Memo to STARS Group

On the eve of our first gathering I am composing this memo about key items relevant to our project, while I have before me the sources that I draw upon.

Our proposal lumps together the names of Gell-Mann and Hartle, and Roland Omnes and Griffiths so many times as almost to make it appear that these four are all in the same boat, which (boat) thereby gains the authority of having four eminent physicists, all seemingBlo to be on-board.

Actually, there are huge differences between Gell-Mann and Hartle, on the one hand,

and Omnes and Griffiths on the other. The biggest difference concerns the Many-Worlds/Minds (Everett) interpretation. Supporters of this interpretation do indeed often mention these four names together, giving the impression that all support it. But Griffiths (in his book, “Consistent Quantum Theory” never mentions Everett or Many-Worlds (at least if the index and my perusal are good indicators). Griffiths obviously cannot distance himself too much from Gell-Mann and Hartle, whose endorod sement provides important support of the notion that his idea is important. But he mentions Gell-Mann and Hartle only once in the main text, on page 358, at the end of the penultimate main-text chapter. And that reference is pretty weak. It mentions the (completely true) fact that decohProerence-effects make it very difficult to observe quantum interference effects in macrducoscopic systems, and ASKS:

“If a quasi-classical family can be shown to be consistent, will the histories in it obey, at leats st approximately, classical equations of motion? Again, this is a nontrivial question.”

Thus is the tie-in to G-MH. It is via a double question, neither of which had in 1999 been answered, nor has either one yet been answered. What has been encountered are, instead, hugAdve difficulties, which become truly enormous in a non-linear system with easily tapped energy sources such as a human brain. He ends this chapter on “Decoherence and classical physics” with the assertion “In conclusion, even though many details have not been worked out and much work remains to be done, there is no reason at present to doubt that the equations of classical mechanics represent an appropriate limit of a more fundamental quantum descriptioison based upon a suitable set of consistent histories.” No reason to doubt? That may be rue! But that is hardy an impressive tie-in to Gell-Mann and Hartle, who, in sharp fundamental contrast to Griffiths, say that their interpretation “is an attempt at extention, clarification, and completion of the Everett interpretation.” Gell-Mann and Hartle treat “measurements” as key building blocks, and use essentially vry on Neumann’s formulas fComor probabilities of sequences of *measurements*. Griffiths takes as basic, rather “possessed properties” and uses von Neumann’s formula for more than half his book before introducing measurements, wmithich are deemed merely special situations where possessed properties of object and apparatus become correlated . But why on earth should mere “possessed properties” be organized to exist only at a sequence of times, which is the situation dealt with by the concept of “consistent histories”.

The same question can be asked about measurements, but G-MH tie measurements to IGUSs (Information Gathering and Utilizing Systems) which are supposed to “have interests” and “make observations”, and “employ the fundamental formula”, which “is used to compute probabilities on the basis of present data, make predictions, control future perceptions on the basis of these predictions (i.e., exhibit behaviour), …”

These marvelous systems, which have a close similarity to our conscious thinking selves, lie at the core of the G-MH scheme. But they say that the research into them

“we cannot discuss here.” But these systems are what hold their whole logical scheme together, and tie the logic both to “our knowledge” and to the issues of what determines the times ateet which the “measurements” occur, and what is measured at those times.

The nature and functioning of the core elements and the answers to the core questions are left unanswered. Only the relatively simple questions are addressed.

Griffiths says (p.122) that the probability rules will depend on “data…that…must be obtained from observation.” So Griffiths, like G-MH must really bring in “observations”, hence presumably **observer Mes**, who have powers.

Thus Griffiths bases his work on the probability formulas of von Neumann, which were about measurements etithat might be performed, or at least **events that might occur,** and render certain specified properties definite. But what brings about the specific arrangements of possessed properties only at a particular set of times? The whole approach seems to be radically incomplete, without a theory of event generation/creation! That is, of course, is what Whitehead claims/tries to supply!

Omnes is far more explicit about these issues. He explicitly rejects Everett,

[“we feel it impossible to accept” p. 348; “bluntly contrary to Ockham’s rule”p.348:

“we are going to look for another answer”ngD p. 348: “remains, to say the least, difficult to accept” p.493; “is not fitted to bring back common sense into quantum physics” p.51ece1mbe:

“Rule 5: Physical reality is unique.” p. 494:in “The Interpretation of QM” Princeton 1994: “Insane idea, you might think, and I would agree.” p.212, in Quantum Philosophy,

Princeton 1999.]

