Indeterminate Innovation

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One of my pet peeves when watching televised sports is when the commentators declare that one or another player or team "has momentum" or that "the momentum has shifted." Typically, this statement is made shortly after a team or player does something that puts them in a better position to win the game, and the implication seems to be that this change in momentum will carry someone to victory. But there are at least two problems with this all-too-typical sportscaster pronouncement. One is that "momentum" is a mathematically well-defined notion in physics, where it means the mass of an object multiplied by its velocity; linear momentum is also a vector quantity, and has both a magnitude and a direction. It is this complexity that allows momentum and changes in momentum—in conjunction with an account of the various forces at work on the object—to explain the object's trajectory. A well-kicked football has momentum in the physics sense, but it is quite unclear how the "momentum" of a player or a team might be calculated, to say nothing of the various forces at work on the player or team's movement through the playing of a game. Hence both the *determination* of a player or team's "momentum," *and* the use of that "momentum" in explaining or predicting the outcome of a game, necessarily remain at the level of metaphor.

But this is not the only problem with "momentum" in the sports context. After all, we regularly translate and adapt notions and concepts from different domains, both as scholars of international affairs and just as ordinary people, and words can easily have somewhat different meanings in different contexts. And the issue isn't just that "momentum" has a precise definition in its source domain (physics) but a rather vaguer one in the target domain (sports commentary); "ecosystem" and "ecology" have pretty precise definitions in a biological context, but we use them in other contexts without much difficulty (for example, Charles Tilly, "Social Boundary Mechanisms," *Philosophy of the Social Sciences* 34[2]: 211–36, 2004). Instead, the problem is that concepts come with baggage, and the specific baggage that "momentum" brings is quite problematic. An object's momentum explains its trajectory not as a result of moment-to-moment (or play-by-play) effort, but as a consequence of an inherent physical directedness. How a baseball is hit—a change which affects its momentum—explains whether the ball is a line drive or a home run or a lazy fly ball, but to attribute, say, Aaron Judge's success in hitting home runs during the 2022 baseball season to some inherent physical directedness of *his* as he passed through the season and broke Roger Maris' single-season record downplays Judge's continual effort in each at-bat.

My skepticism about "momentum" in sports commentary parallels my skepticism about efforts to bring the language of quantum physics into international studies. Two charges might be leveled at any such effort: that the physical-science-derived language is just a metaphor, and that importing concepts from physics in particular is inherently problematic. The editors of *Quantum International Relations: A Human Science for World Politics*, James Der Derian and Alexander Wendt, are quite aware of both of these charges, and have assembled an impressive line-up of contributors to address them en route to finding "a better mode of comprehending world politics in transformation" (p. 5). They suggest that "the superior heuristics of quantum theory to understand quantum-like phenomena" are especially apt for a world in which "observational practices and visual imagery transmitted in near simultaneity through densely networked systems of multiple media produce powerful superpositional ***e***ffects as well as entangled ***a***ffects" (p. 8, emphasis original). There is no single argument on offer here; instead there are a variety of explorations of quantum international

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relations (QIR hereafter), ranging from ambitiously speculative to highly concrete. Different chapters in the volume address the conceptual underpinnings of a quantum approach (Part 1); the potential impact of quantum technologies—especially quantum computing—on international affairs (Part 2); parallels between quantum theory (defined by the editors as the conceptual apparatus at work in quantum physics) and a variety of broadly critical approaches in international studies (Part 3); and the implications of quantum theory for how we understand consciousness, traumatic memory, and ethics (Part 4).

I could discuss each of these chapters individually, as they all provide rich food for thought. But instead I want to focus here on the overall project of QIR, and whether the volume as a whole succeeds in advancing that project by providing compelling answers to the two charges mentioned earlier. Each of the charges might be answered in different ways, and the volume as a whole does not provide a single uniform answer to either charge. On the question of whether the application of quantum-mechanical notions like entanglement and uncertainty are just metaphors or something else, some authors explicitly argue that their use of these notions is more than just metaphorical, while others bracket the question in favor of a focus on whether the notions—metaphorical or otherwise—do interesting and productive work in international studies. On the question of borrowing from physics, some authors argue that the dangers of such borrowing have been overstated, while others make the strong ontological claim that any coherent social science *must* be founded on physical science. While I am not sure that any of the answers on offer here are so compelling as to silence all of the skeptics of the QIR project, the volume remains extremely significant in assembling many of the best efforts to answer the charges adduced here.

