Neuroscientific Inquiry and International Relations

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Social Neuroscientific Approaches to International Relations

Over the last few decades International Relations (IR) has increasingly imported insights from psychology into theory building. Following decades of separation of individual psychology from IR theory's main focus, understanding the nature and structure of the international system[1], psychology is now a fixture in the IR landscape and influences diverse approaches from decision-making[2], to nationalism and identity[3], to potentially even the structure of the international system itself[4]. Put simply, the general study of psychology and role of individuals in IR theory is back in a rather large way.

One research area of psychology that is beginning to receive widespread attention is the application of findings in biology to better understand social phenomena. These approaches vary in scope and level of analysis. Some researchers have focused on the evolutionary origins of our brain and how this affects our psychological makeup and consequent social behaviors.[5] Others focus less on the details of how we got here in terms of evolutionary process and start their analysis at the genetic level, investigating gene/environment interactions and its subsequent effects on behavior.[6] Still others begin with the chemistry and architecture of the brain itself, investigating the neural roots of social phenomena[7]. What each of these seemingly disparate areas of research have in common is they all open up the "black box" of the individual to understand just what makes us tick and behave in the manner that we do.

The opening of the box was long believed to be impossible. In 1871, the economist William Jennings noted, "I hesitate to say that men will ever have the means of measuring

[1] Waltz 1979; Wendt 1999.
[2] Levy 1997.
[3] cf. Herrmann et al. 2004.
[4] Wendt 2010.
[5] Cosmides and Tooby 1994.
[6] Robinson 2002; Robinson et al. 2005; Robinson 2010.
[7] Cacioppo et al. 2007; Adolphs 2009.

directly the feelings of the human heart. It is from the quantitative effects of the feelings that we must estimate their comparative amounts."[8] As early as the 19th century economists recognized that their assumptions regarding rational and predictable behavior were problematic, though they also knew that getting inside the heads of individuals to measure these feelings, or departures from rationality, was impossible. This lack of ability to look inside the individual is evident when one considers the trajectories of both economics and political science. In the former, since the "feelings" that Jevons notes are difficult to get at, economists simply dropped them from analysis altogether or labeled them "useless intervening constructs."[9] Revealed preference theory illustrates well this move: unobserved preferences (i.e. those in the black box) are assumed to be the observed decisions individuals make (i.e. those outside the black box).[10] Economists understood this very early on. In a 1987 letter Pareto wrote:

> It is an empirical fact that the natural sciences have progressed only when they have taken secondary principles as their point of departure, instead of trying to discover the essence of tings… Pure political economy has therefore a great interest in relying as little as possible on the domain of psychology.[11]

Updates and extensions to this basic premise, be it in expected utility or Bayesian updating, improved upon the parsimony and mathematical coherence of how decisions *should* be made, but nevertheless provided "as if" stories that explained human behavior without needing to get into much psychological detail.[12] Whether or not these updates provide any leverage as descriptive models of decision-making is the subject of great debate.[13]

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[8] Cited in Camerer et al. 2005, 9.
[9] Ibid.
[10] Samuelson 1938.
[11] Quoted in Busino 1964, xxiv.
[12] Rogeberg 2004; Bruni and Sugden 2007.
[13] Schoemaker 1982; Plous 1993; Rabin 2000; Rabin and Thaler 2001.

IR followed a similar trajectory with the rise of behavioralism equating behaviors with preferences and subsequent domination of rational choice theory, which assumes rational self-interested individuals, largely sidestepping human vagaries and psychology.[14] Cognitivism attempted to at least approximate what mental processing consisted of, incorporating such things as beliefs and desires into the mix, but nevertheless also suffered from the problem that we are largely guessing about mind states in our analyses, rather than knowing them.[15] These "as if" approaches, like rational choice, should not be denigrated because of this guesswork nor is the term meant to be pejorative. The point, however, is that the existence of a black box necessarily means that guesswork is involved. There are, however, significant differences in how this is accomplished. Consider the "armchair" guesswork that involves thinking about states from afar and what their leaders may be thinking and the guesswork of a researcher embedded in a culture for years and inductively inferring how a given leader in that culture may act.[16] Interpretive, reflexive, and ethnographic methods all attempt to approximate the thought processes of individuals and groups embedded within a given culture. Indeed these interpretations make good sense if the brain remains a black box and the approaches that have done so provide useful insights and predictions.[17]

One of the benefits of the black box remaining closed is that you can make any number of assumptions about the box itself. Consider the classical realist claims regarding human nature. For Niebuhr, man possessed a desire to dominate and is essentially evil in his nature. Humans possess "unlimited and demonic potencies of which animal life is innocent."[18] For Morgenthau, there are essentially three motives inspiring the individual: "to live, to propagate and to

