International Theory (2022), **14** (1), 130–145
doi:10.1017/S1752971921000063

International Theory

BOOK SYMPOSIUM

Our place in the universe: Alexander Wendt and quantum mechanics

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(Received 1 June 2020; revised 3 November 2020; accepted 4 May 2021)

Abstract
Alexander Wendt claims that quantum physics explains deep mysteries about human consciousness and offers a radical new understanding of human behavior and social interaction. However, the claims rest on flawed interpretations of quantum theory, fringe literatures and metaphorical, almost mystical uses of quantum concepts and buzzwords. He fails to provide any account of human conflict, and defends an almost theological view of the importance of humanity in the universe that is incompatible with a scientific perspective.

Keywords: International relations; philosophy of science; quantum theory

Introduction

The great physicist Richard Feynman is reputed to have said that if you think you understand quantum mechanics, you do not understand quantum mechanics. That has not stopped a lot of people from thinking they understand its implications for other subjects. The theory's very strangeness, its surreal departures from everyday perceptions of reality, combined with its modern and scientific image, have exercised a fatal attraction on a long series of mystics, gurus, cranks, and quacks. Over the years, airport bookstores have beckoned the quantum-minded traveler with titles purporting to apply quantum theory to eastern religions, reincarnation, the soul, leadership, self-help, healing, and a variety of other topics.[1] The typical contribution to the literature combines a tenuous grasp of physics with an impressionistic set of assertions about what it implies for the topic at hand.

Undaunted by such company, Alexander Wendt in his latest book also turns to quantum theory to shed light on the human brain, the nature of society and the state, and our place in the universe.[2] Wendt claims that his theory solves long-standing puzzles such as the mind-body problem, the mystery of consciousness, the problem of other minds, the agent-structure debate, and free will by grounding psychological and social science in quantum mechanics. Unlike the popular entries

[1]See, for instance, Capra 1975, Chopra 1990, Zohar 1991 and Goswami 1995.

[2]Wendt 2015.

in the genre, Wendt's book is densely written, deeply researched and philosophically serious.[3] The claims are nothing if not bold, and if true, the theory would mark an epochal advance in our understanding of humanity and society.

Unfortunately, Wendt's arguments are primarily based on misinterpretations of quantum mechanics, fringe literatures, and loose metaphorical applications of quantum concepts rather than rigorous theory. For instance, Wendt's favorite conceit, that 'human beings are walking wave functions',[4] sounds impressive until you start to think about what wave functions actually are and how human beings are different.[5] Wendt asks that we take his argument 'holistically' and not judge it by 'a close reading of everything in the bibliography'. He argues that the strength of each individual claim is bolstered by the coherence of the entire vision. Of course, there is a place for bold sweeping claims and revolutionary insights. Quantum theory is a great example. But, such visions are not science until the logic is rigorous and the implications are empirically verified. Quantum theory overthrew classical mechanics because the math was tight and the experiments confirmed it, not because it was trippier. Wendt's vision is neither rigorous nor well connected with empirical reality. It is therefore very unlikely to revolutionize the human and social sciences.

In the main part of what follows, I will go through the book chapter by chapter, summarizing the argument, and outlining why I find it unpersuasive. I will then discuss a curious lacuna in book, namely any discussion of conflict. In a work by an International Relations scholar, such an omission is noteworthy. Finally, I offer a brief reflection about how this book fits into a larger philosophical debate over the place of humanity in the world. I argue that Wendt is trying to use quantum theory to create a view of the universe with a more important role for humanity than a scientific perspective warrants.

I make no claims of expertise on these topics, beyond that acquired studying physics and philosophy as an undergraduate, and working as an applied game theorist in International Relations. My standpoint is a conventional materialist one, and I will be content if my contribution to the symposium can serve as a more or less representative response to the book from such a perspective, for what it's worth.

Summary and response

In the Introduction, Wendt lays out a series of philosophical puzzles that he views as unsolved, principally having to do with how the phenomenon of consciousness could arise in a material universe governed by the laws of classical physics. He contrasts the physical ontology of particles and energy with the social ontology of intentional actors, and argues that the latter cannot plausibly be reduced to the former, because dead matter cannot have consciousness. He then poses the main question of the book, 'how might a quantum theoretic approach explain consciousness and by extension intentional phenomena, and thereby unify physical and social ontology'?[6] The question is interesting, and certainly worth thinking about.

[3]His promotional video is also better, compare https://www.youtube.com/watch?v=WpkhPgpY28M with https://www.youtube.com/watch?v=X8l9AprftVw. [4]Wendt 2015, 37. [5]Donald 2018.
[6]Wendt 2015, 29.

https://doi.org/10.1017/S1752971921000063 Published online by Cambridge University Press

Wendt also introduces his answer: 'panpsychism' or the idea that consciousness exists at the subatomic level. The answer is profoundly unpersuasive, both as an interpretation of quantum theory and on more general philosophical and scientific grounds. I will reserve more detailed discussion for the chapters where it is treated at length.

Part I of the book consists of three chapters in which Wendt lays out his understanding of quantum theory, the challenges it poses to the classical worldview, and how it should be interpreted.

