of a distinguished cell class in the brain. Finally, the more general 'Privacy-of-Physics' problem will be addressed.

## II: Interface Physics

Our aim is to knit chaos theory, quantum mechanics, relativity, micro motions and neurophysiology closer together (with a view to consciousness). This can be done in the footsteps of Niels Bohr and his microscopic interface concept.

Bohr's famous question reads: How does the rest of a classical universe appear to an internal observer (Rozenal, 1967)? The natural tool to use when seeking an answer is the study of artificial universes made up from classical billiard balls in a computer. These so-called 'molecular-dynamics simulations' were invented by Alder and Wainwright (1956). More recently, a macroscopic chemical reaction oscillator was simulated in this fashion using Newton's equations of motion (Diebner and Rossler, 1995). Hence a microscopically accurate artificial universe containing far-from-equilibrium macroscopic dissipative structures (in the sense of Nicolis and Prigogine, 1977) can be set up in a computer.

In particular, an 'excitable system' — a fluid neuron — can be implemented in a microscopic fashion as a model observer in the sense of biology. Eventually, more

sophisticated model observers, involving not one or one hundred but maybe billions of model neurons, will become amenable to the same explicit microscopic treatment. The value of this way of proceeding is that certain key features of the simplest (single-neuron) case will survive in more sophisticated multi-neuron observers of the future.

As a case in point, any microscopically simulated dissipative structure involves mathematically equal particles like 'electrons'. This fact, which was already seen by Gibbs (1902) and Weyl (1949/1926), has the consequence that such systems are almost equivalent to a system of equal pendulums (Rossler and Hoffmann, 1987). A very simple question can therefore be posed: 'How does a collection of equal pendulums see the world?'

The most important feature in that world appears to be the occurrence of 'micro time reversals'.

## III: The Simplest Example

The simplest example is the 'single-pendulum observer'. As the pendulum swings back and forth, every half-oscillation is identical to the previous one under time reversal. This means that after every half period, the *external world* changes its temporal orientation relative to the observer. These 'time reversals' are interface-objective. Although non-existent from the exo point of view, they represent an objective feature of the world of the observer (pendulum).

The main question to address next is 'robustness'. Do the time reversals which hold good for a single-pendulum observer 'survive' in the multi-pendulum case under realistic conditions? While it is likely that the answer is yes, a proof for the 3-D billiard case is currently lacking (cf. Rossler *et al.*, 1997).

When theory has reached a point where its pace is slowed down to a trickle, sometimes empirical observation can be of help. To obtain a hint from the real world, a closer look at the model world is first in order.

## IV: Three Properties of a Classical Interface

The basic idea is that a classical molecular-dynamics-simulated observer ('brain') cannot get rid of his or her own microscopic roots. Residues from the fact that the observer is not 'really macroscopic' but possesses these microscopic reversible 'underpinnings' may make themselves felt on the macro level.

Specifically, three characteristic properties of the observer can be expected to surface, epsilon, tau and sigma, each with characteristic consequences.

### (1) Epsilon

Epsilon is the 'thermal-noise' energy of the observer. It is equal to the mean energy of motion possessed by each particle for each dimension in the observer. In real physics, its value would be  $\frac{1}{2} kT$  where  $k$  is Boltzmann's constant and  $T$  the momentary temperature of the observer.

At first sight one expects epsilon to leave an incorrigible mark on the observable world. However, the observer can make use of 'amplifying machinery' which acts as an effective screening shield. An everyday example from technology can make this clear: very faint signals can be picked up by the cooled first amplifier of an expensive radio. The same 'shielding effect' occurs in the model universe. Epsilon if taken

alone therefore imposes *no* limit on the accuracy of measurement achievable by the internal observer of a model universe. Unexpectedly, epsilon returns through the backdoor of the second parameter, tau, as we shall see next.

### (2) Tau

Tau is the mean half period of a micro oscillator in the observer. More specifically it is the average interval between two time reversals in the multi-pendulum observer. Unlike epsilon, tau is inescapable: *External causality* oscillates with this period for the observer as we saw in the single pendulum case. The vacillation of causality includes all measuring chains — so that amplification cannot act as a shield this time. After every second time slice, tau, the amplifying 'measuring chain' becomes a dis-amplifying 'perturbing chain'. The perturbation energy that is inflicted each time on an observed micro object is epsilon (Rossler, 1987). Hence epsilon is back in the picture.