The question of whether the application of quantum-theoretical notions to the study of international affairs is something more than metaphorical—in the editors' terms, whether the elaboration of quantum theory in international studies paves the way for a quantum science of international affairs (p. 14)—is especially difficult because, as physicist Michael Schnabel reminds us, quantum notions are "mathematically relatively easy to conceptualize, but hard to do so in words" (p. 89). Badredine Arfi agrees: "Whoever says 'quantum' says a certain type of mathematical framework," and the choice of framework requires theorization (p. 236). This would suggest that any more-than-metaphorical elaboration of QIR would have to be mathematical. But with the exception of David Orrell's use of the mathematical methods utilized in quantum physics (especially apt because they incorporate the notion of negative probability) to reconceive of money "as exhibiting its own version of quantum properties" (p. 302), the contributors to the volume—like the vast majority of QIR aficionados—do not make use of such quantum-mechanical formalisms. Instead, those claiming to be doing something more than metaphorical base their claims on the *reality* of quantum effects. Jayson Waters observes that according to quantum physics, "we have always lived in a quantum world," even though much quantum weirdness washes out at the macroscopic scale because of decoherence, and as such, "to 'quantize' IR is merely to attempt to better understand our world and ourselves in line with our best physical theories" (p. 64). Karen O'Brien and Manjana Milkoreit concur, basing their account of social change on the claim that "the concept of entanglement is not only a metaphor, but a reality," and as such, "individuals and collectives entangled through language and shared meaning" can shape political futures in ways that go beyond typical notions of interest aggregation (pp. 137-138).

The punchline concerning the call for mathematical elaborations of QIR is that we don't yet have a sufficiently robust formal framework to allow for the kinds of calculations that are common in quantum mechanics when applied to physical phenomena, but the authors in the volume taking this tack are optimistic about the possibility. By contrast, the non-mathematical elaborations of QIR rest their confidence on something like a scientific realist wager: if a theoretical notion is explanatorily useful, then it must be somehow in touch with an intransitively real feature of the world. For scientific realists, existing theories are *transitive* in that they point to the real world, and their value as theories depends on the ways that they hook into *intransitive* features of that world (as Roy Bhaskar argued in his 1975 book *A Realist Theory of Science*). This is not to say that a theory can ever finally or exhaustively capture the intransitive aspects of the real world; the transitive aspects of theories can change, but the intransitive truths that they contain are conserved when this happens, even if they are expressed in novel theoretical language (on scientific and critical realism in IR, see, *inter alia*, Jackson, 2016, *The Conduct of Inquiry in International Relations*, 2nd ed., Chap. 4).

This shades into the question of precisely what useful explanatory work quantum notions like "entanglement" and "superposition" actually do when applied to the study of international affairs. Most of the authors in the volume seeking to answer this question do so in a way that, ironically, *diminishes* the potential contribution of QIR by underscoring the ways that quantum notions parallel already-existing theoretical notions in international studies. Michael Murphy argues that "the vocabulary of quantum physics … can complement the conceptual tools already at work in critical IR" (p. 252), but this makes it unclear what—beyond a language derived from physics—QIR gives us that isn't already present in, say, feminist and poststructural international theory. Murphy goes on to highlight "fundamental relationality" as a key quantum insight that can displace our intuitive individualism—"we

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are not separate entities coming into relation, but our relations are always already there and experience can only occur within our entangled system" (p. 256)—but this sort of relationalism, even in academic international studies, pre-dates QIR by some decades, something that we should not forget. (On the forgetting of feminist relationalism, see V. Spike Peterson, "Transgressing Boundaries: Theories of Knowledge, Gender and International Relations," *Millennium* 21[2]: 183–206 [1992], and Marysia Zalewski, "Forget(Ting) Feminism? Investigating Relationality in International Relations," *Cambridge Review of International Affairs* 32[5]: 615–35 [2019]. Important examples of the relationality of poststructural international theory include Richard Ashley, "The Poverty of Neorealism," *International Organization* 38[2]: 225–86 [1984], and R.B.J. Walker, *Inside/Outside: International Relations as Political Theory* [1993]).