[14] Snidal 2002.
[15] Goldstein and Keohane 1993; Hasenclever et al. 1997.
[16] Thanks to Rick Herrmann for pointing out this example to me.
[17] Bruni and Sudgen 2007.
[18] Niebuhr 1941, 178-179.

dominate."[19] We have according to the classical realists, an *animus dominandi*, or desire to dominate. Neorealism replaced this assumption about human feelings, to use Jevons' term, with an assumption about security. The only requirement for man's nature for Waltz is the desire to survive.[20] In a world of scarce resources, anarchy will be enough to permit violence; no desire for power is necessary.[21] What should be clear from each of these examples is the assumption made about the black box that sets the theory in motion. It need not matter if the realists were right or wrong about their assumptions. Simply by *having* assumptions they were able to construct an overarching theory and approach to understanding world politics that could generate testable hypotheses. Whether explicit or implicit, much of IR theory rests on similar assumptions about our collective individual inner psychology.[22]

Increasingly, recent advances in biology, and specifically the neurosciences, have allowed researchers to "open up" the black box of human psychology and assess whether some of the assumptions we make regarding human psychology are accurate and derive new theoretical insights by observing the connections between social behavior and biological process.[23] Social Neuroscience (SN), a field that emerged in the early 1990s, is focused on the study of how biological, though largely focused on neural, systems both implement social processes *and* how social processes affect biological systems. This is made possible through increasingly advanced technologies, such as functional magnetic resonance imaging (fMRI) and positron emission tomography (PET), which allow three-dimensional precise pictures of functional processes in the brain and other parts of the body.[24] The study of the brain and

[19] Morgenthau 1960, 36-37.
[20] Waltz 1979; Waltz 1997.
[21] Waltz 1979.
[22] Tetlock 1994; McDermott 2004.
[23] Camerer 2007, 1.
[24] While out of the scope for this article, there is a large literature developing on the use and misuse of fMRI data. For more see: Poldrack et al 2008; Poldrack 2008; de Beeck et al. 2008.

nervous system, allows us to measure what Jevons and social scientists of previous centuries thought were fundamentally immeasurable: feelings, emotions, thoughts, ideas, predispositions, instincts, and so forth. We now have the ability to assess many of the assumptions about how individuals see the world, how they interact with others, and how they process information, all of which have driven both theory-construction and empirical testing. This opening of the black box challenges our understanding of social behavior in many ways, most particularly in that the relationship between brain, mind and action that is elucidated, or assumed, in IR theory.

Interestingly, however, there has been considerable push back among some IR theorists to adopting biological approaches to the study of IR. Despite all political behavior being reflected in the brain, students of politics have often been uncomfortable using the brain itself as a source of explanation.[25] The criticisms have been varied. Duncan Bell has called biology a "false prophet" and warns that the claims that its proponents tend to make are inflated and ultimately will be shown to be wrong.[26] Although his critique is aimed more at the evolutionary psychologists, many of his problems are attributable to biological approach writ large. A common criticism of "sociobiological" approaches is the ethical issue created by the discipline's unfortunate history with Nazis and justification of genocide. As Bell notes:

> It is unfair to criticize people simply because their ideas are employed for purposes beyond their control… But some ideas are more susceptible to hijacking and abuse than others, especially those proclaiming that the 'truth' about human nature actually corresponds, as it does in [evolutionary psychology], with many damaging and deeply ingrained social stereotypes. If it teaches nothing else, history should caution us against these sorts of claims, as well as the endlessly recycled quest for certainty about human affairs.[27]

[25] Schreiber 2010.
[26] Bell 2006.
[27] Ibid, 506-507.

While it is not entirely clear how far Bell wants us to take this criticism and what types of research should apply (since the application of biology to IR can mean many different things to different scholars), the overarching point is clear: the historical linkage between biology and politics have made some, not unreasonably, uncomfortable regarding claims about human nature that rely on biological evidence. The root of this uncomfortable feeling is often a presumption of biological determinism, the notion that neuroimaging may reveal the soul to be an illusion or once and for all end the nature vs. nurture debate in nature's favor.[28]

Assuming these particular criticisms can be dealt with satisfactorily, a bigger epistemological problem remains. The notion of digging into the brain to answer questions about complex social phenomena is not entirely intuitive. The questions are multiple. Why focus on something as minute as a neuron when the behavior to be explained is abstract and political in nature? What could brain structures and chemicals possibly tell us about complex relationships, such as between Israelis and Palestinians that would be worth knowing? How do we move from reductionist insights of neurons to macrostructures in a compelling and falsifiable manner? What about the well known multiple realizability problem that affects reductionist and individualist analyses of all stripes? Indeed, there are no shortage of questions to answer when it comes to applying neurons and brain chemicals to complex social outcomes.