At first sight, the assumed 'time slices' of positive and negative causality resemble those of a movie. Therefore one expects the oscillation of causality to be 'integrated over' in the same fashion as the frames of a movie. This 'flicker-fusion argument' is valid only on the macro level. Note that a frozen frame in a movie can indeed be replaced by a short motion sequence of the same duration, and every second such dynamic frame can then be time-inverted since each frame remains 'virtually motionless'. This macroscopic game can actually be performed today using electronic equipment.

The analogy breaks down, however, when the macroscopic realm is left. The coupling between observer and world then ceases to be 'passive' (as in a movie) and becomes 'active'. For in the complete micro description of the observer and the rest of the universe, the micro motions in the observer enter the interface on an equal footing in both time slices. Hence the thermal noise energy of the observer is 'projected outward' during the anticausal time slices (Rossler, 1994).

It follows that an 'action noise' falls on the observable world like a mist. Note that the product of an energy (epsilon) and a time interval (tau) is an 'action', as Leibniz first saw. If both components have a constant mean, their product in general possesses a constant mean too. The consequence is an action-type perturbation. The smaller the mass of an object, the stronger the perturbing effect on its position or velocity.

The resulting unit action provides a *fundamental limit* to internal observation in the model universe. Although only of an endophysical origin, it cannot be 'edited out' by the internal observer. Its size: epsilon times tau. Its proposed name:  $\hbar^*$ .

### (3) Sigma

Sigma is the mean observer's diameter. If the observer is spherical, it is the mean diameter of the sphere. If the observer is grape-shaped (consisting of many approximately equal 'cells'), sigma is the mean cell diameter.

Like epsilon, a finite observer diameter is a property which generates no limit to observation when it is present alone. In the case of epsilon, a second modulating parameter (tau) existed. The same applies in the case of sigma. Tau again enables sigma to become manifest. In the former case (epsilon combined with tau), it was small-mass objects that were affected, in the present case (sigma combined with tau),

it is high-speed objects. When causality reverses its sign every unit time interval tau, the behaviour of speeding objects cannot stay unaffected.

Each point of a by-flying object (or rather the signal coming from it) returns, at the end of the next time slice, to the point inside the observer it reached at the end of the original time slice. As a consequence, the object effectively returns to within a distance of one sigma during every time slice. Moreover, the object which passes by is distorted in the forward direction. Points reaching the observer later coincide with points having reached the observer earlier. Hence rather than passing by at its original speed, the object gets reduced both in its velocity and in its length.

Thus a *second fundamental limit* to internal observation exists in the model universe. It consists in a maximum observable speed. Although only of an endophysical origin, the speed limit cannot be 'edited out' by the internal observer. Its size: sigma over tau. Its proposed name:  $c^*$ .

The existence of both limits,  $c^*$  and  $\hbar^*$ , taken together, implies that a *third* characteristic feature of the observer makes itself felt in internal observation: sigma itself. Note that sigma is  $c^*$  times tau, while tau is  $\hbar^*$  divided by epsilon, so that sigma is  $c^* \hbar^*$  over epsilon.

Thus, if the internal observer of the model universe for some reason did not know his or her own diameter (because the observing subsystem may make up only part of the observer's body and brain), the true diameter could be estimated empirically from  $c^*$ ,  $\hbar^*$  and the observer's temperature.

The two 'absolute' limiting constants in the world of the observer,  $\hbar^*$  and  $c^*$ , would then paradoxically reflect two observer-specific properties *temperature* and *diameter*.

## V: Transcription to the Real World

So far, we have only looked at an artificial universe that can be implemented in a computer. Moreover, even for the model universe, the new predictions arrived at have yet to be confirmed. The generality of the key assumption made — existence of observer-generated time reversals — is still unknown. And the details of how measurements are presented in the interface are still open.

Even unfinished theories may profit from a side-glance at reality. Experiments aimed at providing such auxiliary information have to be distinguished from ordinary experiments. While ordinary experiments test 'serious' theories about reality, the present class may be termed 'scrap-paper experiments' — because they only serve to reduce the delay until one knows what to put into the computer (or on the yellow pad) next. Such an experiment is possible. It consists of three steps.

First step: The limits  $c^*$  and  $\hbar^*$  of the model universe are heuristically identified with  $c$  and  $\hbar/2$ , the velocity of light and the effective Planck's constant, respectively, in the real world.

Second step: A typical 'physiological body temperature' of a human real-world observer, 310 degrees Kelvin, is first inserted into  $\hbar/2$  to derive tau:  $\tau_{\text{real-world}} = (\hbar/2)/\epsilon = 24.6$  femtoseconds. Then insertion of tau into  $c$  yields sigma:  $\sigma_{\text{real-world}} = c/\tau = 7.39$  micrometers.

