Bringing the World Back In:
Revolutions and Relations Before and After the Quantum Event

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"All matter, indeed, is capable of entertaining thought."
-Thoreau, 1845

"The only laws of matter are those which our minds must fabricate, and the only laws of mind are fabricated for it by matter."
-James Clerk Maxwell

Introduction

In 2013 I was invited to attend a symposium at the University of Sydney on quantum theory. The invite was an accident of sorts. Someone else had to withdraw from the event and a seat needed to be filled. I had never been to Australia and James Der Derian was organizing it. I was only a couple of years into my career, and travel and room and board were being covered. What could go wrong? I accepted immediately. Then the panic set in. Everything I knew about quantum theory came from Billy Bob Thorton's courtroom monologue in the Coen Brother's *The Man Who Wasn't There*. I had been very invested in the ways complexity theory could be folded into the social sciences, but my understanding of psychics began and ended with the phrase 'Heisenberg's Uncertainty Principle'. I had two months to read everything I could before walking into a room of experts, and this is what I did in the intervening weeks. I was happy to find that nearly all of the major contributors to quantum physics had written collections of philosophical essays. This meant I would not have to learn new math. To my surprise and relief, they were also interested in the same philosophers that had drawn me to complexity theory. They all shared a dissatisfaction with the Kantian schema of knowledge and its relationship to the world. What struck me most directly reading the essays and reflections of Niels Bohr, Werner Heisenberg, Erwin Schrödinger, and to a lesser extend Albert Einstein, was how speculative they were both in their pursuit of science, and in what they thought their findings meant in an existential sense well beyond any technical application.

I went to the event in Sydney with every intention of moving on from quantum thought after surviving the weekend. That did not happen. What has kept me interested in Q - coming back to three more Q symposia and numerous panels and other events on quantum - falls into two categories that are not exactly specific to quantum theory, but favor the introduction of quantum theory to the social sciences. First, the generation of physicist that started the quantum revolution saw philosophy as an invaluable part of their research and thinking. Each of the physicists had much more than a passing curiosity in philosophy. The writing of this generation demonstrates deep philosophical study and interdisciplinary curiosity well outside of physics and even the natural sciences. The same versatility is present in the philosophers of the generation proceeding and following the quantum event in physics. Despite the significant specialization and disciplinary narrowing of research that took place in the first half of the 20th century, the common languages of philosophy and mathematics still broadly unified the academy. The more I read, the more I have come to see the influence that mathematics and physics had upon the philosophers who came to define the intellectual trajectories I follow in the social sciences.

Second, after arriving in Sydney for the first Q event, I was profoundly struck by just

how little of this cross-disciplinary curiosity and dialogue had survived the second half of the 20th century. In a room full of physicists, philosophers, and social scientists, all brought together to discuss quantum theory, we more closely resembled the tragedy of Babel than a community of scholars. We possessed no common language, no legible research questions in common, and few common texts or questions to return to. It felt like we were starting from scratch. Four years later, a lot of forward movement has happened. Yet we are nowhere near the mutual legibility necessary for something like the debate between Henri Bergson and Albert Einstein.

I am not interested in romanticizing the greatness of a truly liberal education, although I wish I had the classical training of the early 20th century. Instead, I want to return to the moment just before the quantum revolution to describe a kind of intellectual ethos that I think holds a great deal of value for contemporary research in the social sciences and International Relations. The philosophers and physicists that take up the bulk of this article possessed a humility and spirit of adventure held in a tension that, I believe, made useful and provocative dialogue possible, long after it was possible for every scholar to fully engage every other scholar's research. Alfred North Whitehead was not capable of performing the double slit experiment, but he could debate its significance with physicists. Likewise, Bohr did not possess the depth of philosophical knowledge to *be* a philosopher, but he possessed sufficient interest and knowledge to engage and challenge contemporaries like Arthur Bentley and John Dewey in ways that pushed everyone involved beyond what their own experience could have produced.

I want to argue that this mutual vulnerability of reaching out beyond one's expertise, while also bringing the virtue of one's own expertise to bear on shared questions, offers promise for the interdisciplinary collaboration we need today. We face not just another quantum revolution, but also challenges from artificial intelligence, climate change, nuclear weapons, global governance, and many other multi-sector complexities that demand of us expertise and the risk of dilettantism if we are to respond the world in any meaningful way. The hesitancy to take up the ethos of intellectual adventure is regularly justified in the social sciences. We are often punished for experimenting with new ideas, and those whose work centers on International Relations have attempted to ground themselves in a particular science before.

The article is inspired by four of the most recurrent criticisms I have heard over the past five years. The criticisms made most often of those wishing to engage quantum theory are: 1) the charge of science envy; 2) the related but distinct concern that bringing in quantum theory will allow the sciences to 'colonize' the social sciences; 3) that those who engage quantum physics are doing so only metaphorically; and 4) that what can be gleaned from quantum physics is redundant with early insights from post-structuralism, critical realism, and complexity theory. Rather than refute each claim specifically, I am taking a more oblique strategy. I am going after what I think inspires these concerns. The wager is that an overly narrow view of what the quantum event was, and a correspondingly narrow view of science generates much of the anxiety over including physics in our social scientific conversations. If we came to consider what Der Derian has called 'the Q effect' as a broader epistemological and ontological crisis—a crisis of cosmology—then we may reassess its potential contribution to the field.

There are two main sources of quantum in the field of International Relations. There is James Der Derian's Project Q (2013) and Alexander Wendt's *Quantum Mind and Social Science* (2015). Der Derian's application of the theory centers primarily on providing a framework for the non-local character of informatics and mimetics of diplomacy and warfare. If the interest in Virilio was that of acceleration and war, the interest in quantum is what 'phase shifts' happen when simultaneity and entanglement make speed an antiquated question. Der Derian sees both

opportunity and danger in Quantum. Der Derian's point is that a Q revolution had happened, and he wanted know why it had passed us by. More directed toward longstanding philosophical debates than contemporary politics, Wendt's book, to put it succinctly, is a plea to constructivists to take materialism (physics) seriously, and concordantly, for physics to take consciousness seriously. By his estimation, neither materialists nor constructivists can adequately account for the other. To accomplish the first task, Wendt develops what he calls, borrowing from Manuel Delanda, a flat ontology. The second task requires defending a theory of conscious matter called panpsychism. For both Der Derian and Wendt, quantum thinking offers the possibility of a major paradigm shift in IR, and quantum physics is positioned as a new archive for addressing major theoretical problems in the field.

