

BOOK SYMPOSIUM

Why IR scholars¹ should care about quantum theory, part I: burdens of proof and uncomfortable facts

Alexander Wendt 

Department of Political Science, The Ohio State University, Columbus, OH 43210, USA

Corresponding author: E-mail: wendt.23@polisci.osu.edu

(Received 29 June 2020; revised 4 May 2021; accepted 4 May 2021)

Abstract

How burdens of proof are allocated in science has an important bearing on how new knowledge develops. Usually, the burden is on new theories to prove their worth relative to a default, baseline of knowledge that is considered established and secure. However, in the case of classical vs. quantum social science matters are not that simple because the long-standing classical default has itself already failed to pass crucial tests, which has spurred the search for quantum solutions instead. Part I of this paper, therefore, tries to ‘re-balance’ the burdens of proof with *Quantum Mind and Social Science* critics, by highlighting two significant limits to date of classical thinking about the mind and society: the philosophical problem of finding a place for consciousness in the universe, and the scientific problem of explaining the Kahneman–Tversky anomalies in psychology. Acknowledging these outstanding problems does not equalize the burdens of proof, but it does mean that as we head into the more substantive discussion in Part II there is no secure default position. Just burdens of proof all around.

Keywords: Burdens of proof; cognition; Kahneman–Tversky anomalies; mind-body problem; national interests; quantum decision theory; quantum

The consolidation of quantum mechanics in the 1920s has had a deep technological impact on social reality – not least on the part of international relations (IR) scholars study, through the advent of nuclear weapons that have revolutionized major power war. And the development of quantum ‘material forces’ has only just begun, as today we are witnessing the emergence of a race to build the world’s first practical quantum computer – which from a geopolitical standpoint could change everything.²

Yet, it is quantum theory’s intellectual revolution that has made these technological developments possible. That revolution encompasses not only a new understanding of the external, material world, but also of how the latter relates to our internal, subjective world, and ultimately of how we *think about thinking* itself.

¹And everyone else.

²For a skeptical view of such ‘quantum hype’, see Smith 2020.

In order even to describe, much less understand the results of their experiments, quantum physicists had to suspend laws of rational thought that had been taken for granted for centuries. Before quantum theory it was axiomatic that nothing could be both A and not-A at the same time; and that the total probability for any set of potential events could not be anything but 1. After all, *logically* how could they be otherwise?³ However, it turns out that, at least at the sub-atomic level, these and many other supposed *a priori* truths do not hold. Thus, an entirely new logic – a quantum logic of both/and vs. the usual Boolean logic of either/or – had to be invented, and quantum probability theory too, both of which subsume their classical counterparts at the limit. In short, quantum theory provided a new, axiomatically well-founded non-classical way of thinking, even as it left behind deep interpretive questions about what it all means that philosophers are still trying to answer.

None of that should be gainsaid, but in *Quantum Mind and Social Science* (QMSS)⁴ I went farther. I embraced the heterodox (heretical?) view of a small but growing number of philosophers, physicists, and other scientists that consciousness is a macroscopic quantum mechanical phenomenon, and that quantum theory should therefore be directly relevant to understanding human beings. The quantum consciousness hypothesis is highly speculative, not least since it challenges a widely held belief in quantum theory itself that whatever weirdness is going on sub-atomically mostly washes out or ‘decoheres’ above the molecular level.⁵ If that is right, then in *social* science we can act like the quantum revolution never happened, and continue to work within the classical worldview⁶ we inherited from physics in the 19th century.

This skepticism is borne out in the other contributors to this symposium, who while intellectually very diverse all have deep reservations about QMSS’ argument. So, let me, therefore, begin by first emphasizing how grateful I am to these critics in particular, all fellow IR scholars, who were willing to invest so much time trying to make sense of a difficult non-IR text that they mostly find in-credible. That is definitely beyond the call.