Along similar lines, Thomas Biersteker notes that a dialectical approach to international theorizing is "like quantum" in being "situated in sharp contrast to conventional approaches and methods" in canonical U.S.-centric IR, and that dialectical theorizing and pedagogy contains analogues for key quantum notions. But this would seem to be an argument in favor of these notions *however* derived, rather than an argument for QIR. And when Matthias Albert and Felix Bathon highlight the "recursive" character of both modern systems theory and quantum theory—in virtue of including the observer in the act of observation, "*both* are about the world in a necessarily contingent and open sense"(p. 292), this too would seem to be an argument in favor of recursive theory and not QIR in particular.

To really establish that QIR gives us novel, and in some way *better*, ways of explaining and understanding the world, one would need to show that quantum notions do something significantly different to our scholarly explanations when integrated into our theoretical toolkit. The case for QIR really needs both of these warrants, lest language derived from quantum physics becomes nothing more than just another way of saying what we could already say, using the theoretical and conceptual tools that we already had. That case is unfortunately not made decisively in the volume, in my view. The three chapters on quantum technology distance themselves from a quantum *approach* to international affairs (most explicitly, Frank L. Smith III, on p. 173) in order to explore the potential effects—understood in very conventional IR terms—of innovations in quantum computing. For all three of these chapters, what is novel about quantum technology is not that it is quantum, but that it is new technology; Shohini Ghose likens it to the technological impacts and spin-offs of the effort to land human beings on the moon (p. 125). Jon Lindsay characterizes quantum computing as a phantom menace, pointing out that "classical societies implement quantum computers" and that the patterns and dynamics of such societies "will tend to overwhelm the potential of quantum science at the microscale" (p. 165). All three of these contributors suggest—contrary to the strong claims of QIR—that we do *not* need to rethink how we do social science in order to account for the impacts of quantum technology.

Two of the volume's most intriguing empirical chapters also do not sufficiently demonstrate that QIR can provide novel insights that cannot be reached in other ways. QIR certainly questions notions like the strict observer/observed distinction characteristic of neopositivist scholarship, and suggests connection rather than separation as the fundamental point of departure, but it is far from the first or the only theoretical initiative to do so. Mark Salter's fascinating account of the differences between, and the engagements between, Inuit and *qallunaat* notions of justice and sovereignty does a very effective job of illustrating the simultaneous presence in international affairs of multiple social arrangements and the ambiguities that such situations generate. Salter identifies *qallunaat* as "the Inuktitut word for white people" (p. 277), and uses it throughout the chapter when referring to Canadian legal practice. This is an elegant way of distancing and defamiliarizing what we might otherwise think of as simply how sovereignty and law per se work. But it is not clear to me what calling the co-presence of Inuit and *qallunaat* notions "the superpositionality of sovereignty" does except to put old wine in shiny new bottles. Likewise, K.M. Fierke and Nicola Mackay put forth some radical-sounding claims about the "entanglement" of the past and the present, but studies in the politics of historical memory have long highlighted temporal oddities, such that the past is sometimes more present than the present (for example, see the chapters in Duncan Bell [ed.], *Memory, Trauma and World Politics* [2006]). Here again it is unclear what distinct novel insight or explanatory value quantum-theoretical notions and language bring to the account. For example, Fierke and Mackay speculate that their "U.S. Politics of Hate" study might have been related to the "increased ability to see slavery" in the United States after the far right demonstrations in Charlottesville in 2017 a few months later than their study (p. 356), but to me it seems far more plausible that both the responses of the participants in the study and the response of the news media after Charlottesville were products of a slow rethinking of the role of racial hierarchy in U.S. politics and society that has been going on for decades, and reached a new pitch with the election of Barack Obama to the U.S. presidency—and the subsequent backlash that gave us his successor in that office.