This article is inspired by four of the most recurrent criticisms I have heard over the past five years against a quantum approach to the social sciences. The criticisms made most often of those wishing to engage quantum theory are: 1) the charge of science envy; 2) the related but distinct concern that bringing in quantum theory will allow the sciences to 'colonize' the social sciences; 3) that those who engage quantum physics are doing so only metaphorically; and 4) that what can be gleaned from quantum physics is redundant with early insights from post-structuralism, critical realism, and complexity theory. Rather than refute each claim specifically, I am taking a more oblique strategy. I am going after what I think inspires these concerns. My wager is that an overly narrow view of what the quantum event was, and a correspondingly narrow view of science generates much of the anxiety over including physics in our social scientific conversations. If we came to consider what Der Derian has called 'the Q effect' as a broader epistemological and ontological crisis—a crisis of cosmology—then we may reassess its potential contribution to the field.

The persistent and most pressing question for me is how to position quantum thinking amongst other kinds of and claims to knowledge, and thus I want to horizontalize in a different way from Wendt's flat ontology. While I agree with the monism of the flat ontology, more pressing for me is the need to horizontalize where different kinds of knowledge sit within the renewed attention to quantum theory. Rather than just horizontalize or flatten ontology, I want to see what happens when we flatten scientific and philosophical inquiry, and what that does to where we think quantum fits as a resource for the social sciences.

In the first section of the article I sketch the major contributions of quantum physics and relational philosophy side by side in order to demonstrate overlapping concerns and also the independence of philosophy to pursue these questions. In the second section of the article I will make a case for an ethos of adventurous humility for engaging quantum theory. Alongside this ethos, I want to sketch a non-progressivist view of theory. What if the value of the social sciences is not progress at all? What if the value of the social sciences is to work out the philosophical tasks or problems raised by philosophy, physics, biology, politics, war - you name it - in each context, era, and point of inquiry?

An Outline of the Quantum Event

What was the quantum event? Was it only in physics, or was it a more fundamental crisis in the nature of reality for which every discipline had to reckon? If it was the latter, then what role did philosophy play in giving the world its due in a complex and chancy cosmos? I understand the contribution of quantum physics along four lines of inquiry: discreteness, scale, space/time, and causality.

Discreteness is a key feature of a Newtonian or mechanical worldview. For things to be made of parts, and for those parts to enter into an efficient causal relationship, they must be separate. Quantum experiments challenged many of the assumptions about the boundaries between people and things. There are a few different examples of this in quantum theory: the Observer problem; entanglement i.e. communication between particles despite spatial distance and no *apparent* relation; and non-locality i.e. electrons as probabilities rather than objects at particular coordinates. All of these examples complicate how we understand relationality and substance. In the words of an editorial from the *New York Times* in response to quantum theory, "It is like matter is now a wraith" (Crease and Goldharber, 2014). According to Bohr, words like inside and outside are arbitrary after quantum insights. Speaking of the problem of the observer's body in an experiment, he writes: "It was by no means necessary that this limit should coincide with the geometrical limits of the physical body of the individual who observes. We could quite well 'contract' the observer or 'expand' him: we could include all that passed within the eye of the observer in the 'observed' part of the system—which is described in a quantum manner. Then the 'observer' would begin behind the retina. Or we could include part of the apparatus which we used in the physical observation—a microscope for instance—in the 'observer.' There is thus no part of the system which is essentially the observer, but in order to formulate quantum theory, an observer must always be placed somewhere (Bohr, 1998: 120).

Contrary to the common assumption that quantum effects 'wash out' in the macro world, scale was a frequent concern of early quantum theorists. In addition to the ways in which entanglement questioned our spatial understandings of distance and matter, we also have Heisenberg and Schrödinger's work in biology as evidence that quantum phenomena had a longer reach into the micro and macroscopic world. Heisenberg in particular was curious about the role of quantum phenomena in genetics. One of the examples he gives of how quantum phenomena cross scales is the way radiation causes changes to evolutionary history. When a particular gene gets knocked out sometimes, but not at other times, then what? It changes the whole course not just of an individual animal but of the entire species: "Genetic investigations into the frequency of mutations, for instance, seem to indicate that under certain conditions an event on an atomic level, such as the release of a single chemical link in a chromosome of a cell nucleus, can cause changes in the whole future development of an organism. In such cases the statistical laws of quantum theory assume a direct practical importance for the behavior of a living being" (Heisenberg, 1979: 91).

Discreteness and scale are particular ways in which the conception of reality changed after the popularization of Albert Einstein's theories of relativity. Beyond the average person's grasp of the theory itself, the point taken was that perceived reality did not conform with empirical testing. The idea, for instance, that gravity could change time or that speed and position altered the nature of space suggested that reality was in some very basic sense not intuitive. That we now had to speak of space/time and the fact that reality was 'relativistic' was a shock to political and social theories that rested on the providence and elegance of a clock-like universe.

Although less famous than Einstein's theory of relativity, Bohr's concept of complementarity was much more radical in that it challenged the very pausibility of causality. Complementarity questions whether reality is strictly contingent, or if novelty can emerge semi-autonomously from initial conditions. According to Prigogine and Stengers, Bohr's insight into Plank's constant is that the 'wave collapse' is only describable as an interaction between the measurement apparatus and the light being measured. The 'value' assigned is not assigned to the

light packet but to the interaction, that is, the measurement itself (Prigogine and Stengers, 1985: 226). According to Bohr, "In physics, causal description, originally adapted to the problem of mechanics, rests on the assumption that the knowledge of the state of a material system at a given time permits the prediction of its state at any subsequent time… However, a wholly new situation in physical science was created through the discovery of the universal quantum of action, which revealed an elementary theory of 'individuality' of atomic process far beyond the old doctrine… This novel feature is not only entirely foreign to the classical theories of mechanics and electromagnetism, but is even irreconcilable with the very idea of causality" (Bohr, 1998: 141-142). One of the most basic characteristics of empiricism, the observation of cause and effect, is at some level, according to Bohr, an illusion.

Very much parallel to these scientific insights, but historically prior to the experiments of quantum physics, there are, broadly speaking, four corresponding clusters of contributions from relational philosophies: monism, the continuity of relations, panpsychism, and a shift to process over efficient causality. [i]

Let us first consider monism, the theory that everything in the world is made of one substance rather than the dualism of mind and body. Monism, while going back to the very beginnings of ancient thought, made a distinct comeback at the end of the 19th century. Some of the most well known thinkers of this position are William James, 20th century cyberneticists like Norbert Weiner, and biologists like Henri Atlan, who is still a working artificial intelligence designer.

Second, the idea that relations are continuous and indivisible is an extension of monism, but one whose specificity runs in close proximity to the quantum problem of non-locality. Like Bohr's electron, which only exists in movement, Henri Bergson[1] radicalizes Zeno's paradox to argue that all things, including time, are continuous rather than mechanical and discrete (Bergson, 1912). Bergson also adds to the claim of continuity a number of things that are real but do not take up space. These are what Bergson calls intensive rather than extensive things. The category of intensive changes describes forces whose intensity makes a difference, but that this intensity cannot be measured in space or discrete units. For instance, we can consider the intensity of rage or sadness. This is important because it allows Bergson to consider forces like meaning or affect, which change systems even if they are not mechanically describable. To put it a bit differently, the category of intensive things means we are not stuck with the barren world of a narrowly interpreted physical causal closure. Yet we also do not have to invent a spiritual realm or second substance for those non-physical things that are real, but only in their relation. Intensive differences are a kind of predecessor to what complexity theorists call emergent phenomena.