Chapter 2 introduces some concepts from quantum theory and discusses three experiments that highlight the weirdness of the quantum mechanical understanding of the world.[7] The main concepts are the *wave function*, *superposition* and *entanglement*. Quantum theory conceives of elementary particles like photons and electrons as *wave functions*, or probability distributions over a set of properties, such as location and momentum. For instance, a photon emitted from a light source and traveling through space could be polarized at any angle. When it hits an object and is absorbed, one of those possible angles will be realized, and if the object is a measuring device with a polarized lens attached, we can find out which one. However, the photon cannot be said to have had that angle all along, it could just as easily have been different, according to the probabilities of the wave function. Contrary states, different angles, exist in *superposition*, each with some probability of being actualized when the photon hits the object. Finally, particles may also be *entangled*, such that learning about the properties of one particle tells the observer about the properties of another, even if it is far away and has not itself hit anything yet.

The three experiments bear out this strange view of the world. The two-slit experiment illustrates the wave function and superposition. When light is shone through two slits onto a screen behind, an interference pattern emerges as if the light is composed of waves that cancel each other out when peak meets trough. This interference pattern remains even if only one photon is sent through the device at a time, which seems to imply that each photon is going through both slits at once and interfering with itself. This supports the idea that each individual photon is a wave function of different possibilities that only 'becomes a particle' with a definite location when it hits an object and is absorbed. The Bell experiments demonstrate the phenomenon of entanglement. When the polarization of one of two entangled photons is measured, the polarization of the other one becomes highly correlated, even though it may be kilometers away. Finally, the 'delayed choice' experiment is a variant of the two-slit experiment in which a measurement device is introduced along one path a photon could take while it is in flight. If a hit is registered, it would seem to indicate that the photon took one path rather than the other, but if the device is not introduced, the photons will form the usual interference pattern, indicating that they took both paths at once. Some have interpreted this to mean that introducing the measuring device changes the past by causing the photon to have taken one path rather than another.

[7]As a summary of a summary, this presentation will be brief and unsatisfying to many readers. For an introduction, see the text on the topic such as Griffiths and Schroeter 2018.

https://doi.org/10.1017/S1752971921000063 Published online by Cambridge University Press

As a summary of the looking glass world of quantum physics, chapter 2 is fascinating and by and large well done. Here, as in chapter 1, I have some quibbles with some of the arguments but will reserve these for the chapters in which the arguments are more fully developed.

Chapter 3 discusses six challenges to our usual understanding of the world posed by quantum mechanics. Wendt argues that quantum theory undermines our usual commitment to materialism, atomism, determinism, and causal mechanisms. Some of these points are overdrawn, but my main interest is in his final point about the subject–object distinction. Because measuring a wave function causes it to collapse into a definite particle, Wendt argues that the classical distinction between observer and observed reality cannot be sustained. Reality is what it is because we observe it (cf. his discussion of creative measurement in chapter 2).

This point gets picked up in chapter 4, which covers various interpretations of quantum theory. Wendt discusses three varieties. The instrumental approach takes no stance on what the quantum world is 'really like' and just asserts that the formalism is a useful tool for making predictions. The materialist approach asserts that the quantum world is real and distinct from our minds, while the subjectivist interpretation argues that it is a product of our decisions about what to measure, and in the strong versions, does not exist independent of our observing it. Wendt is clearly partial to the subjectivist interpretation, although he will take it in a slightly different direction with panpsychism in Part II.

Before we leave Part I, however, I should articulate my first substantial objection to the direction Wendt is going. By claiming that quantum mechanics undermines materialism, mechanism and the distinction between observer and observed, Wendt is giving a quantum gloss to an old tradition of thought, going back to George Berkeley[8] and before, which denies the existence of the external, material world. Berkeley argued that since all we have access to is our mental impressions, they must be all that really exist. The quantum spin on this is to say that since particles don't really exist until we measure them, our measuring is what brings them into existence.

However, this kind of quantum Berkeleyism is as unpersuasive as the original classical version. Two objections can be raised, one classical and one quantum. The classical objection to Berkeley remains as forceful as ever. Nothing in our sensory impressions makes the slightest degree of sense unless we presuppose a material world that exists independent of our minds. And once we do, lots of things make a great deal of sense. The entire edifice of everyday life, not to mention all of science, depends on this assumption. The objection to the quantum version is that it is not 'measurement' per se that collapses wave functions, but their impact on physical objects. A photon wave function that is emitted by the sun and hits a leaf in the Amazon rain forest where no one is there to see is absorbed and may even contribute to photosynthesis and help the tree grow. The fact that no one measured it doesn't mean it didn't happen. Other photons hit the moon, and warm it up slightly without anyone noticing. Almost every photon in the history and future of the universe will be born, travel, and die unmeasured. We affect a tiny fragment of reality by measuring it, but the vast bulk of reality rolls on without us. The fact

[8]Berkeley 2009.

https://doi.org/10.1017/S1752971921000063 Published online by Cambridge University Press

that our measurements affect the world makes it harder for us to learn about it, but it remains out there all the same.

In the end, Wendt is not a full-blown quantum Berkeley; he takes the argument in a slightly different direction. But he uses some of these arguments to undermine our usual faith in objective reality, so it is important to critique them before moving on.