This article will attempt to address many of these questions and argue that there is promise for neuroscience in IR. While the social critiques, such as that of sociobiology and Nazism will be dealt with, the larger epistemological question regarding the use of biological knowledge in social analyses will be the focus. This question can be summed up simply: How can (and should) neurological findings inform IR theory that has seemingly developed quite well on its own? I will offer what I see as two broad approaches and then present a framework that

[28] Wolfe 1996; Schreiber 2010.

justifies both. In some instances SN may help us to update our theories to reflect what is known about the brain. In other instances it may mean rebuilding a theory from the ground-up. I will focus on SN for a number of reasons. Most important among them, researchers in the area have spent considerable time thinking about how their work comports with social analyses, such as social psychology and political science. Indeed the entire enterprise is *built upon* linking complex social outcomes to brain processes. They are therefore well experienced in addressing the skeptic. I will build off their insights, based largely on the work of the two founding fathers of the field, John Cacioppo and Gary Berntson, and provide a general framework for how we can use SN in IR. Ultimately I will provide examples of neuroscientific inquiry already in IR and suggest that SN provides a new updated non-deterministic materialism that manages the mind-body problem in a way that will be extremely fruitful for IR.

Two Models of Incorporation

In considering potential applications of social neuroscientific findings to the study of international politics, two broad trajectories seem plausible and share a similar epistemological justification: top-down approaches and bottom-up approaches. These are conceptualized as a continuum, not necessarily as a binary. Nor is this structure unique to neuroscience. Outside disciplines have historically experienced similar dynamics in IR theory building.[29] In the top-down approach, neuroscience adds value to existing IR theory by informing the reality upon which the theory was built. For instance, neuroscientific insights might generate the specific conditions under which most individuals depart from rational decision-making.[30] In this case the value of neuroscience is to add additional variables or scope conditions to the existing theory. For instance, one of the stumbling blocks encountered when applying prospect theory to IR has

[29] Holmes forthcoming.
[30] McDermott 2004.

been the difficulty of assessing, a priori, when an individual perceives oneself in a domain of gain or a domain of losses.[31] Making such determinations post-hoc is much easier than constructing a general theory of when prospect theory outcomes are obtained. If we could look inside the brain to determine precise conditions under which "loss" or "gain" are processed, this stumbling block may be overcome. Indeed the ability to predict *when* individuals will view themselves in a domain of gain or loss may be achieved is the subject of inquiry among prospect theory scholars.[32] Thus, the theory is made stronger through a greater congruence with the underlying reality of how humans make decisions. The key point here is that extant theory is *updated* by the implications of neuroscientific research.

The bottom-up approach, in contrast, builds theory directly from the neuroscientific evidence itself. It does not assume that existing IR theory is necessarily misinformed (since, as argued above, having assumptions is often enough to generate predictive theory), yet it nevertheless "turns back the hands of time" to ask how IR theory might have developed differently had the black box of the human mind and brain been open all along. Consider the following likely widely-shared claim: "War seems to many to be an irrational act of passion...Yet for all the emotion of the battlefield, the premeditation of war is a rational process consisting of careful and deliberate calculations."[33] Recent neuroscientific evidence suggests that what we think may be "rational processes" of decision-making are likely much more complex and involve emotional processing.[34] Thus, rather than decisions to go to war reflecting a cold calculation of costs and benefits, we know that emotion and affect enter the calculus as well. Depending on the weight one gives this sub-individual (i.e. in the brain) finding, one might be willing to turn back

[31] Levy 1997.
[32] Trepel et al 2005; Rangel et al 2008; Glimcher et al 2009; Martino et al 2010.
[33] Bueno de Mesquita 1981, 19.
[34] McDermott 2004; De Martino et al. 2006.

the hands of time and think about how rational war theory may be premised on an incorrect assumption regarding human information processing and decision-making. If decisions to go to war are based partly on "hot" emotion processing, then it may be that the default state, rather than the exception, should be one of emotional processing.