Still, as the new kid on the block I could have hoped for a more welcoming reception. Chernoff and Prozorov generously praise aspects of the book but both reject its main argument. For their part Hutchings, Kratochwil, and Kydd dispense with even ritual praise for 10 years of hard theoretical labor, and instead render harsh summary verdicts on QMSS, with Hutchings even suggesting it is ‘dangerous’.⁷ The uniform resistance and even hostility of such diverse responses is striking and suggests that perhaps Hutchings is right (if not as intended), that quantum social science is subversive of all orthodoxies, positivist and interpretivist alike. Which would stand to reason, since that is what quantum theory has done in every field it has entered, so why should IR be any different?

³I think only now do I understand what Badredine Arfi has been telling me for years: in the end it is all about quantum logic. See Pitowsky 1994 for a detailed yet accessible contrast of the two logics.

⁴See Wendt 2015, cited henceforth as QMSS.

⁵See Kuhlmann and Glennan 2014 and Waldner 2017.

⁶Usually understood as encompassing Newtonian mechanics and 19th century energy physics.

⁷Hutchings 2022, 184 however, the condescension and dismissiveness of Kydd’s 2022 essay is in a class by itself.

However, it could also be me (!), in that it may not always be quantum social science *per se* to which critics are objecting, but the ‘interpretation’ of it in QMASS, which is rooted in my interest in consciousness and scientific realism. There are of course also a number of interpretations of quantum theory in physics itself, and given the much more heterogeneous starting points and thematic concerns of social scientists, if quantum theory spreads among us then the potential for ‘interpretations’ to proliferate further seems high indeed. Thus, it is important to emphasize up front that QMASS is just one particular reading of the idea of a quantum social science, with its own potentials and problems like any other. Someone coming to the idea from the more post-structural starting point of Karen Barad’s magisterial *Meeting the Universe Halfway*, for example, would see many resonances with QMASS, but also many differences.⁸ So, although perhaps difficult to do in practice, it seems important to distinguish criticisms of QMASS’ interpretation of quantum social science from criticisms of the larger idea.

Science is an epistemically conservative practice, so the burden of proof must ultimately be on claimants to new knowledge, and the more those claims deviate from what is considered established knowledge, the greater the burden. As Hume said about miracles, ‘extraordinary claims require extraordinary evidence’. In light of this, even playing defense against united critics attacking from all sides might seem hopeless, much less going on offense. On the contrary, although it is reasonable to put the burden of proof on new knowledge, it is reasonable also to expect our deference to old knowledge to be justified. To the degree that it is not – to the extent that The Orthodoxy Has No Clothes – the playing field may be more level than it appears.

That is what I propose to do here, in Part I of this paper, to call out the taken-for-granted assumption in the human sciences that, physically speaking, people and society are classical systems (since, I will argue, what else would they be if not quantum?). That will not in itself prove the opposite, quantum view, nor equalize the burden of proof. However, Kratochwil is right that I do want to *change* the burden, by making it fairer.⁹ I do so by highlighting two ‘uncomfortable facts’ about the classical orthodoxy. One is its failure to make any progress on explaining consciousness, which is the essence of human subjectivity and so-called ‘hard’ part of the mind-body problem. The other, more empirical problem is the failure is to explain the many deviations from classical rationality that psychologists have observed – and the early success of quantum decision theory (QDT) in doing so instead.

I call these facts ‘uncomfortable’ because they call into question what I take to be the underlying classical physical ontology of modern social science. As such they will still be there, generating doubts, even if we dismiss quantum social science out of hand (indeed, left only with classical thinking, the doubts will be even more pressing then). These facts, in other words, are among the reasons we are even here talking about a quantum social science. So on the principle that we should not reject new ideas before recalling the limits of the old they were introduced to solve, in Part I, I show that classical social science faces important burdens of proof of its own. Quantum social science is hard to believe, but when you really

⁸See Barad 2007.

⁹Kratochwil 2022, 171.

think about it, so is the alternative. Creating this doubt about the orthodoxy will prepare the ground in Part II, if not for going on offense, then at least for a mobile defense.