Part II is the heart of the book, where Wendt develops his quantum theory of consciousness and his version of panpsychism.

In chapter 5, he argues that the brain is a quantum computer. Every bit of matter has quantum processes within it, of course. Quantum brain theory goes beyond this to argue that the brain sustains wave functions over macroscopic distances and that they do essential work in computation and thought. Wendt acknowledges that this cuts against the widely held 'neuron doctrine',[9] by which neurons are thought to be the smallest structures in the brain necessary to understand thought. He argues for 'microtubules' as possible sites of uncollapsed wave functions within neurons. And he acknowledges that 'the idea has been ignored by most neuroscientists and philosophers of mind'[10] in part because there is essentially no evidence for it. The obvious objection is that in an environment so warm and full of matter as the brain, wave functions are constantly interacting with other matter and collapsing over quantum distances, and so it is difficult to envision how they could remain in their quantum states long enough to contribute much to thought. Quantum brain theory, therefore, remains a speculative theory in a fringe literature.

Nevertheless, Wendt wants us to accept the theory as a plausible candidate because it hasn't been *disproven*, reversing the usual burden of truth for new theories in which extraordinary claims require extraordinary evidence.[11] He takes this stance primarily because a quantum brain is a necessary building block for the quantum society he depicts later in the book. But for those of us who are not predisposed to believe in such a vision, the burden of proof should be on the new claim, and the logic and evidence for it is quite weak. No one arguing for quantum mechanics when it emerged a hundred years ago had to ask for the benefit of the doubt. Crucial experiments confirmed its predictions again and again. Quantum brain theory has had no such confirmation, and there is no reason to require anything less.

In chapter 6, Wendt presents his theory of consciousness. He defines consciousness as composed of three aspects: cognition, experience, and will.[12] Cognition refers to thinking information processing, memory retrieval, and so on. Experience refers to feeling what it is like to be a certain organism. Will refers to the ability to act, choose one course or another, and change one's surroundings to some degree. Wendt starts from the premise that materialism has failed to explain subjective experience, or what it feels like to be human. The gap between the material world and the internal world of consciousness is held to be unbridgeable. Wendt argues for a solution via panpsychism and neutral monism. Panpsychism argues that actually all matter has subjective experience, not just living beings. There is consciousness all the way down to the subatomic level, so there is

[9]Wendt 2015, 96. [10]Wendt 2015, 102. [11]Wendt 2015, 106.

[12]Seeming to follow 18th century spelling conventions, Wendt often capitalizes these three words.

https://doi.org/10.1017/S1752971921000063 Published online by Cambridge University Press

no need to derive consciousness from dead matter. Neutral monism claims further that there is only one substance, which is at once material and mental, so there is no messy duality in the ontology of the world. Wendt gives these ideas a quantum gloss by identifying uncollapsed wave functions as the repository of consciousness. This helps explain why animals seem more conscious than rocks, since within rocks the wave functions collapse too rapidly to sustain much thought but animal brains have mechanisms (presumably the microtubules) that prevent rapid collapse.

My chief problem with this chapter, and by extension the entire project, is that I do not actually see the difficulty in explaining consciousness from a material basis as being that great. Consciousness strikes me as clearly a property of living things. As such, it is a product of evolution. As they evolve, organisms face competitive pressure. There is tremendous advantage to be had by being able to sense changes in the environment, to distinguish day from night, rain from drought, predators from innocuous creatures, food from inorganic matter, harmful events from beneficial ones, and so on. Living things have, therefore, evolved a panoply of sensory organs that give them information on their surroundings. That's what experience is, the reception of sensory inputs. Cognition is the processing of those sensory inputs. For instance, the ability to move is selected for, because then one can happen across food rather than just waiting for it to arrive, or making it yourself from sunlight. If you can move, it is advantageous to have a mental model of the world derived from your sensory inputs, so you know where to go. As life evolves, those models get more and more complex and realistic, until they become aware of the self and others, in social species, and eventually become scientific theories, in the case of humans. Finally, will is also an obvious product of evolution. Once you have sensory inputs and a mental map of your surroundings, and particularly if you can move, the ability to make choices will be the difference between success and failure. The animal that runs away from predators, seeks out food and mating opportunities, stops doing things that cause pain, and doesn't eat things that smell bad will do much better than one who just sits there and takes life as it comes.

But, what of the subjective element of experience, or 'what it is like to be a bat', as Nagel famously put it?[13] How can this be reduced to a physical substrate? Doesn't there need to be a 'ghost in the machine' to have the feelings, or, as Wendt might have it, doesn't the machine need to be ghostly? This seems to be one of those questions which either seems very troubling to one[14] or does not, and I confess for me it does not. I suspect it is akin to grand sounding but nonsensical questions, like, 'what is the meaning of life?' For the materialist, what it is like to be a bat is simply the sum total of sensory inputs, mental states, cognitive responses, and activities that typify a bat's existence. These are all compatible with a material physical basis; no need for panpsychism. If in the future we learn so much about bats that we could program a drone with a sonar detector to mimic bat thought processes and abilities exactly, that drone would experience what it is like to be a bat.[15] In terms of the great philosophical debate of the

[13]Nagel 1974. [14]Chalmers calls it the 'hard problem' of consciousness (Chalmers 1995).