One example of where this has already occurred with neuroscientific insight is Wendt's auto-critique of *Social Theory of International Politics*.[35] While *Social Theory* builds off an implicit Cartesian dualist mind/body position ("ideas" and "rump materialism" are fundamentally irreducible), the problem is that, as Wendt puts it, "very few scientists and philosophers take it seriously."[36] There is a "reality constraint" here: the assumptions made in the theory are not congruent with what we know about reality. Put another way, *Social Theory* (and most social science) is built on an assumption about the mind: it is a *classical* mechanical phenomenon.[37] Wendt goes on the auto-critique, and subsequently in later work (forthcoming), to hypothesize what a social science that did not have this problematic assumption built-in would look like. In effect we are "turning back the hands of time" to rebuild theory from the ground-up. Extant theory therefore in this case is not necessarily updated but rather new theory *created* with the foundation of neuroscientific evidence. This is made possible, and some might say necessary, because of insight from the natural sciences that problematize the assumptions we have made.

Both the approaches I have identified here, whether bottom-up or top-down, presuppose that IR theory can progress through the incorporation of neuroscientific insight. This is not obvious. Indeed some have made the argument that neuroscience specifically, and biology generally, provide little additional explanatory leverage for a number of reasons including, but not limited to:

[35] Wendt 2006.
[36] Ibid, 183.
[37] Ibid, 185.

1) The level of analysis problem. We are normally interested in aggregated group activities (states, firms, institutions, and so on), so how is it that neural substrates help to make sense of those phenomena? Is not that chasm between neurons and an institution such as the World Trade Organization (WTO) or United Nations (UN) simply too large to bridge?

2) The determinism problem. Philosophers of mind tell us that individuals can always tell their predispositions rooted in genes and neural substrates to "take a hike."[38] Indeed this agency is not only seemingly one of the key aspects of being human but it is a core construct of much extant IR theory. How do we square SN, which seems deterministic in making claims about the links between behaviors and brain processes, with what we know about human agency?

3) The "old wine in new bottles" problem. Stephen Walt, in assessing rational choice theory and its applications to IR, notes that to be useful rational choice must be "precise, logically consistent, original, and empirically valid."[39] Duncan Bell et al echo a similar concern about the relationship between sociobiology and IR theory generally: "… the microfoundations that a sociobiological informed theory of international politics produces are indeterminate and contradictory. For this reason, sociobiological microfoundations provide no additional analytical leverage in explaining and understanding international politics."[40] If the theory fails at any of these then it risks not being generally accepted or simply tells us little that we already

[38] Pinker 2002.
[39] Walt 1999, 8.
[40] Bell et al. 2001, 187.

know. The same is true for SN. In order to be generally accepted, SN's theories and predictions must not only be precise, logically consistent, and empirically valid, but they must tell us something of consequence that we do not already know. Ideally SN would make different predictions than leading extant theory.

4) The "sociobiology" problem. The legitimating force of science, for all its normative good, also has an unfortunate history in the 20th century of being used for normatively undesirable political activities. Is not this type of research simply too dangerous for our unfortunate political reality?

Before exploring the merits of the two interdisciplinary approaches identified above and how those approaches might inform IR, the four significant problems above must be addressed. Put simply, the broader case that SN has a legitimate place in IR must be made.

The Epistemology of Top Down and Bottom Up

Explaining

From an epistemological perspective, it is not obvious or clear why "digging deeper" into brain neurons helps us to explain complex and inherently social political behaviors. This is particularly true when it comes to IR and the level of analysis is usually not individuals but states, groups, firms, and so on. Can neural substrates really inform anything about the behavior of states? This presents the first epistemological problem that needs to be overcome, the issue of levels of analysis: of what use is knowledge of neural substrates for aggregate phenomena and explanation? There are a number of different approaches to answering this question from different epistemological perspectives.

The first option is to simply limit the level of analysis to individuals themselves. Once this move is made, then jumping into the brain of the decision-maker seems relatively uncontroversial. Political psychologists have a rich history of doing just this in their analysis of decision-making under risk, decision-making using images, and so forth.[41] Scholars of personality and leadership have been looking at the "hearts" of individual leaders for years.[42] Hymans, for instance, explains the state decision to "go nuclear" not by the structure of the international system or a tragic security dilemma pitting two powers against each other, but by a shared characteristic of leaders, a shared conception of their nation's identity he calls "oppositional nationalist."[43] This shared identity characteristic drives emotions of fear and pride, which in turn may result in a desire for nuclear weapons. By focusing on actual individuals, instead of states, we transcend the problems of moving from individual neural substrates to state behavior: state behavior *simply is* the behavior (and identity conception, emotions, and so on) of individuals.