Consciousness and the CCP

The mind-body problem is about how to integrate our subjective, mental (and thus social) lives into an objective, scientific understanding of reality that respects the causal closure of physics (CCP).¹⁰ Subtleties aside, the CCP holds that everything in the universe is physical, and as such is constrained and enabled by the laws of physics. Although usually tacit, the CCP is almost universally accepted in other physical sciences today, and in my view it is implicit throughout the social sciences as well. If you doubt it, consider submitting an article to a social science journal in which God or the Devil figure as a causal mechanism in your argument. I suspect your paper would be desk rejected not for lack of adequate (i.e. *physical!*) evidence, but because it would be considered *unscientific a priori*, and so they would not even consider whatever evidence you offered. The ‘methodological atheism’ to which I think all social scientists implicitly subscribe today is rooted in the CCP, which helps define the outer limits of ‘science’ for all of us.¹¹

Nevertheless, as we will see in Part II, not everyone accepts the CCP, especially among interpretivists. Usually, this is based on worries that the CCP will abet physics imperialism and thus put real social scientists out of work. I could not disagree more (after all, I would be out of business too!). Thus, it is important to emphasize here and again later that, despite being an ultimate ontological constraint, when it comes to epistemology the CCP does not imply other sciences are reducible to or ‘nothing but’ physics, in the sense that we could replace their qualitative descriptions with equations from physics *without loss of understanding*. Quite the contrary. Without the discourse of social theory and everyday life to make sense of them, physicists’ equations about human behavior would be completely meaningless. So, epistemically at least, the objective, physical story depends on the subjective/inter-subjective one, and as such the latter will remain irreducible and essential to social inquiry. What the CCP does require, however, is that even those subjective descriptions themselves be instantiated in the physical world, and thus have a *correlated* physical description. I return to these issues in Part II.

The constraints of the CCP have naturally evolved over time with our best physics, which today is considered to be quantum field theory. However, with the mind-body problem philosophers routinely default to a 19th century, *classical* CCP, where the sources of consciousness have to be purely material. Notice the crucial but implicit assumptions being made in this default: that consciousness has a macro-(classical) level explanation, and therefore that the intentional objects in our minds should observe the same physical and logical principles as the material objects in our environment. From a quantum perspective, on the contrary, not only does that beg key questions that should be left open, but it also helps create

¹⁰On the CCP see QMASS, 7–11.

¹¹See Porpora 2006 for a fascinating discussion of what a challenge to methodological atheism might look like.

the mind-body ‘problem’ in the first place. Although some aspects of the mind lend themselves to classical explanation, materialists seem to have made no progress at all understanding consciousness itself. By that term philosophers do not mean Kydd’s ‘mental models’, which are more like computer software. Rather, consciousness refers to the *feeling* or *subjective experience* that accompanies the operation of that software (95% of which is unconscious).¹² The mind-body ‘problem’ is that there is an ‘explanatory gap’ between the objective descriptions of the brain provided by classical materialist neuroscience and ultimately physics, and the subjective experience of being inside a brain. Since Kydd (pp. 134–5) suggests that I am alone in thinking this gap is a problem, consider my favorite assessment of their field by a prominent philosopher of mind, Jerry Fodor:

Nobody has the slightest idea how anything material could be conscious. Nobody even knows what it would be like to have the slightest idea about how anything material could be conscious. So much for the philosophy of consciousness.¹³

Nor are philosophers of mind alone. Across the sciences and humanities, the origin and nature of consciousness is widely seen as one of the deepest mysteries facing the modern scientific worldview.

Compare that with the breezy confidence of Chernoff, Kratochwil, and Kydd that classical materialists will eventually solve the problem. Indeed, Kydd makes short work of it himself, suggesting that the evolution of consciousness will be favored by natural selection because of its survival value.¹⁴ By chance, this is a distinguished line of argument going back to William James. The problem is that there are equally distinguished *materialist* arguments against it, which center on the problem of mental causation and epiphenomenalism.¹⁵ To have adaptive value in evolution consciousness must have the power to do or cause something in the world. Yet, if its explanation is purely material, as a classical CCP requires, then what more is there for consciousness to do that the neural processes accounting for it have not done already? (It’s not called ‘causal closure’ for nothing!). The experiential aspect seems epiphenomenal, and thus has no reason to evolve. In this way, the evolutionary approach to consciousness is widely thought even among materialists to beg the question.