Now, if one is convinced that no social science is complete or coherent without a basis in physical science, then the value of notions that are derived from quantum physics is obvious: because the current state of the art in physical science is quantum mechanics, social scientists are

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fundamentally hampered by having an account of social reality that is anchored in classical (or "Newtonian") physics. Early on in the QIR movement, Alexander Wendt—one of the volume's co-editors—argued that a key limitation of classical physics was that it had no room for consciousness, and that this was a problem insofar as all of our social theories presumed conscious actors. (I discuss this claim at greater length, and somewhat critically, in Jackson, "Fundamental Grounding," *Perspectives on Politics* 14[4]: 1153–57 [2016].) Quantum physics features a different role for observation and the observer than we find in classical physics, and this opens the door for understanding consciousness in quantum terms—as long as the problem of decoherence can be somehow solved. Decoherence refers to the tendency of an entangled quantum system to fall apart into more or less classical components under conditions much less like the inside of specialized laboratories and much more like our average ordinary world. In one chapter in the volume, Ghose points out that at the moment, preventing a qubit from decohering—a fundamental prerequisite for quantum computing—"requires a room full of cooling and control equipment" to keep the qubits "at temperatures colder than outer space" (p. 122). At the very least, the jury remains out on how decoherence might be prevented in warm, wet brains.

Assuming that this problem can be solved, Leonardo Orlando argues that quantum theory allows researchers to take introspection seriously as a way of gathering data about decision-making, calling this "the ontological condition of possibility for a *proper* understanding of the connection between consciousness and physical states, meaning between mental processes and agency" (p. 332, emphasis added). The value here lies in having an account of social life that is consistent with, even grounded in, physics; that is what Orlando means by a "proper" account. But this begs the question of whether we *need* such a grounding in the first place, and indeed, whether the "micro-phenomenological interview" techniques that Orlando recommends require a quantum-theoretical basis in order to bear fruit. The strongest claim that Orlando makes in this regard is that "the validity of first-person reports" is "epistemologically isomorphic" with "social research conducted within a quantum framework" (p. 336). But this still seems like a stretch, insofar as the role of the observer in quantum mechanics is not to introspect, and outcomes are produced not by states of mind, but by how the experimental apparatus is designed and operated.

A lot hinges in this analysis on the importance that one places on consistency and coherence between physical and social science. Jairus Grove is meticulous in showing that the founding figures of quantum physics drew on notions that came from beyond physics—"physics in no way has a monopoly over the seemingly key concepts of complementarity, entanglement, or even the wave particle duality," as these can all be found in social and philosophical thought at the same time as or even earlier than they became current in physics (p. 74), However, this does not in my view defuse the danger of *scientism* in our thinking about social life. The fact is that notions derived from the natural sciences, especially from physics, have a cultural and rhetorical currency and capacity that far outstrips any precise and measured use of those notions (recall the example of "momentum" in sports commentary with which I opened this review). Quantum theory is in this sense never an innocent importation, and despite Biersteker's blunt declaration that "we do not need the approval of physicists for our theoretical models and frameworks" (p. 212), many of us still proceed as though we did. That makes me nervous. Grove refers to the "quantum event," by which he means the disruption of substantialist assumptions across the intellectual landscape in the late nineteenth and early twentieth centuries, and the articulation of relational alternatives; he celebrates "how quantum research questioned commonsense understandings of even the most basic assumptions of reality," and made possible novel "speculative thinking" (p. 83). Perhaps it did and does, but as long as social theory and the social sciences outsource the right to say what the world "really is"—and how it *really* works—to the natural sciences rather than insisting on the distinctive value and insight of its own explorations, it will remain in thrall to a way of understanding the world that prioritizes disenchanted physicality over creative meaning-making.