To avoid the problem of monism becoming a kind or reactionary determinism where everything is just the result of matter senselessly interacting, we need French sociologist Gabriel Tarde's ideas of a relationality and intention at the heart of all things. This is similar to the vitalist principle of *élan vital* put forward by Bergson. For Tarde, everything is a society from top to bottom, and humans in particular are an imitative and entangled species rather than individualistic and cut off from direct experience. However, for Tarde, humans only have this ability because all species, particles, and even stars are entangled, and transactional in imitative

[1] In strict philosophical terms Bergson is really a parallelist very close, I think, to Spinoza. However, given the anemic categories of materialism and idealism that dominate contemporary IR Bergson gets to hang out with the Monists and is in many ways much closer to thinkers like James and Peirce than the neo-Kantian thought of IR constructivists.

and innovative ways (Tarde, 2012). All things, according to Tarde, are innovating and synching swarms at multiple scales from crowds, to nations, to planetary scale assemblages. Tarde's relational properties also extend from the macro to the quantum and back again. This allows Tarde to replace causality and structure with what he calls polygenesis, where one investigates how each thing or process is made rather than beginning from presumptions about structures or ideal types as explanatory tools (Tonkonoff, 2013).

Fourth, alongside complementarity, we have Alfred North Whitehead's case that we should abandon essence and identity in favor of process, relations, and rhythm (Whitehead, 1919). For Whitehead, the organizations of things are lured into an attraction with each other that becomes concrete, rather than having a discernible cause. Following this line of reasoning, he claimed required that the limits of logic be defined by the world rather than by humans. Whitehead argued that any *rational* explanation of the cosmos and the event of humans within it required abandoning the principle of non-contradiction much in the way the Bohr would articulate the abandoning of causality in his theory of complementarity. According to Whitehead, the terms "coherent and logical" needed to be replaced by the terms "applicable and adequate." (Whitehead, 1985: 3) Lastly, for process to be understood, empiricism could not subsist on the naive realism of observation. Empiricism required an experimental and speculative metaphysics as much as it needed science and observation. For Whitehead, neither observation nor rationalism were sufficient conditions of knowledge, again like Bohr, knowledge included the observer and the observed in its production and therefore the appearance of things was just that an appearance and often fell victim to what he called the fallacy of misplaced concreteness. (Whitehead, 1997: 91)

Put side by side, I hope it is becoming apparent that physics in no way has a monopoly over the seemingly key concepts of complementarity, entanglement, or even the wave particle duality. In fact, as I will continue to argue, quantum physics is only a sliver of the quantum crisis, for which I think philosophy and social theory were undergoing similar crises in many cases a full generation before Einstein, Bohr, Schrodinger, and Heisenberg. Furthermore, relational theories make a significant contribution beyond their apparent similarity to physics particularly for what the questions of causality, locality, process, scale, and the epistemological status of laws and change in the universe mean for us as humans coping with those crises. As I will address in more detail in the subsequent sections, relational theories also conceptualize questions about the relationship between epistemology and ontology that quantum theorists were often either hesitant to offer or simply did not ask in the first place. To demonstrate this point I will draw attention to the explicit and implicit dialogue between philosophy and physics as it develops over the end of the 19th and beginning of the 20th century.

Newtonian and Bergsonian Time

In 1948, mathematician and scientific polymath, Norbert Wiener, published *Cybernetics or Control and Communication in the Animal and the Machine.* The new science of cybernetics was meant to be a theory of everything. In part, the insights of quantum physics and their probabilistic character was supplemented by the stochastic character of larger scales of matter, and further connected through a profound relationalism or transactionalism often characterized as information. Everything was chancy, everything was connected, and those connections—feedbacks and effectors—could be recorded as information. Matter, life, everything is a signal to noise ratio, where a particular organization of things i.e. order was a signal. Noise was the chaos

or potentiality it draws upon. Furthermore, following Heisenberg and Bohr's rejection of Kant's *a priori* schema, Wiener highlighted that unlike Newtonian systems in which causality could be run forwards and backwards without changes in the casual relations, this new science of things relied on time independent of whether or not humans were watching. That is, order and change were time-dependent and irreversible evolutionary processes.

Wiener described this break with a timeless, mechanical world, as a shift from Newton to Bergson. The mention of Bergson is not itself evidence that philosophy played a significant part in the scientific cosmologies of quantum physics and the subsequent turn to probabilistic and stochastic approaches that created nearly every scientific breakthrough of the 20th and 21st century. However, more importantly, Wiener's attention to Bergson suggests that the *evolutionary* or temporal character, as well as other intensive differences not captured by the experimental findings of quantum physics, were essential to an understanding of systems as something other than giant Newtonian clocks. According to Wiener, even sciences like Astronomy that thought of themselves as cyclical, predictable, and mechanical, found that their stability was the effect of the experience of time. On longer, non-human time scales, even the elegant movement of the planets, acquires the messy, contingent, and fleeting character of meteorology (Wiener, 1948, 34-35).

Alongside the disruptive theories of scientists like Boltzman and James Clerk Maxwell, Weiner cites the ideas of Spinoza and Leibniz as essential to returning mind and other complex phenomena back to the observable world (4). According to Wiener, Spinoza — with his view that the continuous nature of the will and the world as one substance, two modes—helped bring the contingent and creative character of the world back to reality. In Weiner's estimation, it was the dynamical vision of Leibniz's monads that made possible a vision of complexity in which things could be inter-involved and at the same time retain some distinctiveness. However even these advances were insufficient. Leibniz's monads, according to Wiener, are a "a Newtonian solar system writ small" as there is no alteration of each monad in their involvement, "no transfer… from one to the other" (41). What was missing was the evolutionary or creative character of time.

This was Bergson's contribution. Bergson presented a series of real changes that were not in the substance or atoms of the things, but were in the passage or evolution of that substance in time. Like the advance in Thermodynamics taking place during Bergson's generation, time mattered. In Wiener's words "Vitalism has won to the extent that even mechanisms correspond to the time-structure of vitalism" (40). Wiener is correct to identify Bergson as a source for vitalism but implicit in the statement is more than Bergson's *elan vital*. The success that Weiner is describing is the evolutionary principle of relational thought developed significantly by others.