So will future classical neuroscience and materialist philosophy of mind eventually explain consciousness? Perhaps, but Fodor’s assessment suggests that is a big leap of faith,¹⁶ one which even some materialists lately are having trouble making, albeit in a revealing way. Conceding their failure to explain consciousness, they have concluded not that their classical starting point is wrong, but that what they are trying to explain – consciousness – is ‘wrong’, in the sense of actually being an

¹²Note that this definition does not imply *self*-consciousness, like that of humans. Consciousness in my view is present in even the most primitive life forms. ¹³The reference is in QMASS, 17.

¹⁴See Kydd 2022, 135–6.

¹⁵See Lindahl 1997 and Robinson 2007 for discussions on this theme.

¹⁶Since Kydd sees my worldview as essentially theological (I would give him more romantic) it is worth noting that many philosophers have commented on the role of faith in also sustaining *materialism*; see QMASS, 18, fn 68.

*illusion.*¹⁷ Even assuming that ‘illusionism’ about consciousness (and for good measure free will) is not a performative contradiction, I cannot bring myself to believe it, and I bet most of you cannot either. If denying the existence of consciousness is where materialism ends, then it seems time to admit defeat. For what else would ‘falsify’ materialism?

Illusionism is a symptom of a deep intellectual crisis in the modern scientific worldview. But, it is also a practical problem for social scientists, who are trying to explain why our ‘objects’ (sic), most of which are invisible, shared mental phenomena like states, behave (sic) as they do. If these objects are not just fictions, which is widely accepted, but actually illusions, then what really are we doing? Regardless, my critics’ indifference to the mind-body problem ignores one of the main sources of discomfort that led me to write *QMASS*: that without consciousness in its ontology, a classical social science would have to be a science of objects, not subjects, and thus hardly a *social* science at all.¹⁸

On the principle that desperate times call for desperate measures, enter the quantum consciousness hypothesis, which proposes that consciousness (defined as experience) is a function of non-trivial quantum processes in the brain, body, and beyond. One intuitive reason to consider such a view is that whatever is going on at the sub-atomic level, it is not material in anything like the ordinary sense. The quantum revolution long ago put paid to the world of tiny material objects that classical materialists assumed would provide a secure foundation for knowledge, including of consciousness. In its wake, quantum left an ontology of probabilistic wave functions, pure potentialities which are *physical* (because they are described by physics) *but not material*. This allows for a possibility that many have mooted and I embraced in *QMASS*, namely that consciousness emerges in the collapse or decoherence of wave functions, which transforms potentialities into actualities (particles). That would mean that ‘physical’ processes at the elementary level of reality have an irreducibly mental aspect (panpsychism, not materialism), which then scales up to the human level. If correct, then quantum theory – usually seen as the ultimate physical science – would be a *human science* too.¹⁹

So is quantum consciousness theory a ‘fringe’ theory, as Kydd says by way of dismissal? Of course it is! Given the dead end that materialism has come to, where else shall we turn? These days, if your theory of consciousness is not fringe, then it seems hard to take seriously (illusionism at least passes that test!). Indeed, in 2019 two prominent physicists, Nicole Yunger Halpern (Harvard) and Elizabeth Crosson (Cal Tech), published ‘Quantum information in the Posner model of quantum cognition’ in the *Annals of Physics*.²⁰ Here, for 55 pages of physics, they address critically but sympathetically a recent hypothesis about how quantum cognition might be realized in the brain (one different, incidentally, from Hameroff and Penrose’s discussed in *QMASS*). So is that fringe – or cutting edge? Their article is certainly speculative, but I challenge anyone to read it and conclude that it is not

¹⁷See Frankish 2016 for a more recent synthesis.

¹⁸See Wendt 2018 for further discussion of the mind-body problem in social science.

¹⁹See Der Derian and Wendt 2022a, 2022b.

²⁰See Halpern and Crosson 2019. Note that they are talking about quantum cognition, not consciousness, but without the former there is no latter; also see Gambini and Pullin 2019.

serious. Or if that is your conclusion, then give us a classical theory of consciousness better than the many that have come and gone before. Good luck with that.