Third step: falsification.  $\sigma_{\text{real-world}}$  is an empirically testable number. A population of cells (or subcellular structures) may or may not exist in the brain having precisely this value for their mean diameter or extension. The 'grape-shaped

observer' considered above in the model universe could, in principle, have an analogue in the real world.

It goes without saying that any search for  $\sigma_{\text{real-world}}$  in the real world represents a scrap-paper experiment. For the model universe may have nothing to do with the real world.

## VI: The Four Privacy-of-Physics Tests

The experiment proposed above is so strange that a moment of reflection is needed to put it into perspective. The most unfamiliar trait of the experimental proposal just made is not its 'scrap-paper nature' but the implication that objective relational properties of the physical world (like the shape of a stone or the value of a constant printed in a book) might be observer-dependent.

Were it not for the fact that the mass of a stone depends on the velocity of the observer, the idea of an 'objective interface reality' would be hard to communicate. The present proposal goes still farther, however. As in Everett's (1957) observer-relative theory of quantum mechanics, whole observer-specific worlds are claimed to exist. Unlike what holds true for Everett worlds (which are believed to be hermetic), however, the present observer-centred reality is empirically *unmaskable* in principle.

To put the unmasking idea into perspective, a look at other examples in the same class is justified. Three are available so far, each designed to detect a previously unnoticed observer-centered property of physical reality. Collectively, they may be called *PoP* tests — for 'Privacy-of-Physics'.

### (1) Fever test

The first *PoP* test is the *fever test* (cf. Rossler, 1989). Three people sit around a table staring into a textbook of physics — after one of them has taken a fever pill. Using a hand-held calculator or laptop, they find out to their amazement that the value of the effective Planck's constant as printed in the book coincides to all digits with the value for  $\hbar^*$  calculated classically on the basis of the temperature and density of the observer who has taken the fever pill — and who now observes all this.

A formula to calculate  $\hbar^*$  exists (Rossler, 1985). It is implicit in Gibbs' (1902) formula for the 'phase space volume' of a classical system. (In the simplest case — that of a gas of  $N$  equal particles in three dimensions —  $\hbar^*$  is the  $3N$ -th root of total phase space volume.) The best current estimate for the classical phase space cell valid for electrons in materials having the density of the brain at body temperature is  $\hbar^* \approx \hbar/20$  (Rossler, 1985). This means that  $\hbar^*$  is about 63 per cent of the real-world value,  $\hbar/2$ .

Therefore, only the *first digit* comes out correct. The fever test thus has failed dismally. Nevertheless the 'near-match' can also be taken as a hint that a more sophisticated calculation (taking into account the presence of Coulomb-type potentials, for example) might generate an even better match.

A way to obtain more information exists. Since the proper phase space cell in nature is given by the effective Planck's constant,  $\hbar/2$ , the fact that an 'inexact classical calculation' approximately reproduces this value is perhaps not too surprising. At any rate the 'link' can be exploited in a quantitative fashion. That is, an exact quantum-mechanical calculation can be used to derive the 'correct' (although from

the standpoint of quantum mechanics meaningless) classical phase space cell valid for electrons in biological materials.

This is not an easy task, as it turns out, since it does not suffice to reproduce the density of water (or brain tissue). The classical phase space cell is potential-dependent (so that its value differs for inner and outer classical electrons, for example). A second inherent difficulty is more fundamental. To base the fever test on a quantum calculation means introducing a kind of 'bootstrap principle': The value of  $\hbar/2$  put into the calculation co-determines the outcome (so that a functional fixed-point problem arises). These difficulties notwithstanding, a positive outcome of the test would prove that each observer lives in his or her own 'quantum world'.

In this way, a generalized version of Everett's observer-centred theory — in which not only individual measurements but also their recorded mean values vary across worlds — is empirically falsifiable.

### (2) Rotation test

The second *PoP* test is the *rotation test* (Rossler *et al.*, 1994). It tests a general prediction implicit in interface theories in one and two space dimensions: Slow *co*-rotation of observer, object and measuring apparatus should leave the interface unchanged to first order. Potentially interface-generated measurement results in the real world (like quantum measurements) can be compared with this prediction.

The rotational state of a ring of superfluid liquid Helium II is a possible case in point. The ground state ('zero rotation') of such a macroscopic quantum system might be invariant under a transition from a situation of *co*-rotation with the earth of the whole lab (including the observer, the measuring apparatus and the object of measurement) towards a situation of absolute nonrotation of the whole lab.