This move is justified when one considers that state policy is ultimately constructed by individuals. Consider Robert Jervis' interrogative work on the intelligence failures leading to the 2003 invasion of Iraq.[44] While Jervis finds much blame to go around, ultimately it is characteristics of individual decision-making that played a causal role in the intelligence failures, including rampant confirmation bias and the certainty effect. For instance, he finds little support for the popular "groupthink"[45] hypothesis that previous Senate Select Committee on Intelligence (SSCI) reports cited.[46] Therefore, there seems to be support for the claim that state decision-

[41] Herrmann and Fischerkeller 1995.
[42] Barber 1985; Hymans 2006.
[43] Hymans 2006, 2.
[44] Jervis 2006; Jervis 2010.
[45] Janis 1972.
[46] Jervis 2006; Jervis 2010.

making can sometimes be reduced to individual decision-making and thus it make sense to study individuals and their intricacies (perhaps even their brains) in order to form a more comprehensive understanding.

Further, whether they acknowledge it or not, many IR theorists who are talking about states are really also talking about individuals, either metaphorically or otherwise.[47] Consider claims made about state motivation and how such claims are operationalized. State decision-making (such as "the Soviet Union wanted x concession from the United States") is often reduced in practice to what the individual leader motivates (such as "Gorbachev asked Bush for money in exchange for arms control"). Nevertheless, at least ostensibly, IR theory normally considers states first and focusing on individuals may be a way of bringing neural substrates to the discussion.

The problem with this approach is that it only weakly implicates the unit of analysis that IR theorists normally occupy themselves with, the state. Decision-maker and decision-*making* analysis certainly provide insight into how decisions at the state-level are made, but it is not the state per se that is being analyzed and described. As Kenneth Arrow pointed out, aggregating discrete individual decision-makers is not simply a matter of addition.[48] What happens, for instance, when multiple decision-makers disagree on the best course of action? Indeed if the unit of analysis is the individual decision-maker, the claims derived from that analysis largely need to remain at that level and cannot be aggregated upward to the state. At the very least one then needs a theory of decision aggregation. One way to conceptualize the problem here is to consider what happens when individual decision-makers disagree on a policy prescription. It may be, for

[47] Jackson 2004; Wendt 2004.
[48] Arrow 1951.

instance, that diplomats do indeed construct policy,[49] but what happens when they are overruled? An analysis of decision-making might allow us to understand how each individual reached the conclusion that they did, but the "state decision" represents some other discrete process of aggregating various opinions together.

Another appealing route is to adopt an ontology of states "as people."[50] That is, even if IR is interested in states, we can make the move to reduce the state to the individual. Scholars implicitly do this routinely asking questions such as "Why does Iran want nuclear capabilities?" as if Iran is a cohesive single entity. Some scholars have made the move explicit and argue that "states are people too," sharing a number of salient characteristics and properties.[51] It occurs routinely in other disciplines and realms of social life as well. In 1886 the United States Supreme Court ruled in *Santa Clara County v. Southern Pacific Railroad* that a corporation was entitled to the taxation benefits that individuals enjoy. In other words, corporations (essentially a group of individuals) could enjoy the same rights under the Fourteenth Amendment as did natural persons. Whether for analytical clarity, legal consistency, or a belief that states share enough characteristics with natural persons to warrant *being* persons, treating groups as individuals has a rich and useful history. Indeed this move of suggesting what applies to people usually applies to states, be it in psychology, need for ontological security[52], and so on, has provided useful theory and inferences. Indeed it is hard to imagine the counter-factual: what would IR look like if we *did not* assume that states were people?

The problem with this move for biological interdisciplinarity is while it is one thing to make the move that states and people share characteristics, it may be problematic to argue that an

[49] Neumann 2002.
[50] Jackson 2004; Wendt 2004.
[51] Wendt 2004.
[52] Mitzen 2006.

individual's brain state can provide explanatory leverage for aggregated behavior at the state level. Put simply, it is one thing to say that states are people too in that they share characteristics; it may be another thing altogether to say that they have the functional equivalent of neurons and chemical reactions, however. This largely turns on how far one is comfortable taking the personhood analogy. The "weak" analogy of states as individuals would view states as people for conceptual clarity. That is, lacking another fruitful metaphor, individuals seem to provide a pretty good device for making sense of the international system. This weak version would have trouble making the argument that states have neurons too, since the argument is not that states necessarily are people, just that we act as if they are. A "stronger" version of the argument that moves slightly away from analogy and more to congruence, may be that states exhibit nearly all of the characteristics of natural persons and functional equivalents exist for natural things. That is, while states don't physically have neurons like people do, they have a functional equivalent. Aggregated individuals include aggregated neurons and therefore there would be some support for this argument from a conceptual level. In this case there may be justification for studying the brains of individuals to gain explanatory insight into the inner-workings of the state.

