The Scientific Requirement to Suspend Belief

Why do we speak of suspending 'belief'? It is my contention that belief has no legitimate role in scientific discussion. Religious congregations and football players *believe* – or say they do. I try not to. Although I must say that however much I despise the word, I do 'believe' in the impossibility of levitation, perpetual motion machines, and that Einstein's relativity resulted from a simple algebraic mistake. Such denials of scientific notions are, indeed, incredible to me. That apples fall and entropy increases are not notions I am likely to doubt. My acceptance of associated theories is not based upon a belief in the infallibility of Newton, Faraday, Maxwell, Boltzmann, Einstein, or the host of other brilliant minds right up to the present day who stand behind the theories; my acceptance derives from the lack of consistency of counter arguments. Let's be clear, the legitimacy of an argument does not depend upon who came up with it, but on the logical structure on which it is based. It comes down to the credibility of the argument and credulity of the individual considering it after having understood the argument. One must remain incredulous to the extent that one can sincerely entertain doubts about the viability of an argument.

If one is checking the work of a peer, that he or she might have made an algebraic or arithmetic error is at least credible. It should not be insulting to oneself or the peer to suppose such an error is possible. One cannot be obligated to pretend that anyone is beyond making a mistake. To suppose that there is an algebraic error in a proof that has been accepted by the scientific community for decades or centuries is not credible. That is just perspective on the legitimate rationale for accepting or doubting a scientific idea? Serious scientific questions do not arise because of suspected mathematical errors, but because underlying assumptions are suspect. As science progresses, what would formerly have been a 'common sense' assumption may no longer be valid.

For example, in Einstein's treatise on special relativity, he mentions the "law of the transmission of light" as rationale for key analytical decisions. That was 1906. Proper understanding of the behavior of light transmission was not finalized until about 1926. Ding! An alarm should go off. Arguments based on an outmoded 'law' are suspect. Period.

Born and Wolfe's proof of the invariance of wavelength in forward scattered light involved what they referred to as a 'general scaling law' which became a cornerstone of spectroscopic analysis. But they specifically neglected relativistic treatment of scattering electrons. Forward scattering through high temperature intergalactic plasma requires relativistic treatment. Ding! Arguments concerning cosmological redshift that depend on a law that does not apply to the environment in question are suspect. Period.

Einstein explained that it is momentum transfers between radiation and particles that 'maintains' compatibility of the Maxwell-Boltzmann particulate and Planck blackbody radiation distributions. His analysis was amazingly thorough. But he used the classical Doppler formula rather than his own relativistic formula. His relativistic formula makes a typically small (second order) difference. However, that difference is *always* positive – repeated occurrences do not cancel out. Ding! Ignoring negligible quantities is typical of physical analyses, but when the analyses concern astronomical numbers of such occurances one must assure that the small quantities do in fact cancel out statistically. Period.

'Time's arrow' is an observable fact at the macroscopic level of existence, but all interactions at the submicroscopic level of reality have been conceived as being reversible. That defies centuries of the scientific reductionist agenda. Ding! Statistical mechanics attempts to achieve what Boltzmann's collision analyses and his 'H theorem' could not. The analyses omit the thermalization process of mediated interactions of photon transmission between molecules and atoms. But the conservation laws of energy and momentum for the particles and radiation are not commensurable. Particle interactions mediated by photons can only happen when and if the particles are approaching because of the discrete energy levels of atoms. So, is it actually true that all submicroscopic interactions are reversible? No. Because, if velocities of approaching molecules are reversed, viable interactions will no longer be allowed. For each allowed interaction, extreme velocity differences will be reduced. Rather than these interactions merely 'maintaining' the Maxwell-Boltzmann distribution, this is the process whereby a submicroscopic thermalization process drives a distribution to equilibrium, increases entropy, and dissipates otherwise usable energy.

Black holes are, on the one hand, conceived as inescapable. But on the other hand, according to the standard cosmological model, the universe itself is (or has) qualified as being the largest conceivable black hole and is expanding outward beyond its event horizon. Ding!

Probably most freshmen physics students have wondered why electrostatics and gravity could not be unified. The one is ten to the fortieth power smaller than the other but the smaller of these has been grafted into geometry as capable of warping space itself. Why not the other. Both classical theories assumed 'point' particles of charge and mass, both involved action-at-a-distance, however masked. That's an example of a ding that we learned or were intimidated into ignoring.