This is an unexpected prediction. It invokes a discrepancy between two kinds of test designed to measure the same quantity, one quantum, the other classical. For example, Foucault's pendulum, a giant pendulum of museum fame, retains its plane of oscillation while the earth turns around underneath. In 1851, this experiment falsified Copernicus' prediction that the earth's rotation was impossible to measure from the inside of a closed lab. Thus the first 'interface-oriented' prediction of a discrepancy between two types of measurement (lab with windows, lab without windows) failed. The present prediction has the same logical status ('quantum Copernican experiment'). A discrepancy between two types of rotation measurement (one objective, one interface-bound) is at stake. Falsification is therefore possible, again. Indeed it has apparently been accomplished by now (Avenel *et al.*, 1997).

This result was not unexpected since the prediction was based on a two-dimensional artificial universe and the real world is three-dimensional. Nevertheless the experiment was a necessary step on the way towards a more sophisticated test involving a two-dimensional absolutely nonrotating electron gas (which can perhaps be prepared for this purpose).

In this way, Everett's observer-centred theory of quantum mechanics (which makes the same prediction) may become amenable to empirical falsification.

### (3) Relativistic Bell experiment

The third *PoP* test is the *relativistic Bell experiment* (Rossler, 1990). Compare Penrose (1989, p. 287) for a related proposal. Although the relativistic Bell experiment

has yet to be performed, the prediction made — confirmation of the Bell correlations — is not in doubt. Only the significance of this outcome is what is at stake. The prediction goes like this: Two standard Bell experiments, performed in two relativistic frames involving two frame-bound observers, may both involve the same pairs of measurement. This prediction is unproblematical as long as the two measurements performed, one in each frame (and each communicated to the other frame), occur in the same temporal order — with the left one being the first, for example. Both measurements then constitute a single Bell experiment. However, the experiment reaches ‘criticality’ when the temporal order between the two measurements is no longer the same in the two frames. Then in each frame the frame-bound measurement precedes the other measurement (performed in the other frame). The latter is then performed on a photon whose spin has already been fixed by the first measurement. Thus, two different Bell experiments co-exist, each performed in a different temporal order. The point is, that both share the same pairs of measurement results.

The standard versions of quantum mechanics are put in a quandary by this prediction. The reason is the identity between two pairs of noncommuting measurements. Note that the one measurement is ‘virgin’ (reduces the superposition) in the one frame, and the other measurement is virgin in the other frame. This identity implies that the commutator relations of quantum mechanics are violated (Rossler, 1992).

The violation can be circumvented if more than one quantum world exists. For if each frame-specific observer lives in a different quantum world, standard quantum mechanics is strictly obeyed in each quantum world. Therefore only Everett’s version survives among the accepted versions of quantum mechanics. The relativistic Bell experiment is feasible to date (Rossler, 1990).

This means that Everett’s theory is falsifiable. Only the ‘singular status’ of the above test has so far prevented it from becoming a focus of debate. Should any of the other PoP tests have a positive outcome, ‘independent confirmation’ would be available. The relativistic Bell experiment would then cease to be an anomaly.

#### (4) Diameter test

The fourth PoP test is of course the *diameter test*.

Suppose the prediction for the size of sigma had been confirmed. That is, a histological search in slices of human brain tissue had come up with a distinguished class of cells (or cell structures) clustered around a diameter or size of 7.4 micrometers. (The most likely site would be the reticular formation where wakeful consciousness is maintained; cf. Petty, 1998.) The most likely cells — if it is whole cells — would be a kind of micro glia since only glial cells have small enough diameters to qualify (Ernest Rossi, personal communication 1995). Five conclusions would then follow:

- (i) Both  $c$  and  $\hbar$  cease to be fundamental in the exo-objective sense (and become only endo-objective).
- (ii) A sharply defined material correlate exists for the ‘observing consciousness’.
- (iii) The mean diameter of the material correlate of the observing consciousness has entered an endo-objective fundamental constant ( $c$ ).
- (iv) The mean temperature of the material correlate of the observing consciousness has entered another endo-objective fundamental constant ( $\hbar$ ).

- (v) The material correlate of the observing consciousness consists of a well-defined sub-population of cells in the brain. More precisely, it consists of those substructures of those cells (like membranes or filaments) which make up the observing subsystem of the real world. Most precisely, it consists of the lightest particles (electrons) making up the particular dissipative structure which observes the universe as a subsystem.