Charles Peirce, a contemporary of Bergson, took up the evolutionary or temporal problem with a clarity eerily prescient of the insights of quantum experiments decades later. Responding to research on light from the 1880s and incongruities between atomic theory and thermodynamic measurements during the same period, Peirce speculated that light is both a wave and a particle and that atoms may not be mechanically Newtonian. In a series of essays written for a journal called the *Monist* in 1891, Pierce writes:

> In like manner with regard to light. That it consists of vibrations was almost proved by the phenomena of diffraction, while those of polarization showed the excursions of the particles to be perpendicular to the line of propagation; but the phenomena of dispersion, etc. require additional hypotheses which may be very complicated…When we come to

> atoms, the presumption in favor of a simple law seems very slender. There is room for serious doubt whether the fundamental laws of mechanics hold good for single atoms and it seems quite likely that they are capable of motion in more than three dimensions. (Peirce, 1966, 147)

Max Plank would explain that very complicated dual nature of light a decade later. Bohr would develop the Copenhagen interpretation three decades later to reconcile the non-mechanical character of the electron. Several decades after that, John Stewart Bell would give some empirical evidence for the fight over entanglement i.e. Peirce's atomic behavior outside the 3rd dimension. What is most important about Peirce's ability to extrapolate many of the major problems of quantum theory from the simple observation of experimental data in the late 19th century is the philosophical position inspired by all that 'spooky' data. Contrary to the constructivist position of philosophers of science like Thomas Kuhn, who see changes in laws as paradigm shifts, Peirce tried to account for the very nature of change in nature. According to Peirce, the indeterminacy of things, the weirdness at the margins of physics, was not just a problem of scientific progress. For Peirce, reality is not sitting around waiting for a better hypothesis to gain hegemony. Instead, Peirce argues "the only possible way of accounting for the laws of nature and for uniformity in general is to suppose them results of evolution. This supposes them not to be absolute, not to be obeyed precisely. It makes an element of indeterminacy, spontaneity, or absolute chance in nature" (1966, 148)

Like Bergson and a little bit later like James' 1909 coining of the multiverse in his Pluralistic Universe lectures (Rubenstein, 2015: 3), Peirce, was building a relational ontology of things, where the very *laws* of things are themselves subject to change at the margins due to the interaction of things over time. James and Peirce were not alone. French sociologist, Gabriel Tarde, joins this crowd of when he writes in 1899:

> The mysterious basement of the phenomenal world may be quite as rich in differences, though differences of another sort, as the upper stories of visible, superficial reality... But Something far more important than a mere increase of difference is constantly taking place, namely the differentiations of the differences themselves. The process of change is itself undergoing a change. (Tarde, 2013)

The idea that change changes resonates with the later findings of quantum theory of the more adventurous of physicists such as Bohr and Heisenberg. However, it is the more radical ontological claim about the status of 'laws,' rather than the more moderate claim of Bohr and Heisenberg about the epistemological status of laws, that gives these thinkers the opening to productively question the Newtonian universe decades before experiments could be designed to do so. In so far as a kind of intuition must always proceed even the most experimental of experiments, the intuition of Bohr and others thrived for decades in the pluralistic cosmologies of relational thinkers like Peirce, James, Bergson, and Tarde. And, according to Weiner, these thinkers continued to exert an influence as the disruptive waves of quantum physics found their way into other fields and areas of application, such as biology and chemistry, and new intergrative fields such as systems theory and ecology.

From Forerunners to Interlocutors

The insights of Peirce, James, Bergson, and Tarde were not lost on quantum researchers. This is not a story where two ships pass in the night in pursuit of the same destination, never to know the other is there. The next generation of relational thinkers, as well as Bergson himself, continued to engage with science, including many of the scientists involved in the break from classical to quantum physics. Bergson engaged Einstein publicly on relativity. While many declared Einstein the winner, the advances made following the Bergsonian line of thinking in cybernetics and chemistry suggest otherwise.[ii] Chemist Ilya Prigogine in particular repeated a similar debate with Einstein, resulting in a Nobel prize and the outline of a time-dependent complexity theory that underwrites everything from climate models to dynamical systems theory. Theorized and then demonstrated by Prigogine, contra Einstein, time is far from an illusion. The entirety of chemistry and life depends on a real arrow of time rather than a 'symmetrical' and 'reversible' view of time at the heart of both classical and much of quantum physics. (Prigogine, 1997) From Prigogine's perspective, Bergson was not too radical in his dualistic position of mechanical time and experienced time. It was that he was not radical enough. The real of time, an evolution in matter itself, is at the heart of nature according to Prigogine.

Again, though, we did not have to wait for Prigogine, to correct the dualism lingering in Bergson's theory of matter and memory. Whitehead, who also directly engaged Einstein and quantum physics in his 1922 book *The Principle of Relativity*, took on a fully monist approach inspired by James, an approach very similar to that of Peirce and Tarde. Rather than a parallelist or dualistic account of matter and experience, Whitehead described the dual nature of things as dipolar: two aspects of one substance. Much like a magnet can have two opposing forces, positive and negative in one object, so can matter have conscious and non-conscious properties. Also, somewhat opposite of Bergson's more caustic challenge to quantum physics, Whitehead saw the quantum revolution as the agent provocateur that awoke him from the dogmatic slumber of rationalism.[iii] According to Whitehead:

"..{W}hen I went up to Cambridge early in the 1880s...nearly everything was supposed to be known about physics...By the middle of the 1890s there were a few tremors.., but no one sensed what was coming. By 1900 the Newtonian physics were demolished...Still speaking personally, it had a profound effect on me. I have been fooled once {by the claim of certainty} and I am damned if I will be fooled again… There is no more reason to think that Einstein's relativity is final than Newton's *Principia*. The danger is dogmatic thought…"[iv] (Whitehead, 2001: 314)

Despite being inspired by relativity, like Bergson, Whitehead found physics insufficient for the pursuit of larger existential and cosmological questions particularly related to how creativity, change, and complexity enter the world. In Whitehead's words:

> A way of life is something more than the shifting relations of bits of matter in space and in time. Life depends upon such external fact. The all-important aesthetic arises out of them, and is deflected by them. But, in abstraction from the atmosphere of feeling, one behavior pattern is as good as another; and they are all equally uninteresting. (Whitehead, 1947: 15)

Whitehead's version of relativity and subjectivism was not 'pixilated,' as some commentators have described Einstein and Planck's quantum view of the world. (Crease and Goldharber, 2014)

For Whitehead there is no discreetness between objects, nor a smallest possible unit or instant, meaning no quanta. Whitehead emphasized the significance of wholes rather than parts all the way up and down. Change occurs not in the accumulation of bits. Rather the world emerges as process, or what philosophers in the tradition of Heraclitus call becoming. The emphasis on process and the rhythm rather than the physicalist composition of that process allows Whitehead to be a monist without falling into the strict contingency of a mechanical universe. This is to say, that quantum physics may be able to account for the substance of life, but everything we call interesting about life is actually an aesthetic domain of intensity, movement, and rhythm, and not simple extension.