Quantum decision theory

Although Halpern and Crosson and others have much to say on a theoretical level, at this stage we are unable to directly test empirically any quantum models of the brain, since the hypothesized mechanisms are too small and subtle for current technology to see. Fortunately, however, such models do have a clear *behavioral* implication that we can test at the level of whole human beings, and thus *indirectly* test the idea. Namely, if our brains are quantum, then our behavior should obey the principles of quantum logic and quantum probability theory, not their classical counterparts.

That is the second ‘uncomfortable fact’ for classical social science: strong and growing experimental evidence that QDT can account for systematically observed deviations from the predictions of standard decision theory, the axiomatic structure of which is classical. What are sometimes called the ‘Kahneman–Tversky anomalies’ – framing and order effects in survey research, preference reversals, several violations in probability judgment, and many others – have proven very robust in experiments and led to much hand wringing about whether human beings are fundamentally non-rational. Although well-established as empirical generalizations, however, we have lacked an axiomatically well-founded theory that predicts such behavior – ideally all of it. That is what Diederik Aerts, Jerome Busemeyer, Jennifer Trueblood, Joyce Wang, and others have now mostly completed, achieving a unified resolution of anomalies that, to my knowledge, is unprecedented in the social sciences.²¹ Does this substantial and highly technical body of work satisfy Kydd’s demand for a ‘direct test’ of QDT? (Note that CDT *has already failed its test*.) I do not know, but the mathematical psychologists and quantum physicists who do this stuff for a living are clearly working on it.²² And with little opposition. With several hundred(?) articles and books on quantum cognition so far, I am aware of only one detailed critique.²³

In the meantime, there is a larger question at stake, which is why does QDT resolve classical anomalies, if not because we *really are* quantum rather than classical beings? To be clear, as Kydd (and I) note, quantum decision theorists have distanced themselves from this controversial claim, describing their findings instead as ‘quantum-*like*’. As empiricists their primary interest is simply to show that their mathematical framework predicts human behavior better than classical alternatives – and for that they do not need to pick a fight about the ontology of consciousness. However, do they ‘explicitly deny’, by which I assume he means *reject*, quantum consciousness theory?²⁴ As far as I know not in print, nor in my experience talking with them. Some are truly agnostic, while others think human beings are probably quantum, but we do not have enough evidence yet to say. However, most seem to *hope*

²¹See, especially, Busemeyer and Bruza 2012, and for a brief overview, QMASS, Ch. 8.

²²See for example Kvam, Busemeyer and Pleskac 2021, which quantum cognition scientists themselves have hailed as a major successful test.

²³See Boyer-Kassem *et al.* 2016; also see the short, open peer commentaries on Pothos and Busemeyer 2013.

²⁴Kydd 2022, 136.

their work might support such a revolutionary conclusion, and indeed if their findings hold up, it would seem the obvious inference.²⁵ For if we are really *classical* beings, then why do we exhibit systematically quantum behavior? Seems like the commanding heights held by the rationalist orthodoxy have already been captured, but word is only just now reaching the outside world.

That is evident in the pallid response to QDT from the other contributors to this symposium. Only Hutchings and Kydd mention it, and neither comes to grips with the profound challenge it poses to the most mathematically rigorous theory we have in social science. Rather than address whether people really are quantum beings, Hutchings asks why we would want to know that. That is an interesting question too (see Part II), but it dodges the first one. Kydd speaks to QDT more directly, and I agree with him that, ‘when it comes to inorganic macroscopic phenomena, classical probability theory is right’.²⁶ However, that was never in doubt, since quantum probability theory recovers classical at the limit in any case.

The real issue concerns subjective phenomena, where Kydd claims (p. 137) that QDT suggests that people have no social attitudes at all when no one is asking. This reflects a basic misunderstanding of quantum ‘reality’. It is not that social attitudes (or any other mental state) do not exist *at all* except when being measured, but that they exist only in *superposition* in a wave function – a uniquely quantum physical state describing a structure of weighted potentials that are often empirically or logically contradictory. And in John Zaller’s work on public opinion or Paul Slovic’s on preference reversals,²⁷ among others, this is exactly what human scientists have found at the behavioral level. Under many conditions, people do not seem to have well-defined antecedent desires and beliefs, but only probabilistic ‘considerations’ (in Zaller’s terms) that are transformed into specific outcomes when measured (wave function collapse in mine). Note that this is not just a substantive challenge to the rationalist model of man like his old rival, *homo sociologicus*, but an epistemological challenge to the very idea of what it means to think rationally at all.