[15]This is highly unlikely to be achieved, but because of the complexity of bats, not for any philosophical reason.

https://doi.org/10.1017/S1752971921000063 Published online by Cambridge University Press

early 1980s, although we may think of ourselves as spirits in a material world, in reality we are just material girls.

To me, therefore, consciousness is obviously advantageous in the evolutionary process that produced life. I'm not sure much more is needed to understand it. This doesn't make consciousness an 'illusion', it just explains it with reference to the forces that would generate such a thing. By contrast, Wendt's 'elementary particles have consciousness too' argument strikes me as an abuse of the concept of consciousness and a non-explanation, akin to explaining why water is wet by saying that molecules of water have a property called 'proto-wetness'. It is reminiscent of the homunculus theory that a little man inside our head watches through our eyes.

Chapter 7 is devoted to defending vitalism, or the idea that there is a living substance underlying all life that distinguishes it from inorganic matter. Wendt is admirably forthright in acknowledging that vitalism today is dead as a doornail, having gone into terminal decline with the rise of modern biology. But Wendt wants to revive it with a quantum spin. For Wendt, 'life is a macroscopic instantiation of quantum coherence'.[16] Essentially, Wendt identifies life with consciousness, and locates the physical basis of both in uncollapsed wave functions. Living things are the things that have evolved the ability to sustain wave functions.

Given the overlap with chapters 5 and 6, some of my objections to those chapters apply here as well. But I will focus on a different question, that of plant life. Plants are certainly alive, and I would be willing to say that they have a rudimentary level of consciousness, in that they can respond, however slowly, to their environment. They leaf and bloom when the conditions are right, respond in various adaptive ways to drought and rain, heat and cold, lost branches, and threats in the environment. However, there's no getting around the fact that plants are slower and dumber than animals. If we posit, as Wendt must, that they have microtubules or some other structures that sustain quantum coherence, this becomes a puzzle. If quantum computing is so vastly superior to classical computing, and animals and plants alike, by virtue of their participation in the vital essence, engage in quantum computing, why are plants dumber than animals? To normal biologists, the problem is an easy one, animals have neurons and plants do not. Nervous systems allow much greater and faster computation than the crude chemical pathways that plants rely on. The more neurons, the smarter the animal. But, from the quantum vitalist perspective, the problem is puzzling. If quantum processes simply help neurons 'work better' than they otherwise would, then are plants, bereft of neurons, not alive?

Part III of the book begins to apply the theory to human beings specifically. In the Introduction, he lays out a classical conception of man as machine, to be used as a foil for his quantum conception. Then he turns to rationalist models of man, focusing in turn on cognition, will and experience.

Chapter 8 focuses on quantum decision theory, what it means to be rational, and quantum game theory. Here, unlike in the case of vitalism, there are recent literatures to draw from. However, once again, Wendt is forthright in acknowledging that the scholars in these literatures usually explicitly deny the precise move Wendt wants to make: namely, to link their results to a theory of quantum brain function

[16]Wendt 2015, 137.

https://doi.org/10.1017/S1752971921000063 Published online by Cambridge University Press

or quantum consciousness. So, despite the existing literatures, Wendt is out on a limb of his own.

Quantum decision theory purports to explain experimental anomalies in expected utility theory (EUT). EUT assumes that people have fixed and transitive preferences or utilities and assess probabilities in accordance with classical probability theory, such as Bayes' Rule, for updating beliefs in response to new information. They make choices to maximize their utility given their beliefs. Experimentalists, perhaps most famously Daniel Kahneman and Amos Tversky, have discovered many ways in which people depart from EUT. What people prefer often depends on how and in what order you ask the question. If you lead people to believe that Linda favors equal pay for women, they will think it more likely that she is a feminist and a bank teller than that she is a bank teller when the latter subsumes the former category and so must be more likely. People are more likely to gamble again if they know they won or lost the last gamble than if they remain uncertain about its outcome. Quantum decision theory purports to predict these deviations from classical rationality.

The key claim of quantum decision theory is that there are no real underlying attitudes, beliefs, or intentions, just answers to questions that are produced by random processes which are modeled by quantum probability theory. Once again, nothing exists unless you measure it, and how you measure it changes what exists. To my mind this fails the introspection test, which, incidentally, Wendt sets great store by in a book about consciousness. It implies, for one thing, that if a person is alone in the woods, they have no social attitudes, because no one is asking them questions or presenting them with social decisions to make. To pick an example from the 2016 US Presidential election, does a Clinton supporter who shuts her office door suddenly become a possible Trump voter? Does a Catholic on his daily commute alone in his car become a possible Muslim because no one is there to check? Many social attitudes, identities, and so on, are highly predictable and resistant to change. It is hard to believe that quantum theory is going to improve our understanding of them even in cases where they are more volatile.