Heisenberg comes to a very similar conclusion about the limits of scientific thinking: "the hope of understanding all aspects of intellectual life on the principles of physics is no more justified than the hope of the traveler who believes he will have obtained the answers to all problems once he has journeyed to the end of the world." (Heisenberg, 1979: 24) According to Bergson, the false assumption identified by Heisenberg is not rare but instead a deeply ingrained habit of mind in the dominant strands of Western thought that are baked into language and the common pursuit of scientific research. According to Bergson we often fall into the trap of presuming that every question can be attacked by breaking up things into the smallest component part:

> We necessarily express ourselves by means of words and we usually think in terms of space. That is to say, language requires us to establish between our ideas the same sharp and precise distinctions, the same discontinuity, as between material objects. This assimilation of thought to things is useful in practical life and necessary in most of the sciences. But it may be asked whether the insurmountable difficulties presented by certain philosophical problems do not arise from our placing side by side in space phenomena which do not occupy space, and whether, by merely getting rid of the clumsy symbols round which we are fighting, we might not bring the fight to an end. When an illegitimate translation of the unextended into the extended, of quality into quantity, has introduced contradiction into the very heart of, the question, contradiction must, of course, recur in the answer." (Bergson, 2001: 3-4)

So we can journey to the end of the material world, as Heisenberg says, meaning we can know the quantum characteristics of it, but the ontic enclosure, knowing every detail down to the smallest unit, does not get us any closer to any of the problems of meaning making which are emergent from it. Beyond calling into question the tendency of breaking things into piece to make them simpler to understand, one that is as strong in the social sciences as it is in the natural sciences, we should also consider how this interchange between physics and philosophy demonstrates the movement of thought itself. Neither the physicists nor the philosophers moved in a straight line from questions to answer.

Therefore, the fear that physics could *replace* the social sciences seems unfounded. It is not like we can work out all of the quantum problems and then suddenly discover the secrets of the social order. If we follow the way questions migrated from philosophy to physics and back again, then we should allow things like the quantum crisis in physics, or the crisis of scale in Whitehead, or the crisis of extension and intension in Bergson to change our orientation. And we should be particularly open to these external provocations when we encounter things like tsunamis, which we cannot predict, and world changing events that we cannot make sense of -

Donald Trump or hurricanes that change the outcome of elections. After the provocation, we work our way back out through the problems raised rather than forward with a new theory to test.

Despite how much this description of thinking contradicts the hypothesis testing we presume is at the heart of science, I think this is also a more accurate picture of what Bohr and Heisenberg were up to as well. I do not believe based on their writings that they started with a mountain of data and inductively came to the Copenhagen interpretation or the uncertainty principle. They read the whole history of philosophy like many other Europeans at the time, and then the intuitions inspired by that kind of speculative thinking made them seek out certain kinds of data. Schroedinger's book *Nature and the Greeks* (2014) is a prime example of this kind of 'extra-curricular' study. So are Bohr's and Heisenberg's frequent references to the inspiration of Democritus and Lucretius in their revisiting the seemingly settled principles of classical physics. (Bohr, 2010; Heisenberg, 1979)[v]

From Quantum Philosophy to Quantum Social Theory

Moving from metaphysics and philosophy into the field of social theory, John Dewey and Arthur Bentley picked up on the themes of James, Peirce, Whitehead, Bergson, and followed them through the work and ideas of 19th century physicist and predecessor to the quantum generation, James Clerk Maxwell, to build a theory of knowledge that could equally account for the investigator and the object of investigation. The idea was to develop a methodology for research with an emphasis on the 'transaction' that takes place in both directions whenever things encounter each other in the world. Like many of the other thinkers before them, they wanted to reconcile the agentic character of research and investigation with a materialist world view. They also wanted to do this beyond the purely philosophical pursuits of their predecessors in developing a methodology for political and sociological research. Beginning in the 1930's, Dewey and Bentley exchanged hundreds of letters that culminated in a significant corpus of jointly authored work on how to develop a monist theory that accounted in any equal parts for the world and the observer.

Dewey and Bentley came to quantum physics after they had developed their initial theory of transactionalism in their 1949 book *Knowing and the Known*. They drew most of their inspiration from Maxwell's *Matter and Motion* for developing a method of inquiry that could take into account the exchange between rather than the mutual absorption of "structure of knowings" and the "physical cosmos." (Dewey and Bentley, 1949: 310) For Dewey and Bentley, Maxwell and Faraday and their initial understandings of Einstein gave them the ability to make generalizations about how knowledge functioned—epistemology—without violating the principles of how we understand the physical world. However, Dewey and Bentley would go on to find that Einstein was insufficient to the epistemological and ontological challenges of establishing knowledge as something simultaneously irreducible to mechanics and yet not in violation of it. This is a thoroughly monist position without, as Wendt often says, a world of zombies. (Wendt, 2015: 153) In a letter to Bentley dated, December 27th, 1949, Dewey is critical of Einstein's seeming lack of attention to the transaction between the knower and the known. Concluding the letter, Dewey says of Einstein, with a marked sense of disappointment, "he is fundamentally a Kantian." (Dewey, 1964: 614-615) Dewey's reading of Einstein is confirmed in Einstein's later writings. Published a year after Dewey and Bentley's correspondence, Einstein says in one of his late essays titled "Time, Space, and Gravitation," that he believes Kant's greatest achievement is positing that there must be an *a priori* internal schema for ordering the sense data of the external world. Like Kant, Einstein writes, speaking about the external world,

"The fact that it [the world] is comprehensible is a miracle." (Einstein, 1950: 61) Several months later in another letter to Bentley dated May 22, 1950, Dewey makes a sharp contrast between Einstein's Kantianism and Bohr's understanding of the role of the investigator and the apparatus in the making of reality. According to Dewey, unlike Einstein, in Bohr, there is a "recognition of the transactional property of experiment." (Dewey, 631) The subsequent six letters over the next two months concern primarily what Bentley and Dewey can learn and contrast between Bohr and Heisenberg's understandings of uncertainty. What they arrive at is a kind of resonance but not precise overlap between what Bohr refers to as "the individual and his surroundings" and what Dewey and Bentley call the "transactional connection of organism-environing media." (Bentley, 1964: 633)

In 1954, Bentley went on to sharpen his shared insight that Bohr and Heisenberg were fundamentally 'transactional thinkers' in the way he and Dewey had derived the term from James Clerk Maxwell, "Bohr sharpens his long maintained stress on physical complementarity as opposed to the epistemological type of 'reality' toward which he, as well as Bridgman sees Einstein still straining…with strictly practical intent Bohr quotes the ancient saying that men are both actors and spectators in the drama of existence." (Bentley, 1954: 349-350) Bentley goes on to associate Bohr's convergence with their position on the basis of following Heisenberg's uncertainty principle as a source for rejecting the Kantian position of a schematic 'knower' that is *a priori* and entirely separate from the external world.