That said, QDT is not about to take over social science – natural scientific conservatism and bitter enders like Kydd will see to that, not to mention simple lack of awareness. In an otherwise excellent review of recent behavioral scholarship in IR, for example, James Davis and Rose McDermott lament the persistence of the Kahneman–Tversky anomalies, but make no mention of QDT or its success in resolving them.²⁸ Plus, at this stage even its proponents disagree about whether human beings really are quantum. I obviously have my view, but who knows? We have no reliable ‘priors’ for a meaningful assessment – but that is precisely the point. We cannot do social science without an at least implicit model of the mind, but we cannot know which model is right until we better understand consciousness.

First conclusion

This puts social scientists in an awkward position. Normally the burden of proof is squarely on new knowledge, with mainstream opinion a safe default. In IR today,

²⁵ Although see Waldner’s 2017 interesting take, on the one hand rejecting quantum consciousness, but on the other thinking that bringing QDT into social science could be revolutionary.

²⁶ See Kydd 2022, 138.

²⁷ See Zaller 1992 and Slovic 1995.

²⁸ See Davis and McDermott 2021.

this would make rationalist theorizing (our most explicit model of classical thinking) the baseline, which quantum theorizing would have to go beyond empirically and theoretically in something like a Lakatosian sense. However, this is not a normal situation of theory choice, because as we have seen both on a philosophical and an empirical level classical thinking faces challenges of its own, so much so that even many of its proponents think it is in crisis. Does that mean that burdens of proof are now equal? No, since it is still early days, and outside psychology quantum social science is barely known. But, the shakiness of the orthodoxy's foundations suggests that, on a deep level, it too is speculative. In that case, right now it is less about finding a firm baseline than just paying your money and taking your choice.

But is a choice really necessary? What about 'analytical eclecticism' and other forms of pragmatism, which urge us not to get hung up on ontological or epistemological issues, much less in physics, and instead combine substantive local knowledge from a variety of approaches as befits the question at hand?²⁹

I am sympathetic to the inclusive spirit of such an approach, and if quantum theory were adopted in social science, I believe that, as a universal language, it would eventually similarly break down walls between 'paradigms'. However, although quantum theory subsumes classical at the limit, there is no escaping a deep difference in practice, rooted in assumptions about logic and reality itself, between the two kinds of thinking: one is binary and local, the other is multivalent and non-local. And if the experience of physicists is any guide, this difference will deeply affect how we understand key concepts in social scientists' toolkit, like probability, theory, causation, explanation, agents, structures, rationality, and many others. So, at least in the case of classical vs. quantum thinking, it seems the only way to be eclectic about them would be to leave their conflicting ontologies implicit in our work, as they are today, which invites confusion and/or vague theorizing. And given the total hegemony of the classical worldview in mainstream social science, this also means that if we do not argue explicitly for a quantum approach then we get classical by default.

One reason we default to classical thinking is that is how most social scientists were trained in their methods courses, if not before. Interpretivists are less likely to default to classical thinking,³⁰ and indeed have a strong case to have been implicitly doing 'quantum social science' (sic) all along, *avant la lettre* (see Part II).³¹ However, although they have sometimes inveighed against Newtonian, 'billiard ball' models of international politics, until the recent relationalist and New Materialist 'turns' in IR, to my knowledge little interpretivist work has addressed explicitly the *physical* basis of world politics, and even the latest Turns have not done so in terms of physics. To me that suggests classical thinking may be more deeply ingrained than we realize, for that is all we have ever been taught, without even it being acknowledged as such. And with that deep familiarity comes a level of

²⁹ See, especially, Sil and Katzenstein 2010.

³⁰ Although they too have been taught 'logic' and 'probability theory' (sic), so which kind would they choose if their work suddenly required it?