But, what about the experiments? Doesn't quantum decision theory predict the anomalies for EUT, just as quantum mechanics did for classical physics a century ago? I strongly suspect that it doesn't. I grant that I am not able to review the literature that Wendt cites in depth for lack of time. However, until quantum decision theory achieves widespread acceptance among the scholars most closely concerned, in economics and psychology, I think the lay person has ample reason for doubt. The experiments that Wendt alludes to were very carefully crafted to be crucial tests of EUT. They are tests where EUT makes a clear prediction that can be falsified. It is not obvious to me that they function in a similar way for quantum decision theory. Does quantum decision theory make a specific prediction in these experiments that can be falsified by observed behavior? My guess is that it does not, but rather the quantum theory adds additional degrees of freedom to the model that render it supportable by any observed behavior in the experiment. For instance, imagine an experiment in which classical theory predicts a one to one, 45 degree relationship between two variables and quantum theory says it can take any angle depending on some unknown parameter alpha. Let's say the angle turns out to be 10 degrees. Classical theory is falsified, but quantum theory

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is not confirmed, since it made no real prediction about the angle. Until quantum decision theory passes crucial experiments designed by economists to falsify it, I will remain skeptical about its claims.

Next, Wendt turns to the debate over the meaning of rationality. Part of the debate is whether EUT should be held up as the ideal of rationality, from which we fall short, or if we should adopt alternative, possibly more pragmatic, possibly more quantum conceptions of what rationality means. Here, I would put in a plug for the traditional ideal role for EUT. For one thing, when it comes to inorganic macroscopic phenomena, classical probability theory is right. It's no accident that classical probability theory was discovered hundreds of years ago by individuals who wanted to make more money betting against their slower witted fellow aristocrats. If you want to know how likely you are to draw a spade after two hearts have been drawn from a well shuffled deck of cards, classical probability theory, specifically Bayes' Rule, provides the correct answer. To the extent that humans provide answers to such questions that deviate from Bayes' Rule, they are making mistakes, and to the extent they are betting on those answers, they are losing money.

The same goes for questions that mix objective and subjective factors. Pothos and Busemeyer[17] provide an example where a subject is asked two questions, are you happy and are you employed. It seems perfectly reasonable that if someone is asked whether they are employed and answers yes, they are then more likely to answer that they are happy than if the happiness question came first, because they are reminded of a good thing in their lives and happiness is subjective. However, if the first question is about whether I am happy, and I respond that I am sad, it would be a mistake for me to then answer that I am unemployed, if in fact I have a job, as my students would be quick to remind me if I acted on that belief and failed to come to class. Employment is a social fact, not a subjective attitude.

Finally, Wendt turns to quantum game theory. Game theory is the study of strategic interaction, and as such involves the interaction of at least two people. Here, Wendt further develops the notion of entanglement and claims that wave functions, kept from collapsing in our minds, are entangled with similar wave functions in other people's minds. This enables the strategies they pursue in a game to be entangled as well. I postpone discussion of entangling across minds to chapter 12 where Wendt develops it at greatest length. For now, I will simply point out that one doesn't need quantum game theory to see that allowing the players to make their strategies contingent on each other's play makes cooperative outcomes possible where they were not before. Cooperative game theory and the concept of correlated equilibria have long established that. The whole point of non-cooperative game theory is to analyze the hard case, where actors with no ability to make commitments to each other interact in situations where their interests at least partially conflict. Quantum analyses of the security dilemma that claim that it can be transcended between entangled actors, therefore, are about as interesting as analyses of poverty that point out that if people were given lots of bitcoins they could have a better life. The currency may be novel, but the basic idea is trivial.

[17]Pothos and Busemeyer 2013.

https://doi.org/10.1017/S1752971921000063 Published online by Cambridge University Press

In chapter 9, Wendt turns to will. Wendt, as is evident in his earlier work,[18] is firmly committed to teleological explanations and Aristotelian final causation, or the idea that desired end states cause the actions that bring them about. He holds that this involves the future causing the past, which is incompatible with a classical perspective. Here, he offers an interpretation of will from a quantum perspective and a discussion of the classical philosophical problem of free will. 'Will projects itself into what will become the future and creates a destiny state there that, through the enforcement of correlations with what will become the past, steers us purposely toward that end'.[19] This perspective is loosely based on interpretations of quantum theory that, like the delayed choice thought experiment, seem to suggest that measurement-related actions in the present can affect 'choices' made by wave functions in the past. As a naïve materialist, the concept of will seems much simpler to me and easily explained. Sensory information, mental map-making, threats and opportunities in the environment, and the physical ability to act all culminate in an enormous value in the ability to act quickly and intelligently in response to stimuli. Animal nervous systems have evolved to make such plans and carry them out. We don't yet know exactly how these plans are encoded in neurons or the choices made, but the computer analogy is compelling. We program ordinary computers to do this sort of thing all the time. Nothing quantum is needed here.

The debate over free will is the one place where quantum effects do seem useful at least emotionally. Animal behavior is somewhat predictable, but certainly not completely, and human behavior is even less so. We also like to think that we are not machines, but are endowed with the ability to make choices and shape our own destiny (see below). That seems to be incompatible with a classical deterministic worldview, in which, our behavior is, in theory at least, perfectly predictable. Quantum mechanics seems to ride to the rescue here by showing that at the smallest level, there is a fundamental indeterminacy, and so unpredictability, in nature, and so by extension, in us. The future is not perfectly predictable, not even in theory. That may give us some existential comfort, which is fine. In the end, I am probably what Wendt calls a compatibilist, seeing no contradiction between determinism and free will. To take a walk on the beautiful seaside cliffs of Cornwall is a decision of free will, which could have a number of different causes. The decision to not jump off onto the rocks below is another decision of free will, motivated in this case by a fairly obvious desire to survive. One decision is more predictable than the other, but both are free choices, to the extent that we can tell. The fact that we can predict a choice does not make it any less free.