Heisenberg's own philosophical writings confirm this kinship. For Heisenberg, the insights of quantum physics are so out of synch with previous understandings of reality, they invalidate the very idea that the limits of knowledge can in some sense be specified *a priori* before investigation, which is the entire project of Kant's *Critique of Pure Reason*. Using the example of Wilson's cloud chamber experiments, Heisenberg points out that scientists felt comfortable describing what they saw as the path of an electron. That description, according to Heisenberg, was not at all a problem until there was new seemingly contradictory experimental data. Heisenberg's point is that there is no 'a priori criterion' for fixing the language of Wilson's experiment before the subsequent quantum data came in. Instead, the rules of what could be known and what was known changed because our experience of the world changed, and not simply our thinking (Heisenberg, 45-46). To put it differently, the world changed thought. This is an impossible event within the Kantian schema of human consciousness.

For Kant, and much of philosophy after *The Critique of Pure Reason*, the structure of understanding must already be contained within the two schema of space and time for possible experience. According to Kant, "these rules for understanding are not only true a priori but are rather envy the source of all truth, i.e., of the agreement of our cognition with objects, in virtue of containing the ground of the possibility of experience, as the sum total of all cognition in which objects may be given to us." (Kant, 2009: 339-340) Therefore, For Kant, datum should not be able to alter the boundaries of the thinkable. Rather the thinkable ought to be the boundaries of what datum can be experienced. Heisenberg posits that the findings of quantum theory suggest that we need now "a sufficiently thorough" philosophical investigation of Kant's premises given the "new outlook." (21) Unlike physicists such as Stephen Hawking or at times Einstein who declared that physics makes philosophy obsolete, Heisenberg sees quantum findings as a reason to start philosophical inquiry anew. However, like many of the other relational thinkers such as James, he cautions against assuming any new philosophical positions will be anything other than provisional.

A Vitalist Sociology?

The world is weird but is it weird enough that we need a 'vitalist sociology?' (Wendt, 2015) Despite the seeming newness of the quantum question, many in International Relations and Political Science took up the challenge of a monist and vitalist approach during the middle part of the 20th century. These were not minor figures in the field. Most notable was Karl Deutsch. In addition to engaging Planck, Heisenberg, and Bohr explicitly, as well as Wiener, Bergson, and Dewey, Deutsch's *Nerves of Government* (1963) is by any measure a thoroughly monist account of a fully relational theory of political action and political change. Deutsch spoke of this work more in the framework of cybernetics than quantum politics, however there is a strong claim to make that cybernetics was just the extension of the insights of quantum and transactional theory into other domains of inquiry. That said, we should engage Deutsch's early work as it also exemplifies the kind of interdisciplinary approach to the sciences and philosophy that places each on equal footing.

There are a few other texts that operationalize relational thinking along the lines of Deutsch with comparable levels of success even if they, like Deutsch, have mostly been forgotten by the field.[vi] Margret and Harold Sprout's *The Ecological Perspective on Human Affairs* (1965) and *Towards and Politics of Planet Earth* (1971) attempt a monist and relational approach to global politics although one more indebted to cybernetic or systems approaches to biology and ecology. The same year as the Sprout's first book, David Easton published *A systems analysis of political life* (1965) which like the Sprout's and Deutsch offered a top to bottom relational theory for analysis politics which amongst other similar inspirations as those of Weiner references Bentley's transactional approach. Harold Laswell's *The Signature of Power: Buildings, Communication and Policy* (1979) tried to embedded the problems of power and communication within the physical architectures that sustain them.

The fact that Deutsch and others where quantum before quantum was cool does not in any way detract from the significance of contemporary scholarship like that of Wendt and Der Derian. Der Derian is responding to a very real challenge posed by the application of quantum theory in the form of quantum computing. Wendt does vastly more than update the 50's and 60s interest in relationalism. Even Deutsch, probably the most philosophically minded of his generation, did not try to make an original contribution to the philosophy of mind so much as he just tried to put it to work. Wendt's effort is also highly distinct from the bits and pieces of vitalism that have found their way into the field of International Relations in discussion of New Materialism. Wendt has attempted to fully reconstruct a positive social theory that reintegrates the agency, or in his words 'will' of constructivism, with the materiality that will and the rest of the world depends upon. Wendt's position, like that of James, Pierce, Tarde, and Whitehead. and slightly departing from Bergson and other parallelists of the Spinozist variety, is thoroughly monist. It is an attempt to posit one substance—matter—without falling into a mechanistic and therefore deterministic world view.

Wendt is not alone in his interest to develop a vitalist sociology if we broaden our scope beyond International Relations. In philosophy this position is known as panpsychism and has broad interest across many fields. Major figures in the mainstream of the field of philosophy such as Galen Strawson (2006) take this position. Panpsychism has experienced a significant revival amongst those who work in continental traditions, particular those inspired by Deleuze, such as Jane Bennett (2010), Karen Barad (2007), and Steven Shaviro (2014). The panpsychist

position has also found its resonance with other cosmologies often classified as animist such as Amer-Indian thinking, Shintoism, and European Pagan thinking just to name a few. As a result, many anthropologists associated with what is referred to as the ontological turn in anthropology have found panpsychist thinkers and ideas useful for demystifying cosmologies like those of many Amer-Indians that never fell into the two-world metaphysics of mind vs. matter. (Charbonnier, Salmon, and Skafish, 2016) As one anthropologist of this tradition has put it, "In Amerindian cosmologies, the real world of different species *depends* on their points of view, for the 'world in general' *consists* only of different species, being the abstract space of divergence between them *as* point of view. For as Deleuze would say, there are not points of view on things, since things and beings are themselves points of view." (Castro, 2014)

The attraction to this kind of flat ontology where everything has a point of view and is a point of view makes *sense* at a time when ecological crises are calling into question the providence of modernist thinking. Ignoring the world as a kind of dead matter subservient to conscious thought has not gone well—if we can agree that flourishing and survival are collective goods. However, beyond good timing and an ethical impulse to be less ethnocentric, the new monism and its relational cosmology also clears away a great deal of unnecessary *mess* that has stymied discussion over ideas and materiality.

Referring back to Bergson's preface to *Time and Freewill*, it is possible that many of the 'hard problems' of the social sciences and International Relations specifically are more indebted to first principle errors—presuming two substances, smuggling in a two-world metaphysics, etc.—than they were to some actual real tension between ideational and material accounts of change. The permutation that the world is *both* ideas and materiality is unsatisfying precisely because from the monist perspective it settles a peace where there was no war in the first place. There is the world and the processes of different social relations (remember in Tarde's monist sociology all relations are social even those of stars and microbes) have different properties. The social relationship of diplomats differs in attribute not substance from those relationships that sustain nuclear chain reactions just as photosynthesis differs from animal respiration. For a species, obsessed with its own ability to speak, language as a form of relationality will certainly play a significant part even in a monist ontology. However, the monist position, particularly as articulate by the most recent inheritors, challenges the provincialism of human and might also point out that we should consider that *we* believe in the power of language because it is the easiest point of entry to our species and not the world. (Connolly, 2017) Once the world in total comes to define the limits and possibilities of relational differrences, the contest between ideas and matter is no longer an abstract, theoretical questions. It is a context—and relationally-dependent difference of degree. What Whitehead calls a 'way of life'—each particular distribution and organization of different relations—makes the difference, but the investigation of difference does not require privileging, for instance, meaning making over say war making. Instead perspective and consciousness or world-making is baked into the formative material processes of mobilization, life and death, violence, negotiation, insecurity, demographics, nationalism, and thermodynamics.