#### VII: Discussion

Is physics observer-private — not only regarding primary qualities (like colour) where this is well known but also regarding secondary qualities (relations)? Or, to use the Latin words for ‘so-things’ and ‘how-things’, are ‘*talia*’ like ‘*qualia*’? More specifically, are *some talia* like *qualia*?

If this turned out to be the case, the awkward ‘special role’ of consciousness would be lifted (cf. Rossler & rossler, 1993). Simultaneously, ‘interface physics’ would acquire a mediating position among the two major outgrowths of Cartesian natural philosophy — the natural sciences on the one hand and consciousness studies on the other.

The natural target of any ‘Privacy-of-Physics test’ is the interface. It is an invisible layer of reality which, like the subconscious of psychoanalysis, may or may not be accessible in principle. The existence of an ‘inverse problem’ also in physics — to reconstruct the observer from the objective world — is an undecided new question.

The first moment in history at which the question of the privacy of physics almost surfaced took place in Paul Ehrenfest’s house in Leyden in 1933. He had invited his close friends Bohr and Einstein to discuss complementarity and relativity, which to him was a question of vital importance. One sees the effort on their faces as they sit, Einstein chain-smoking, Bohr chewing on his hand, in deep chairs one beside the other, on the photographs reproduced on the cover of Wheeler and Zurek’s book of 1983. Bohr apparently could not bring himself to suggest to Einstein that complementarity is a microscopic version of relativity. For Einstein’s next sharp question would predictably have been: ‘But then, quantum mechanics would have to be observer-private, wouldn’t it, because a micro frame cannot be shared by several observers?’ This predictable conclusion would have been unacceptable to Bohr who, while steadfastly believing in a classical picture of the unobserved micro world (cf. Rozenal, 1967), had also always insisted on the classical nature of the macro world since the results of measurements have to be communicated in plain language. Both classical stances, however, cannot be adopted simultaneously.

A quarter of a century later the same issue was faced again by Everett. In his famous paper of 1957 titled ‘“Relative state” formulation of quantum mechanics’, the micro relativistic stance was chosen, albeit on a quantum-mechanical rather than classical basis. To quote from the paper: ‘To any arbitrarily chosen state for one subsystem [e.g. observer,] there will correspond a unique *relative state* for the remainder of the composite system [i.e. the rest of the universe]’ (Everett, 1957, p. 455). The words in brackets, were added in accord with the context. Unlike Bohr, Everett thereby opted for many macro worlds! Even though a flurry of papers was triggered by Everett’s paper, the word ‘relative state’ was apparently not taken up again. The privacy of an observer-relative state was too unfamiliar.

It would be interesting to learn how Everett thought about this privacy of physics in his later years. All that is known is that he died in 1983 'from smoking' (John Wheeler, personal communication, 1993) and that after obtaining his PhD (from Wheeler) in 1957, he worked for the rest of his life at the Pentagon 'as a member of the Weapons Systems Evaluation Group', as Murray Gell-Mann (1994, p. 137) disclosed.

Everett's theory has a seductive quality to it. Wheeler when once asked by a journalist to explain why he no longer believed in it begged to be spared the answer for fearing a relapse when thinking about it again. ('Only he who knows sin . . . ' were the words he used; John Wheeler, personal communication 1983.) For the third time in a row, one feels, common sense and the subconscious acted together to prevent the idea of an observer-private physics from taking hold seriously.

What are the odds for a positive outcome of the four 'privacy of physics tests' described above? Common sense forces one to admit that the chances are very slim indeed (except for test # 3 as mentioned). To seriously believe in an observer-private world generated in the interface requires an unusual amount of confidence in the power of the relativity principle. Bohr for one was sure that not even Einstein would go along, but who knows? Let us add one more rationale in favour of Bohr's position: the very notion of 'history' would need to be re-defined if more than one world (and history) could be proven to exist. It is only in the formalism of quantum mechanics proper that the 'many-histories' idea has found a safe haven so far (Gell-Mann, 1994).

To conclude, the notion of the interface may deserve to be taken seriously in physics. Interface physics is a subdiscipline of chaos theory. It deals with the 'effective forcing function' exerted on a subsystem of a universe by the rest of that universe. The universe in question can be either classical or quantum mechanical — the effects are essentially the same. The interface then is the seat of consciousness. The ultimate promise of all observer-centred theories of physics is the prospect of 'blind-sight navigation' in the exo reality. If physical reality were like a personal shadow that cannot be shed, attempts at grasping behind the curtain would not be doomed to failure forever. Even consciousness would lose some of its hermeticity.

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