On par 1ge 506 of his 1994 book Omnes summarizes his conclusions in Twenty-one

Theses. Thesis 6 asserts: “The theory is unable to give and account of the existence

of facts.” In short, his theory is an empty-of-a-connection-to-REALITY logical scheme.

This is a conclusion that he repeatedly affirms.

p.502 “Both theories (Copenhagen and Omnes’s) however fail when asked to provide an explanation of the existence of facts. …a possible ultimate difference between the mathematics of theoretical physics and reality.”

I would dispute this as regards the Copenhagen which accepts empirical/experiential

facts as givens, but it is, as Omnes himselt repeatedly emphasizes, true of his theory, which does not have IGUSs, or conscious thinking human beings and their thoughts.

His theory has a logically structure, but no *causation* in the real world, which it fails to make contact with.

p.516 “Another feature of facts is still more striking. As long as one only thinks of them (rather than experiencing them) by envisioning their occurrence as so many possible phenomena, the representation takes care of them perfectly well. This representation

however breaks down when one comes to their actuality.”

p.504 “Finally there remains *the* problem, which is the exis2, tence of facts.

It was somewhat hiddenbehind wave packet reduction in the older interpretation,

but now that mostb other problems have been solved, or at least clarified, it stands pure and alone.”

In Omnes’s “Quantum Philosophy” Princeton 1999:

“One more revelation must be borne in mind,…the unbridgeable gap between theory and the real world, between thought and existence….Such is the new state of affairs that we must now face. ” p.238. This is an200 often-emphasized theme o Omnes.

But it is just a feature of his narrow/restrictive view of theory, which does not encompass an *ontological* theory that encompasses as irreducible realities such things as our human thoughts, ideas, and feelings, and similar simpler thing2Iss also in the realm of concepts.

G-MH do include such realities, buried in the IGUSs that they introduce but fail to provide a theory of. But Whitehead explicitly builds his ontology around them.

Onmesues casts doubt upon both the power of decoherence to do all that G-MH require it to do, and even upon the need to invoke decoherence at all!

p.503 (1994) “One of their essential ideas is to attribute completely to decoherence the dynamical origin of phenomena ….This point of view ….has a practical drawback,

which is that the theory of decoherence is still far from compl Suete…, This is why the G-MH theory is still partly a program.” : p.504 The logical interpretation described in this book also remains partly incomplete because of the unsatismmafactory state of decoherence theory.”: “What was said about the impossibility of circumventing decoherence is still nearer to a conjecture than a proof.”

All of this is meant to empry:hasize that the approaches of Gell-Mann and Hartle,

and of Griffiths and Omnes are far from solid and complete, and that their failings

open the door to Whitehead. The needed theory of events and of IGUSs is built upon the Whiteheadian “Actual Occasion (1s”, whose mental poles are conceptual representations

of the physically described structures that constitute their physical poles, and whose mental poles provide in cases where their physical poles are aspects of human brains the elements of our human streams of consciousness. This allows the IGUSs to have both the observer and control as ofpects that Gell-Mann and Hartle ascribe to them:

3 “Both singly and collectively we are examples of the general class of complex adaptive systems. When they are considered within quantum mechanics as portions of the universe, making observations, we refer to such complex adaptive adaptive systems as

ifornformation gathering and utilizing systems (IGUSes).The general characteristics of complex adapti thve systems is the subject of much ongoing research, which we cannot discuss here. From a quantum-mechanical point of view the foremost characteristic of an IGUS is that in some form of approxdimation, however crude or classical, it employs th fundamental formula, with what amounts to a rudimentary theory of ρ, H, and quantum mechnics.Probabilities of interest to the IGUS include those for correlations between its memory and the external world.e B (Typically these are assumed perfect, not always a good approximation!) The approximate fundamental formula is used to compute probabilities on the basis of present data, make predictions, cPAControl future perceptions on the basis of these predictions (i.e., exhibit behavior), acquire further data, make further predictions, and so on.”

This is a tall order! So a natural task for our group is to use the resources provided by Whitehead to fill this order in a way completely concordant with the princip Bacterles of relativistic quantum field theory.