Understanding

More generally, however, there is another simple epistemological argument that suggests *understanding* at various levels of analysis is useful in and of itself as it helps to recast what we know and what we think we know. It is this comprehensive notion of understanding that I would like to advance as a key reason to pursue explanation at lower levels of analysis. Paul Churchland, philosopher of science, argues that "making theoretical progress emerges as a matter of finding ever more penetrating and successful *interpretations* of the antecedently interpreted empirical data… It is a process of trying to redeploy our existing conceptual resources in

empirical domains *outside* the domain in which those concepts were originally acquired.[53] That is, one of the values of digging deeper into various levels of analysis, if nothing else, is precisely to advance our theories by seeing if they hold up to new information in new domains. But another is that it allows us to gain new models and metaphors as well.

Consider the metaphors we use and how they become updated when insights are drawn from new domains. Churchland provides the example of Newton's theory of gravity in the 17th Century. He introduced a new metaphor, that of the *flung stone*, to describe the Moon. Newton said that the stone is constantly falling toward the Earth but can never land because its velocity was too high: its tangential motion would constantly compensate for its movement toward Earth.[54] Huygens made a similar contribution by reinterpreting light as traveling waves; Bernoulli saw gas a "swarm of ballistic particles," and so forth.[55] These reinterpretations were made possible by learning and thinking about what occurs at levels deeper than what is being observed. Through these new metaphors and models, new predictions and explanations are generated. Thus, even in the toughest case, where it is argued that digging deeper does not inform *directly* anything about phenomena at other levels, we can find an epistemological justification and basis for diving in.

At first this might seem like an odd argument. If brain science can not inform anything directly about IR, why should we care about it? Churchland's argument suggests that there is value in *understanding* itself. Understanding how various levels of analysis interact with each other to produce an outcome can be beneficial even if we cannot see direct linkages between levels because analysis at new levels, at the very least, helps to provide new concepts and metaphors that can be applied to a variety of problems. It may be, for instance, that

[53] Churchland 2006, 31.
[54] Churchland 2007, 472.
[55] Ibid.

understanding how the brain is organized helps to make sense of how other systems are organized.[56] In 1884 the British neurologist John Hughlings Jackson made a simple discovery that would have a profound impact on the study of physical systems. His research suggested that the widely held view that the brain and body could be understood as a hierarchical system, with the "mind" on top with subservient "body" functions below, was misinformed. This understanding, while intuitive, belied the actual *heterarchical* organization of the system. According to Jackson, "There is no autocratic mind at the top to receive sensations as a sort of raw material, out of which to manufacture ideas, etc., and then to associate these ideas," but rather there exists a system of unification of the whole organism whereby the entire self adjusts, and adapts, to the environment.[57] Put simply, rather than brain/mind controlling body with high-level functions on top and low-level functions on the bottom, what we see at the brain/mind level is a representation of function that exists at lower levels in the body. There is a reliance or interdependence of function rather than subservient hierarchical function.

Borrowing this insight from neuroscience may suggest new ways of understanding for IR. Network theory and the "relational turn" in IR theory problematize the notion that international structure can be understood in hierarchical terms.[58] As Daniel Nexon argues, "Instead of approaching international politics through pre-given levels of analysis, therefore, we should think about international structures as 'network[s] of networks' co-constituted by the network-structures of the actors that populate it, and also by the structure of social ties across and between them."[59] The implication here is that hierarchical or balanced systems are simply possible descriptions of international political structure, though they may not be the only

[56] Holmes forthcoming.
[57] Taylor 1931.
[58] Jackson and Nexon 1999; Hafner-Burton et al. 2009; Nexon 2009.
[59] Nexon 2009, 26.

descriptions. If we bring in the notion that physical symptoms are often designed heterarchically, we gain a new way of understanding, both metaphorically and empirically, how networks may operate in the international system. This heterarchical organization understanding may make for a more reality-consistent understanding of processes within the international system. Thus, at the very least, digging deeper often provides a new way of thinking about old problems, such as how the international system is constructed. It therefore satisfies the Bell et al requirement that sociobiology provide new ways of understanding.

Ultimately I am in favor of such an epistemology of understanding when it relates to brain science and IR, but I suggest that we need not concern ourselves with grand epistemological debates regarding the status of micro-reduction in explaining macro-level outcomes and structures. Rather, this article suggests that there is *not* a single valid epistemological view on this topic that we need to adopt. Instead, the extent to which neuroscience helps to make sense of IR outcomes and create better knowledge is dependent on the research question and method. There are, undoubtedly, many questions where knowledge of what is occurring in the brain is simply redundant and does not add significantly to the discussion. There are also plenty of examples where neuroscience leads to multiple, and perhaps contradictory, conclusions and thus is, at best, inconclusive in terms of updating IR theory. And finally, there are undoubtedly areas where the abyss between neurons and complex social interactions *is* so large that one needs to seriously question the value of attempting to make the jump. This then serves as our starting point: there is not one single perspective or valid argument as it relates to the virtues of incorporating brain science into IR science. We must take something of an ecumenical approach.