In chapter 10, we complete the trilogy by moving on to experience. Here, Wendt chooses to focus on a rather curious debate about whether we can change the past. Apparently, a debate exists in the philosophy of history about whether this is possible. A minority realist camp argues that we can't, while a majority view holds that we can change our interpretation of the past: the epistemological view. The radical fringe (the ontological view) holds that we can change the actual past, although they still seem to be talking about how we understand the past rather than about what actually happened. For instance, in May of 1945 World War II comes to an end,

[18]Wendt 1999.

[19]Wendt 2015, 182.

https://doi.org/10.1017/S1752971921000063 Published online by Cambridge University Press

and so the war that began in Europe in 1939 becomes a 6 year war rather than a war of indefinite duration, as it was before. Wendt, again drawing on the delayed choice idea, argues that the past actually still exists in our minds, in that particles in our minds are entangled with particles in the past. By changing our memory, therefore, we change the past in the same way that putting the detector in the path of the photon causes it to take a certain path in the past.

This strikes me as a rather metaphorical use of the concept of entanglement, a pattern that will become increasingly common in the chapters to come. Wendt seems reluctant to argue that we can really go back and assassinate Hitler, for instance, merely that we reinterpret the past in light of new ideas or events. This seems entirely compatible with the epistemological approach, which in turn needs nothing from quantum theory. And for someone like Wendt who places such store on introspection, the past certainly seems unchangeable despite the human tendency to reinterpret, distort, and outright lie about it. Plenty of people have wanted to change the past. I haven't met anyone who has succeeded.

We now proceed to Part IV, in which Wendt begins to analyze people in groups, rather than in isolation. Chapter 11 is devoted to language, and chapter 12 to the perception of other minds.

In chapter 11, Wendt argues for a quantum theory of language. He starts from the observation that the meaning of individual words and combinations of words is context dependent. The sentence, 'I'm green' could mean 'I'm jealous' if uttered in front of a friend's Ferrari, 'I'm seasick' if moaned on a heaving deck, 'I'm inexperienced', if said in the face of a new task or 'I'm environmentally conscious' if said while throwing something in the recycling bin. Wendt asserts that context-dependent meaning supports a quantum interpretation of language, in which words and concepts are held in memory as entangled wave functions that collapse into specific meanings in correlated ways. He cites a few studies that apply quantum mathematical formulae to try to explain patterns of word association.

I'm certainly not opposed to the notion that meaning is context dependent. However, as discussed earlier, I think it very improbable that uncollapsed wave functions exist in the brain, so by extension I think the quantum theory of language is unlikely to be the right one. With regard to the experiments purporting to support the quantum view, I would like to see experiments carefully designed to distinguish between quantum and classical neural network theoretic explanations, preferably designed by people who would like the quantum view to fail. If instead it succeeds, as quantum mechanics did against relentless attempts to disprove it, there will be reason to accept a quantum view of language.

In chapter 12, Wendt addresses the question of how we know what other people are thinking. The standard theory is that photons hit their bodies, reflect into our eyes, and give us visual clues about their state of mind, and in addition they make noises with their throats that give us additional information, particularly if we share a language. These clues are put together in our heads according to a mental model of other people in general, and specific other people we have gotten to know, that we develop as we make our way in life. This is an indirect theory of perception in accord with the classical worldview.

Instead, Wendt argues for 'direct perception of other minds'. He begins with a seeming digression into the nature of light, arguing that light 'breaks down the

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separability of subject and object'.[20] He then claims that the problem of how we perceive objects to be located in three-dimensional spaces when all we have is photons impacting our retinas, which are two-dimensional surfaces, is unsolved. He proposes that our minds make internal holograms with reference waves from the future, 'enabling us to directly "touch" objects quantum mechanically'.[21] Wendt then argues, citing Wittgenstein, that we directly perceive emotions in people's faces, rather than infer their presence. This is evidence that our minds are 'entangled' with other minds, and so directly perceive them. The quantum theory of language is then developed for the two person case, in which 'there is no need to infer a speaker's meaning, since it is contained right there in her words and their context, which are picked up non-locally, i.e. directly, rather than "transported" to the listener's mind'.[22] This reverses the default question from 'how can we understand other minds', to 'why do we ever make mistakes'.[23]

In critiquing this view, my first piece of evidence is that I have very little idea what Wendt is talking about here. For me, this chapter marks the point at which the book finally takes leave of even a loose association with science and becomes almost entirely metaphorical or even mystical. It seems almost pedantic to point out that we see objects in three dimensions primarily because we have binocular vision, so intra-cranial holograms are unnecessary. As for the theory of entangled minds and language, it reads as a loose metaphor, applying quantum words and concepts to new contexts in which the normal language meaning of the words seems to make sense, but without actually meaning it to be taken literally in a scientific way. Yet, Wendt explicitly forswears this kind of reasoning, insisting that he is talking about ontology, not even 'as if' uses of the formalism.[24] So, if the claim is that quantum processes in two brains are actually literally entangled, what are we to make of it?