³¹ This seems especially true of feminist scholarship, with its more resolute focus on experience (consciousness in my terms) *vv.* discourse.

comfort not only with classical thinking, but also a comfort with its *problems*, like the mind-body problem, which we have collectively learned to ignore.

So, my calling attention to ‘uncomfortable facts’ is partly an effort to re-balance burdens of proof in a debate between classical and quantum ways of analyzing social and international life. But, the larger call is just to take these facts seriously, rather than simply work around them as we have learned to do. The choice here therefore is not between a wildly speculative quantum social theory and (classical) business as usual, because the latter’s problems are becoming more evident every day and will not disappear with the next turn of the IR screw. What is needed is to confront the question directly, and really for the first time, of what ‘the’ CCP means for social science and IR. We all have to answer this question every day in our own work anyway, because we cannot think without logic and there are two logics from which to choose. We may as well make the choice at least once in a theoretically self-conscious way.³²

So, why should IR scholars read this symposium? Well, not because they are *IR* scholars, since there is nothing special about the implications of quantum theory for the study of international politics as opposed to any other social phenomena. But as it slowly begins to enter IR,³³ quantum theorizing could change how we think about thinking in the same ways it has changed thinking everywhere it has gone, starting with the agonizing, mind-bending process that physicists went through over a century ago. Which is to say, IR scholars should read this symposium because they are social scientists, who deal with issues that would be affected profoundly by a quantum revolution in our field. In light of that, there is no more reason to publish this discussion in *IT* than any other theoretically oriented social science journal; but no less either.

Acknowledgement. I am grateful to Duncan Snidal for detailed comments on the first draft of this paper too many years ago, to Stefano Guzzini for several long exchanges in the interim trying to help me understand, and to a rotating brain trust of graduate students for ongoing support and critical discussion.

References

- Barad, Karen. 2007. *Meeting the Universe Halfway: Quantum Physics and the Entanglement of Matter and Meaning*. Durham, N.C.: Duke University Press.
- Boyer-Kassem, Thomas, Sébastien Duchêne, and Eric Guerci. 2016. “Quantum-Like Models Cannot Account for the Conjunction Fallacy.” *Theory and Decision* 81 (4): 479–510.
- Busemeyer, Jerome, and Peter Bruza. 2012. *Quantum Models of Cognition and Decision*. Cambridge: Cambridge University Press.
- Davis, James, and Rose McDermott. 2021. “The Past, Present and Future of Behavioral IR.” *International Organization* 75 (1): 147–77.
- Der Derian, James, and Alexander Wendt. 2020. “‘Quantizing International Relations’: The Case for Quantum Approaches to International Theory and Security Practice.” *Security Dialogue* 51 (5): 399–413.
- Der Derian, James, and Alexander Wendt. 2022a. “Quantum Theory: The Case for a New Human Science of International Relations.” In *Quantum International Relations: A Human Science of World Politics*, edited by James Der Derian and Alexander Wendt. Oxford: Oxford University Press, forthcoming.

³²On this point more generally, see, Lauer 2019.

³³See – among others – the forum on QMASS in *Millennium* in 2018; Zanotti 2018, Fierke 2019, a special issue of *Security Dialogue* on quantum approaches to IR (see Der Derian and Wendt 2020), Murphy 2020, Pan 2018; 2020, Der Derian and Wendt 2022b, and of course this symposium.