In Schrodinger's wave mechanics he began by assuming point particles, substituted operators for dynamic quantities, and ended up with distributed particles, albeit now said to be 'probabilistically distributed' point particles. Heisenberg's matrix mechanics was shown to be an equivalent theory. Did anyone hear a ding?

These are examples of alert signals. We should attend to them. They do not necessarily nullify acceptance ipso facto, but they are key to a fuller understanding required to extend or restrict associated concepts. We ignore them at our own scientific peril.

One hears much about how to 'reason outside the box' with instructions sometimes provided. Are you kidding me? Credulity, skepticism, and yes, reasoning outside the box all seem to me to be personality tendencies, lifelong habits. I suppose one could take a few minor exceptions to these being personality traits, but not many. Even among highly intelligent people there are major tendency variations. Some very smart people are adept at absorbing information and 'know' something (maybe a lot) about almost every topic. While others have great memories, even eidetic memories. But there are still others who are obsessed at figuring out what has yet to be discovered. 'Knowing' has many variations. In the German language there is more subtlety to 'knowing' that in English: kennen (to know a person or place), wissen (to know as fact), and können (to know *how to do* something) and, of course, there is the 'biblical' sense. We have different capabilities. A person is to a large extent just what they are – not to make too fine a point of it. But someone has to hear the doorbell when it dings, don't they?

My intent here is not to generalize or to instruct. I would, however, like to rationalize my own way of being. There are people, places, and facts with which I have little familiarity and might like to 'know' better, of course, and I'd like to have a better memory. But what I am more consumed with is 'knowing' how this universe works and why. 'Why' is not really a scientific question, but we ask it anyway and the answer we want is Einstein's answer, "God would have done it that way" because that is the only way that makes logical sense. What I want to be convinced of is that what I accept as true is, in fact, true. Truth. Epistemology is the issue. So, all these alerts I mentioned above bother me. They nag at me. Antinomies are where it starts – two incompatible truths on the same topic. For me, such cognitive dissonance indicates a problem that has yet to be resolved. The ding is deafening. This fissure is the beginnings of a world view falling apart and in serious need of repair. Perhaps it is mild quakes in the tectonic plates before the 'big one' that Thomas Kuhn memorialized as a 'paradigm shift'.

The next significant question is: why has no one else (or too few) been bothered, or if someone heard the ding, why has no one more qualified been able to resolve the issue? This question, I admit, really baffles me. As an example, I once went up to a professor of physics who had just delivered a paper at a cosmology conference and asked him about his acceptance of the cosmological constant. This is the term that Einstein had originally added to the Poisson equation just to get the solution he wanted rather than the mathematically correct one, and after becoming aware of Hubble's conjecture had recanted, saying it had been his "greatest error". Of course, that constant is being used to account for 'dark matter' in one of which ways the professor had described. In approaching him, I said, "I suppose you would have to conclude that Poisson was the one who was in error." He laughed good naturedly. He actually thought about it for a long minute, finally saying, "Yes, I guess I would have to say that." He still laughed as he walked away. Poisson wasn't wrong. Poisson's equation stands. Ding! I don't know why that bothers me like tinnitus and apparently no one else, but it does.

Roger Penrose demonstrated that, although Einstein had argued that a passing sphere would appear oblate to an observer because of Lorentz contraction. Penrose showed that it would in fact appear spherical but rotated through an angle whose cosine is the Lorentz contraction factor. Penrose's analysis inserted what he called the 'transformation of the field of view' into the determination, concluding that the sphere is actually contracted, but only 'appears' spherical. What? Ding! So, I say, "Okay, maybe," and go through the same analysis for a circular wall-type clock using the frame-independence claimed for the special theory which avers that both relatively moving observers witness the same event at the same time when they are in coincidence, the one observer attributing it to an earlier time than the other. So, do the observers see the same time on the image of the clock or not? Ding! This denial of observation in favor of a metaphysical levels of reality I find objectionable. If what two relatively moving observers 'observe' differs in such a way that it requires two successive transformations (L, for Lorentz and P, for Penrose) to produce the same result, why is a single transformation $O = P(L)$ not the proper expression of relativity?

The author cannot imagine *not* asking these questions and trying with meager abilities and credentials to resolve them. Am I that different from other people? Am I deluded? Do I just not understand the more subtle aspects of accepted theory? It seems as though the answer to one of those questions must be 'Yes'. I really don't know which one. I want to say 'No' to all of them.