In particular, Wendt's attraction to such a world view then is somewhat obvious. A monist, flat ontology, with the weirdness of consciousness all the way up and down, squares the circle of will and materialism. Unfortunately, what it does not do is tell us how to proceed. To say that the entire world from speaking beings to neutrinos play a part in the difference that proceeds every change suggests that we all have to be physicists, biologists, sociologists, political scientists, astrobiologists, etc. all at the same time.[vii] To put it another way, starting from

the premise of one substance and a component of will distributed throughout the cosmos ends a number of theoretical debates, but tells us nothing about where to start investigating new questions.

In effort to address this problem, Tarde and James inspired sociologist, Bruno Latour has suggested moving from matters of fact (the purview of positivists) to matters of concern to draw more attention to the arbitrary choice or cut one makes into the complexity of things when one begins an inquiry. The value of such a position, like Bohr and Heisenberg's view of the apparatus of measurement in the experiment, is to give up on the impossible task of getting to the origin of something or the even more impossible task of getting fully exterior to the observation, and simply makes one's peace with the mess we are in. We take responsibility for starting in the middle of things. Although not a philosophical or empirical argument against monism and panpsychism, the complaint that this position undermines objective, neutral, disinterest scholarship is well-founded. The problem though is that reality, that is the consciousness of experience, is not disinterested. It is invested and multi-perspectival in its nature, and therefore there is no way to do scholarship that is not a form of interested intervention. Even the physicists intervene according to Bohr and Heisenberg on "all levels reality implies an essential element of conceptualization." (Prigogine and Stengers, 1984, 226). And because we are human those conceptualizations carry with them normative and political consequences that we bear responsibility for in the sense of causality. Whether we *take* responsibility for our conceptualization is an ethical question but *our* will results in the conceptualizations that intervene in the world even if we refuse that responsibility.

This does not mean that one cannot design models that have predictive value. Instead it means that when you develop a model, say for the outcome of an election based on significant polling data, the polling in the making of that model, the knowledge of that model as it circulates through the world cannot exist without having an effect on the world it modeled. Model building is world building. In Latour's words, "positivism—in its natural or social form, in its reactionary or progressive form—is not wrong because it forgets 'human consciousness' and decides to stick with 'cold data.' It is wrong politically. It has reduced matters of concern with matters of fact *too fast, without due process.*" (Latour, 2005, 256) The epistemological status of this accusation is interesting because it directly mirrors the weird state of affairs in a monist world.

Simultaneously, the positivist position is politically and empirically dubious. The error is not mistaking a particular matter of concern, say human freedom, for a matter of fact such that if we could just re-sort the things of the world into the right groupings we could go back to the positivist enterprise. Neither is Latour's claim nor the claim of panpsychist monism that we cannot help but make matters of fact into matters of concern. Here the idea is that humans are somehow predisposed to smuggle in crypto-normative judgements when observing the world as a result of being beings of mind in a Kantian sense. Instead, when we put the world back together again, rather than divide it into 'kinds' (mind and matter), the world *is* empirically made up of matters of concern. That is, in a Jamesian sense, consciousness is not an exotic substance sitting apart from the world. It is instead the novel phenomena of relations that are experienced by one another. (James, 2013, 13)

Therefore, it is precisely *our* involvement in things, our intervention, that makes us, those things, and the experience i.e. consciousness of those relationships. What we call data is not 'out there' *and* we are not 'in here.' We are out there with it, because of it, and it because of us. In Wendt's formulation of this problem of experience which he formalizes into a hologram (the unified experience of the storm of relations and experiences), things only appear because they

are observed. Yet they are real rather than mere appearances. Making reference to one of the most important phenomena studied in IR, Wendt says, "the state is like a rainbow—it only exists when someone is looking at it." (Wendt, 2015, 273) So for Wendt, like Latour, the state is real but only because of the effects of studying, observing, and participating in the making of the state.

To paraphrase Latour, the problem of constructivism is not the insight that everything is constructed. That is indelibly true. The problem of constructivism is that is spends so little time considering from what constructed things are made and who and what can make them. (Latour, 2004) For Latour, a bit more provocatively than Wendt, things, including the state and atom bombs and microbes, are made out of states of concern. That is, they are made out of the experience of relations from quanta of light to galaxies. I am sure many will hate this position as it makes what we do as social scientists so much harder, particularly if the gold standard of the social sciences is measured by repeatable and testable theories. However, the position developed here is not strictly a 'position' in the argumentative sense or even the sense often meant by terms like 'critical' in critical IR. The position developed here, built on the insights of the relational revolutions in philosophy and the quantum revolutions in physics are claims to how the empiricism of the real-world works. Therefore, the opposition to this position cannot be the complaint that it is inconvenient or that one *prefers* the other world any more than one can complain about gravity when designing an airplane. Unlike poststructuralism or other hermeneutic approaches, this is not an argument for how to interpret the world. It is a claim about the world as such. As for how we should approach such a world, a world made out of matters of concern lends itself quite well to the idea that theory is a task rather than a riddle to be solved. In Latour's version of a methods book, he suggests that we, "learn how to feed off uncertainties instead of deciding in advance what the furniture of the world should look like." (Latour, 2005, 115) Easier said than done but what else is there to do but begin here where we are.

Bohr provides a good example of what such a research ethos could look like. As is evident by his extensive collections of talks and philosophical writings, Bohr was frequently asked to speak at gatherings of non-physicists. Whether to biologists, to humanists, to philosophers, Bohr began almost all of his talks with the words "It is only with great hesitation…" (Bohr, 2010, 23). The modesty of Bohr's beginning was joined by the strength of his conviction that his quantum findings suggested the necessity to reconsider the common sense of everything, from biology to philosophy. That conviction was earned through experimental research, but it was first and foremost what Bergson called an intuition.