Laura Zanotti's chapter on ethics in a quantum world illustrates both the pitfalls and the potential here (for a similar read of Zanotti's argument, see Laura Sjoberg, "Quantum Ambivalence," *Millennium* 49[1]: 126–39 [2020]). Zanotti argues that "quantum physics' ontological imaginary opens alternative possibilities for justifying agency, devising political change, and engaging in international intervention" insofar as it is founded on an embrace of uncertainty instead of looking for a transcendentally certain imperative (p. 361). Kantian notions of ethics, she points out, depend on understanding the natural world as governed by noncontingent rational laws; this gives rise to the demand for universality in ethical codes and "the excision of uncertainty" (p. 366). Because quantum theory gives us a different account of the natural world, it disrupts this Kantian edifice, in favor of a kind of ethics that involves prudently taking responsibility for "the material engagements that produce political effects … and for the consequences of our acts" (p. 376). But her argument makes the value of prudence in some way dependent on quantum theory being a correct account of the physical world, just as Kantian ethics were dependent on classical physics being a correct account of the world. If quantum theory is somehow

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replaced, logically, prudence would also have to be replaced (on these kinds of shifts between scientific worldviews and their consequences for political and social life, see Bentley B. Allen, *Scientific Cosmology and International Orders* [2018], and William Bain, *Political Theology of International Order,* [2020]).

"We have a duty to always assess the means to the end," Zanotti continues; it remains quite unclear where this "duty" comes from or what could ground it. An acknowledgment of a relational context need not, after all, lead to a responsible assessment of one's role in bringing about an outcome. It might just as easily lead to a decision to exploit those relational elements of the context to one's own advantage, a way of acting which John Shotter refers to as a "counterfeit" use of intrinsically shared social and cultural resources. Even if enforcement of the distinction between genuine and counterfeit uses is decentralized, there still has to be enforcement; a counterfeit use of resources is not *inherently* wrong, let alone unethical (see his *Conversational Realities: Constructing Life Through Language*, p. 138 [1993]). Turning to quantum theory might thus not resolve the problem that Zanotti identifies with Kantian ethics, but only postpone it by shifting from one physical basis to another, instead of dispensing with a physical basis altogether. Insofar as the modern natural sciences—including quantum physics—are what Max Weber called *disenchanted* ways of knowing (most famously in his lecture "Wissenschaft als Beruf," usually translated as "Science as a Vocation"), ontological claims about the character of physical reality simply do not have determinate ethical implications. Such sciences continue to promise, as a condition of their existence as such, a view of physical reality that is in important respects *meaningless*, and as such, incapable of serving as a ground for ethics.

In the end it is this question of a physical basis for social science that the QIR project has yet to adequately answer. Like "momentum" in sports commentary, the metaphorical use of language derived from the natural sciences (and especially from physics) conveys an aura of epistemic respectability. But this in turn is because we live in what the philosopher Charles Taylor has called a secular age, which is marked by the cultural prestige of the disenchanted natural sciences. Only within such an "immanent frame" (Taylor's term from *A Secular Age*, Chapter 15) is there value to the metaphorical recoding of existing insights into the social world by using language derived from physics. Absent this frame, a feeling that a game is going one way or the other is no more enhanced by calling it "momentum" than my thanking the various people who read and commented on earlier drafts of this review —Harry Gould, Sujin Heo, Laura Sjoberg, Samuel Barkin, Daniel Nexon, Swati Srivastava, and Daniel Levine—is enhanced by calling this set of social ties an "entanglement." And simply going along with the immanent frame prevents us from raising questions about the *value*, explanatory or ethical or whatever, of the frame itself, and of the situation of the social sciences with respect to it. Quantum theory might provide an opening for genuine innovation in international studies, but its future is as yet indeterminate: will it end up simply re-inscribing an updated naturalism that rules out the analytical autonomy of the social by presumptive fiat, or will it generate clearly novel insights into the operation of the social world? Will QIR complement existing lines of investigation and deepen them in appreciable and tangible ways, or will it simply work to subsume those established scholarly traditions under its own conceptual categories? QIR as a whole needs to reflect on these issues as it proceeds, especially if it has any hope of articulating what the volume editors call for: a genuinely *human* science.

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