The first objection, noted by Wendt, is the fundamental result in quantum mechanics that entanglement does not permit communication faster than light, much less immediately or 'directly'.[25] This is not a small problem for Wendt, it is fundamental. Wendt's response, however, is to say that verbal communication proceeds at the speed of sound, but we just understand it 'directly' due to our entangled minds. But, if the meaning is not clear from the words, there must be additional information that needs to be conveyed to make it clear. That information cannot be communicated by entangled particles, so how does it get communicated?

Furthermore, if our brains are really entangled, how did they get that way? Particles in the Bell experiments are entangled by careful experimental design, by starting out in the same location and having momentums that are related to each other. Could it be that two electrons were generated somewhere with entangled momentums, made their separate ways into my brain and another person's brain, without hitting any matter along the way that would cause their wave functions to collapse, and are currently held there, presumably in the microtubules, in their still entangles states? The question answers itself in the negative. Wendt seems to think that all particles are entangled with all other particles, so entanglement is everywhere. This does not appear to be the case.

[20]Wendt 2015, 228. [21]Wendt 2015, 230. [22]Wendt 2015, 237. [23]Wendt 2015, 241.
[24]Wendt 2015, 5, 289. [25]Wendt 2015, 239.

https://doi.org/10.1017/S1752971921000063 Published online by Cambridge University Press

Finally, at a much more pragmatic level, Wendt's argument that the default should be understanding and what needs to be explained is misunderstanding strikes me as highly unrealistic. To pick just one example, a substantial percentage of homicides involve cases where the killer and victim know each other. Some are even husband and wife. Less deadly but more common, marital infidelity is usually concealed, at least for a while, along with gambling problems, financial mismanagement, and so on. Fifty percent of marriages end in divorce, and poor communication is often cited as a reason. If 50% of people who think they understand each other the best are incorrect, what hope have the rest of us?

This brings us to Part V, where we move up a notch to analyze society, rather than individuals and pairs. Chapter 13 asks what social structures are, and provides a quantum answer. Chapter 14 applies that answer to the state, a structure of particular interest to International Relations scholars.

Chapter 13 addresses the question of what social structures are, and how they relate to individuals. The supervenience approach argues that social structures are just mental states in fully separable individuals. Wendt engages several debates on related topics before articulating his view that 'what social structures actually are, physically, are superpositions of shared mental states – social wave functions'.[26] As such they help constitute individuals, and exercise downward causation, affecting individual behavior through teleological causation.

As in the previous chapter, if we are to take this as anything more than a groovy metaphor, we must be prepared to argue that wave functions in individual brains are entangled, not just between individuals in close proximity who are having a conversation, but across thousands or millions of individuals in large modern societies. Most of these people will never meet each other, or meet anyone who has met the other. Yet, somehow these millions of minds contain wave functions that somehow were at some point entangled, and remain so despite the ever present danger of impact on a physical object and consequent collapse. How are these wave functions produced, how are they entangled, how are they introduced into so many minds without collapsing, and why don't they collapse subsequently? These questions are not even addressed, much less answered.

Chapter 14 tackles the state. Beyond its status as a social institution, and hence social waveform, Wendt makes two claims. First, 'the state is a kind of hologram'.[27] Holograms have the interesting property that you can destroy parts of them but still reconstruct the image, with some sacrifice in sharpness, from the remaining parts. Similarly, (some) individuals know a lot about their states, so, like a hologram, if a lot of individuals are killed, the state can be reconstituted from the information present in the remaining individuals. Second, states are organisms with consciousness, not metaphorically, but really. An analogy is made to ant colonies and other social insects, where the colony does seem to act as a unit.

Once again, we are in the land of metaphor, and far from science. What it means for the state to be a hologram is unclear to me. In contrast, I can see a case for the state as an organism with consciousness, but I don't see any need for a quantum theory of the brain to underwrite it. States perceive their environments, process

[26]Wendt 2015, 258.

[27]Wendt 2015, 271.

https://doi.org/10.1017/S1752971921000063 Published online by Cambridge University Press

information, have mental models of their surroundings, and act in the world. Experience, cognition and will seem to be all there.

In the conclusion, Wendt offers some thoughts on epistemology, and a final defense of the claim that this theory is ontologically true, not just useful in making predictions. He defends it on grounds of explanatory breadth, unifying disparate observations, and its coherence and simplicity. He claims that it is 'too elegant not to be true'.[28] I would suggest a different metaphor. Wendt would build for us an elegant Greek temple, a structure of many columns with an underlying simple design. Unfortunately, the design only really specifies the first few columns you can see from the front, and after that gets vague as to how many columns there are and how they are attached. Even more problematic, the first few columns appear to be built on sand, and so won't actually support the roof, and it's not even clear that the remaining columns have anything to stand on at all. Wendt wants us to believe it will be a great temple, but it's not finished and it's not well supported.

I now turn to two reflections on what the book leaves out, and what may be motivating the whole exercise.