In fact, there is a certain kinship between Bohr's style of philosophical writing and that of Wittgenstein. Like Bohr, Wittgenstein made a kind of break with an earlier view of rationalist philosophy that thought everything could be subsumed under logical principles. In writing about his later philosophy, Wittgenstein often distinguished between presentation and representation (*darstellung and vorstellung)* in the doing of philosophy. (Cavell, 1989:17) For Wittgenstein, the philosophy of representation tried to use proofs to make a philosophical problem disappear. Wittgenstein on the other hand described his greatest book, the *Philosophical Investigation,* as a kind of album, as a collection of philosophical remarks, a presentation. Following Wittgenstein's earlier statement that to solve someone else's philosophical problem was like trying to wear their hat for them. It makes sense that he would want a philosophy of questions and presentations rather than solutions or proofs. This showing or presentation of philosophical problems rather than proofs of philosophical answers is much closer to the style of Bohr's philosophical writings

as well as his speeches to non-physicists. In one such moment in his 1937 essay, "Biology and Atomic Physics", Bohr celebrates the way Einstein's theory of relativity opened up thinking to consider the nature of reality in ways that were in Bohr's words 'unprecedented.'(Bohr, 2010: 18) However, Bohr, goes on to warn against accepting Einstein's confidence that we can distinguish easily between the observer and the observed, and warns further against trying graft this confidence onto the biological and social world as Einstein's position rest on the assumption of the regularity of the behavior of material world. Instead Bohr suggests the way that the crisis of quantum research itself is analogous to other kinds of crises of other fields. Bohr writes:

> For a parallel to the lesson of atomic theory regarding the limited applicability of such customary idealisations, we much in fact turn to quite other branches of science such as psychology, or even to the kind of epistemological problems with which already thinkers like Buddha and Lao Tse have been confronted, when trying to harmonize our position as spectators and actors in the great dram of existence. Still, the recognition of an analogy in the purely logical character of the problems which present themselves in so widely separated fields of human interest does in no way imply acceptance in atomic physics of any mysticism foreign to the true spirit of science, but on the contrary it gives us an incitation to examine whether the straightforward solution of the unexpected paradoxes met with in the application of our simplest concepts to atomic phenomena might not help us to clarify conceptual difficulties in other domains of experience. (Bohr, 2010: 20)

Bohr is not using quantum theory here as a metaphor nor is he trying to colonize the other fields with a kind of final scientific explanation. Instead, he is horizontalizing the endeavors of philosophy, the social sciences, and even religion as pursuits of a more general set of problems that are similarly inspiring to physics and may benefit from the ways physicist came to deal conceptually with problems at odds with accepted logic. In this way, for Bohr, the value of his research for non-physicists was showing how quantum research questioned common sense understandings of even the most basic assumption of reality rather than physics providing a new foundation on which other modes of inquiry could stand. What Bohr is referring to as 'incitation' is in the same conceptual neighborhood as what Bergson called intuition or an "intellectual sympathy by which one places oneself within an object in order to coincide with what is unique in it and consequently inexpressible.

Bergson, Tarde, Peirce, and James, later joined by Dewey, Whitehead, and Bentley, all saw intuition as a vital philosophical tool, a kind of nose for sniffing out Latour's 'controversies' or 'matters of concern.' Intuition is always employed whether we like it not. And yet intuition is often seen as a kind of methodological sin. We hide our intuitions rather than expose them to contestation and the pursuit of others. What I think Bohr, Heisenberg, and the relational Philosophers who proceeded and then joined them have to offer--rather than a quantum theory of international relations—is an inclination for speculative thinking inspired by the world rather than limited by a desire for how we wished the world worked. If this is what 'Q effect' is on International Relations the fear of science envy, the colonization by science, and the risk of metaphoric appropriation seem unfounded and unlikely. Almost 20 years ago a number of critically inclined IR theorists published an article entitled "God Gave Physics the Easy Questions." (Bernstein, et all, 2000) The article is meant to strike a blow against scientism by showing how distinct the social sciences are from the 'hard' sciences. In some sense, the authors hoped to widen the disciplinary gap between the social and natural world. The long dialogue

from Bergson to Bell suggests there are no easy problems, and that the territorial dispute between humanistic theory and scientific inquiry is a recent and far from inevitable problem of contemporary scholarship. The world in which scholars like Bergson and Einstein debated is only a few generations removed and certainly not impossible to reclaim. The only requirement is that we all agree that it is the whole world and everything in it that is up for debate. James called this radical empiricism. Contemporary thinkers like Brain Massumi have called it extreme realism. The name matters less than the insight James made more than one hundred years ago:

> It is difficult not to notice a curious unrest in the philosophical atmosphere of the time, a loosening of old landmarks, a softening of oppositions, a mutual borrowing from one another on the part of systems anciently closed, and an interest in new suggestions, however page, as if the one thing sure were the inadequacy of the extant school-solutions. The dissatisfaction whit these seems due for the most part to a feeling that they are too abstract and academic. Life is confused and superabundant, and what the younger generation appears to crave is more of the temperament of life in its philosophy, even though it were at some cost of logical rigor and of formal purity. (James, 2003)

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[i] I use the term relational philosophies because the thinkers outlined here do not lend themselves to a school. There was certainly a longstanding dialogue between all of them crossing oceans and generations. However it would not be accurate to call them all pragmatists as that would really only cover James, Dewey, and maybe Peirce. Similarly, regional terms like Continental or Anglo-American also are simultaneously too big and too small. What unifies all of these thinkers is the effort to break out of what Tristan Garcia has called Kant's "metaphysics of access" where philosophy is circumscribed to the question of how we access the world rather than what is in the world—including ourselves. (Garcia, 2014)

[iiiiiii] For extensive recounting and analysis of the debate see Jimena Canales excellent book The Physicist and the Philosopher, 2016.

[iii] It is worth noting that Whitehead's thinking and its emphasis on process and the evolution of laws had a tremendous impact on many of the scientific theories of the 20th century including Stephen Jay Gould's major renovations of Darwin and Gregory Bateson's second order cybernetics which has had far reaching consequences outside his field of anthropology, as well as more overtly philosophical scientists like Prigogine, Lynn Margulis, Stuart Kauffman, and Brian Goodwin. (Prigogine and Stengers, 1984; Sagan and Margulis, 2013; Kauffman, 1993; Gould, 2002; Goodwin, 2001)

[iv] I discovered this quote in William Connolly's forthcoming essay "The Lure of Truth"

[v] Mary-Jane Rubenstein follows the whole history of the multiverse and many of the related models of physics through their philosophical inspirations in her book Worlds without End (2014). Rubenstein's history exhaustively substantiates the long conversation between philosophy and physics well beyond what can be addressed in this article.

[vi] For in depth review of the relationship between Deutsch and Cybernetics see: Hayward R. Alker, "The Powers and Pathologies of Networks: Insights from the Political Cybernetics of Karl W. Deutsch and Norbert Wiener [1]." *European Journal of International Relations* 17, no. 2 (June 2011): 351–351. https://doi.org/10.1177/1354066110396977.

[vii] It is worth point out that Wendt does not think that rocks or planets have consciousness. However, most panpsychists will dispute this on the grounds that if the stuff of consciousness is stuff than the difference between a carbon based rock and a carbon based life form is only an organizational difference and therefore there must be some, even if infinitesimal, degree of consciousness even in the neutrino. For a discussion of the will of micro and nano scale things see: Brian Goodwin, How the Leopard Changed Its Spots, 2001.