- Der Derian, James and Alexander Wendt, eds. 2022b. *Quantum International Relations: A Human Science of World Politics*. Oxford: Oxford University Press, forthcoming.
- Fierke, Karin M. 2019. "Contraria sunt Complementa: Global Entanglement and the Constitution of Difference." *International Studies Review* 21 (1): 146–69.
- Frankish, Keith. 2016. "Illusionism as a Theory of Consciousness." *Journal of Consciousness Studies* 23 (11–12): 11–39.
- Gambini, Rodolfo, and Jorge Pullin. 2019. "Physical Requirements for Models of Consciousness." *Mind and Matter* 17 (2): 129–53.
- Halpern, Nicole Yunger, and Elizabeth Crosson. 2019. "Quantum Information in the Posner Model of Quantum Cognition." *Annals of Physics* 407 (August): 92–147.
- Hutchings, Kimberly. 2022. "Empire and Insurgency: The Politics of Truth in Alexander Wendt's *Quantum Mind and Social Science: Unifying Physical and Social Ontology*." *International Theory* 14 (1): 183–92.
- Kratochwil, Friedrich. 2022. "The Strange Fate of the Morphed 'Rump Materialism': A Comment on the Vagaries of Social Science as Seen Through Alexander Wendt's *Quantum Mind and Social Science*." *International Theory* 14 (1): 169–82.
- Kuhlmann, Meinard, and Stuart Glennan. 2014. "On the Relations Between Quantum Mechanical and Neo-Mechanistic Ontologies and Explanatory Strategies." *European Journal for the Philosophy of Science* 4: 337–59.
- Kvam, Peter, Jerome Busemeyer, and Timothy Pleskac. 2021. "Temporal Oscillations in Preference Strength Provide Evidence for an Open System Model of Constructed Preference." *Scientific Reports* 11 (1): 8169.
- Kydd, Andrew. 2022. "Our Place in the Universe: Alexander Wendt and Quantum Mechanics." *International Theory* 14 (1): 130–45.
- Lauer, Richard. 2019. "Is Social Ontology Prior to Social Scientific Methodology?" *Philosophy of the Social Sciences* 49 (3): 171–89.
- Lindahl, B. 1997. "Consciousness and Biological Evolution." *Journal of Theoretical Biology* 187 (4): 613–29.
- Murphy, Michael. 2020. *Quantum Social Theory for Critical International Relations Theorists: Quantizing Critique*. London: Palgrave.
- Pan, Chengxin. 2018. "Toward a New Relational Ontology in Global Politics: China's Rise as Holographic Transition." *International Relations of the Asia-Pacific* 18 (3): 339–67.
- Pan, Chengxin. 2020. "Enfolding Wholes in Parts: Quantum Holography and International Relations." *European Journal of International Relations* 26 (Suppl. 1): 14–38.
- Pitowsky, Itamar. 1994. "George Boole's 'Conditions of Possible Experience' and the Quantum Puzzle." *British Journal for the Philosophy of Science* 45 (1): 95–125.
- Porpora, Douglas. 2006. "Methodological Atheism, Methodological Agnosticism and Religious Experience." *Journal for the Theory of Social Behaviour* 36 (1): 57–75.
- Pothos, Emmanuel, and Jerome Busemeyer. 2013. "Can Quantum Probability Provide a New Direction for Cognitive Modeling?" *Behavioral and Brain Sciences* 36 (3): 255–327.
- Robinson, William. 2007. "Evolution and Epiphenomenalism." *Journal of Consciousness Studies* 14 (11): 27–42.
- Sil, Rudra, and Peter Katzenstein. 2010. "Analytical Eclecticism in the Study of World Politics." *Perspectives on Politics* 8 (2): 411–31.
- Slovic, Paul. 1995. "The Construction of Preference." *American Psychologist* 50 (5): 364–71.
- Smith, Frank. 2020. "Quantum Technology Hype and National Security." *Security Dialogue* 51 (5): 499–517.
- Waldner, David. 2017. "Schrödinger's Cat and the Dog that Didn't Bark: Why Quantum Mechanics is (Probably) Irrelevant to the Social Sciences." *Critical Review: Unifying Physical and Social Ontology* 29 (2): 199–233.
- Wendt, Alexander. 2015. *Quantum Mind and Social Science*. Cambridge: Cambridge University Press.
- Wendt, Alexander. 2018. "The Mind-Body Problem and Social Science: Motivating a Quantum Social Theory." *Journal for the Theory of Social Behaviour* 48 (2): 188–204.
- Zaller, John. 1992. *The Nature and Origins of Mass Opinion*. Cambridge: Cambridge University Press.
- Zanotti, Laura. 2018. *Ontological Entanglements, Agency and Ethics in International Relations*. London: Routledge.

Cite this article: Wendt, A. 2022. "Why IR scholars should care about quantum theory, part I: burdens of proof and uncomfortable facts." *International Theory* 14 (1), 119–129, doi:10.1017/S175297192100004X