On the other hand, I argue that those who think that the abyss between neurons and social behavior is so large that we should not attempt to bridge it need to reconsider their positions. As

I will show below, the abyss need not be as threatening and impassable as some would suggest. We *can* address the critic who believes that there can be no satisfactory epistemological perspective for incorporating brain science into political science. I argue that the mere idea of there being an abyss may be clouding connections that can be drawn between multiple levels of analysis. Disparate approaches, be they "social" or "biological," miss the point. Human behavior is ultimately rooted in biology, and as social neuroscientists quickly point out, we are learning that biology is in some sense social. That is, the biological and social are linked, not in a superficial way but in a very deep sense: they have effect on each other, and to fully understand either requires multi-level integration and approaches. Investigating the structure and processes of the brain and related biological systems helps us to reach this goal. Importantly, however, as Cacioppo and Berntson point out, this does not mean that biological reductionism solves all problems in a satisfactory manner.[60] It may be that one level of analysis is better than the other and this is *dependent on the research question*. An anecdote that helps to make the point is of a chemist who works with the periodic table on a daily basis but nevertheless uses culinary recipes from magazines rather than the periodic table to cook. The reason is not because the food preparation could not be reduced to chemical expressions, but because it would not be efficient or useful to do so.[61] The same is true in IR. Just because all behaviors may reduce, at some level, to biology (a controversial claim in and of itself) does not mean that it is worthwhile, efficient, or interesting to do explore that reduction.

Social Neuroscience: What Does it Attempt to Do?

[60] Cacioppo and Berntson 2002.
[61] Ibid, 5.

SN investigates the biological correlates in the brain that underlie, and are affected by, behavior. It seeks to help inform and refine theories of social behavior by understanding neural organization and function. Importantly, this is ultimately a two-way street. Social neuroscientists are interested in the interaction effects between an environment and the brain, noting that the brain and neural systems can be affected by the external environment as much as they can affect behavior of the individual within that environment. These interactions occur across multiple levels of organization and analysis, be they molecular, cellular, system, individual, group, societal, etc. In this way while it is perhaps natural to see social neuroscience as occupying the intersection between neuroscience and social psychology, the cross-cutting levels of organization and analysis that social neuroscience is interested in suggests that it has relevance for a number of social domains, including group dynamics.[62] It is precisely through multi-level analyses that social neuroscientists believe that we can understand the diverse mechanisms affecting human social behaviors.

Interestingly, it is instructive to note that just as IR theory developed naive of the inner-workings of the black box of psychology, much of biology and neuroscience developed naive of the impact sociality has on biological systems.[63] Just as social science found advantages to doing so, biology did as well. The advantage of this assumption was that biological systems could be studied in isolation which made tracing outputs of systems to anatomical processes relatively straightforward. When neuroscientists began to study more complex behaviors, however, they realized that the assumption regarding the non-effects of sociality could not be sustained; some basic and long-held principles also came into question. Cacioppo and Berntson note for instance that while scientists understood that phenotypic expression, or behavior, in mice depended on

[62] Decety and Keenan 2006.
[63] Cacioppo and Berntson 2002, 3.

specific genes (the "genetic background") they believed that the effects of the social context were relatively unimportant. Researchers were surprised to discover that the same genetic background could produce wildly different behavioral effects in different social environments.[64] As will be discussed below, if you give a chimp amphetamines, sometimes nothing happens and sometimes behavior changes dramatically. The key explanatory variable that was uncovered is the social hierarchy of the chimps. Concurrently, the psychology discipline was discovering that behavioral data alone provided an incomplete story of social behavior; rather, social processes are clearly the product of brain processes and understanding both provides complementary knowledge. As Cacioppo and Berntson point out, this led some scholars of social phenomena to take seriously the neural substrates of behavior.[65]

Perhaps because of the history of using biological "data" to inform social phenomena in the 20th century, usually in the form of what is (often pejoratively) termed sociobiology, social neuroscientists are usually quite clear in situating their work in non-determinism. That is, simplistic claims such as a neurological chemical reaction "causing" a complex social behavior are eschewed for more nuanced claims about understanding the building blocks of complex behaviors. Anticipating the criticism of determinism, Decety and Keenan in the very first article of the *Social Neuroscience*[66] journal quote bioethicist Paul Root Wolpe's warning:

> History has shown us again and again that society tends to use science to reinforce the moral assumptions and biases of the cultural moment. There is clearly a role for a thoughtful social neuroscience, where findings become part of considered policymaking around controversial issues. For example, research into addiction has provided new perspectives and tools for policymakers willing to use them. But if scientists are not clear about the scope and nature of their work, eager policymakers can seize

[64] Crabbe et al. 1999.
[65] Cacioppo and Berntson 2002.
[66] Decety and Keenan 2006.