The absence of conflict

The biggest and strangest lacuna in the book is any discussion of conflict. Even more so than in Wendt's previous work, the entire apparatus of the argument is brought to bear to explain ostensibly good things: freedom, communication, understanding, cooperation, collective action, and so on. Wendt does not even mention the existence of more negative outcomes. Violence, war, predation, exploitation, hate, hostility, terrorism, conflict, prejudice, and genocide are not to be found in the index. This is a very odd gap in a book by an International Relations scholar that purports to better explain social life. If we study International Relations in order to understand it and hopefully to make things better, here we have no sense of what we need to understand, and what there is to make better. Furthermore, Wendt's organic conception of the state comports very well with a traditional state activity, namely fighting wars with each other to establish dominance and amass greater territory. He is eager to disavow Fascism, but why not at least mention war?

It is as well that the book makes no mention of conflict, as the theory offers no prospect for better explaining it than conventional approaches. The upshot of the theory is that humans are freer, smarter, more understanding of each other, and more capable of joint action than we realize if we remain stuck in the classical framework. How then do we explain the numerous instances in which they are intellectually hobbled, hidebound, suspicious, tone deaf, oblivious to the feelings of others, careless about inflicting pain, and hateful of those deemed different from themselves? How do we explain millennia of war and the existence of nuclear arsenals sufficient to wipe out civilization? To put it in social science 101 terms, a theory of outcome A is no good unless it can also predict outcome not A. Dependent variables must vary.

Intriguingly, in this context, Wendt borrows Leibnitz's term, 'monads', to label his quantum mechanical interpretation of human beings.[29] Liebnitz, when he

[28]Wendt 2015, 293.

[29]Wendt 2015, 269.

https://doi.org/10.1017/S1752971921000063 Published online by Cambridge University Press

wasn't inventing calculus, was a prominent theodicist, who developed a complex defense of God from the problem of evil. He is (in)famous for his argument that the world, although seemingly flawed, is the best that it can possibly be, so we should not blame God for any human suffering in it. Voltaire makes merciless fun of Leibnitz in *Candide* in the character of Dr Pangloss, who spouts optimistic nonsense in the face of heartbreaking, inexplicable misery. Wendt's neo-Leibnitzian argument that we are quantum monads may dethrone God, but by ignoring conflict it would have us believe that we are angels. To more cynical eyes, the entire enterprise seems more than a touch Panglossian.

Our place in the universe

I have attempted, at some length, to explain why I disagree with Wendt's theory. I now offer a brief thought on why it might nonetheless be appealing, to Wendt as to others. In essence, Wendt is offering a view of science that supports an important place for humanity in the universe. The modern scientific understanding of the world as an incredibly complex material system that has evolved over billions of years according to certain laws is very rich and full of marvels. However, it is not comforting. We would much rather understand the world as basically coterminous with us, created for us, by someone like us, who is more or less focused on what we do in the same way that we are. We are high school students earnestly beseeching the supreme creator of the universe for help on a final exam, and worried that He might not grant it if we have premarital sex. Most people are comfortable simply rejecting science when it conflicts with this understanding, with no justification required. Some theologians strive to reconcile God and science. Even philosophers, who may consider themselves atheists, find themselves uncomfortable with the scientific view, and so resort to various expedients to elevate the status of humanity. The idea that elementary particles do not exist until we measure them, so prominent in Wendt's preferred interpretation of quantum mechanics, is symptomatic of this impulse. So is Wendt's insistence that consciousness cannot be explained by a normal material basis, we must have the functional equivalent of a soul. So is Wendt's vitalism. We are not dead machines in a dead universe, we are living beings united in mystical harmony in a living universe. So is his commitment to teleology, backward causation, and the mutability of the past. Our will and purposes are real and have causal impact; we reach into the future and can alter the past. That's better than being a bunch of self-replicating molecules, which is all the materialists have to offer.

Wendt's ideas, therefore, may not be very close to mainstream interpretations of quantum theory, or any other branch of science. But, they respond to a very deeply felt need in humanity for beliefs that endow our story with purpose and progress, that emphasize our freedom and special qualities, and that create a universe in which we are at home, and indeed, king of the castle.

Conclusion

The role of quantum theory for life is an interesting question that may have a great future. However, I remain unpersuaded by Wendt's account of it. The early sections of the book stitch together fringe literatures and minority views on the science and

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the later sections are almost entirely metaphorical rather than scientific, despite the ontological claims. Although Wendt would have us shift the 'burden of proof', on to those who support the conventional materialist conception, the burden remains where it should be, on those who advance new ideas. The burden is to rigorously formalize these new ideas into a coherent theory that can make sharp predictions, and then to design hard empirical tests that could falsify them. It is a gate that quantum mechanics hurdled a hundred years ago, and that quantum vitalism is not even ready to approach. I fear that Wendt has ignored another piece of advice from Feynman about the scientific enterprise: the first principle is that you must not fool yourself.

Acknowledgement. I thank two anonymous referees for helpful comments, particularly their insistence that I engage more closely with Wendt's arguments. I followed their advice, possibly to a fault.

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Cite this article: Kydd, A. H. 2022. "Our place in the universe: Alexander Wendt and quantum mechanics." *International Theory* **14** (1), 130–145, doi:10.1017/S1752971921000063