> preliminary and speculative findings and implement programs unsupported by the science itself.[67]

Accordingly, social neuroscientists have attempted to avoid simple deterministic claims and instead focus on links and correlations between brain systems and social contexts. They have also attempted to be very clear in that complex policy prescription does not, and should not, flow from neurological data. Indeed, if anything, SN researchers have gone out of their way to illustrate that the scope of their work falls outside of the political realm.

There are a number of organizing principles that guide an understanding of the links and correlations that are useful to mention here as they help to illustrate what SN attempts to do and understand and what it does not. This will be particularly useful because in many instances IR theorists have *had the same debates* but come up with different conclusions. This allows for an entry-point in viewing how SN can inform IR.

The Levels of Analysis Problem in Social Behavior

The first organizing principle for SN endeavors is that it seeks to understand "complex mental, behavioral, and social problems" through multiple integrative levels of organization.[68] What Cacioppo and Berntson have in mind here is multilevel analysis that studies a phenomenon from a wide-variety of scales, from the molecular (what they term "microscopic") to the sociocultural (what they term "macroscopic"). These scales are not studied in isolation but rather observations at one level are used to "inform, refine, or constrain inferences based on observations at another level of analysis."[69] The key insight here is that in order to understand a complex social behavior, the underlying systems and processes that comprise the behavior need to be understood. And these systems and processes occur at various levels of organization.

[67] Wolpe 2004, 1032.
[68] Cacioppo and Berntson 1992, 333.
[69] Ibid.

Ignoring particular levels would provide an incomplete (although perhaps intuitive) understanding of the behavior.

Cacioppo and Berntson provide the illustrative example of alcohol consumption. One can construct a very intuitive and compelling account of alcohol consumption with nothing more than an understanding of osmoreceptive mechanisms and volume detectors which work together to produce a desire to drink. Yet, this tells us relatively little about alcohol consumption in bars and the social contagion effects therein. On the other hand, even sophisticated studies of barroom behavior would be unable to uncover the fundamental mechanisms of thirst and desire for alcohol. Nor would they be particularly helpful in understanding why some individuals would be more prone to such drinking behavior than others. Each account would be informative, but ultimately incomplete. Crucially, however, if one *only* looked at either, the explanation would seem satisfactory. After all, it is difficult to know what one does not know. By focusing on one level of organization one can find explanation, it just may not be a comprehensive one as possible because other levels have been bracketed from view.

One of the criticisms that is sometimes voiced in opposition to biological research when it comes to explaining social outcomes is that reductionism essentially boils down to the notion that the goal of science is "the pursuit of explanations at the lowest possible level of analysis."[70] SN does not embrace this view. Rather, it holds that rational reductionism, the "ability to relate one level of organization to another," with causal links going in both directions, is a fruitful approach to understanding social behavior that does not replace, but rather complements, higher-level analyses. As mentioned above, SN researchers feel that there is really no other way to comprehensively understand a behavior; to not look at multiple levels of analysis is to necessarily close off the possibility of gaining new insights. One does not always gain new

[70] Berntson and Cacioppo 2004, 108.

insight by looking across levels, but one can certainly preempt finding useful insight by not looking.

Thus, the organizing principle of multiple levels of analysis can be summed up with three important insights. First, the various levels that contribute to a complex social behavior must be first understood if we are to claim that we have understood the social behavior.[71] Second, however, "almost never can a complex system of any kind be understood as a simple extrapolation from the properties of its elementary components."[72] For this reason, an understanding of sub-systems is helpful to the extent that it is considered in conjunction with processes and events at various levels of the overall system. Finally, since each level of organization *may* provide input into a social behavior, it would be a mistake to argue that a single level of organization is *best* for explaining all social or psychological questions.[73] Clearly, SN researchers are interested in neural substrates, but it would be a misrepresentation to argue that they believe neural substrates are the best explanation for behavior. Rather, analysis at multiple levels helps to construct a comprehensive theory of social behavior.

Principles of Determinism of Social Behavior in Neuroscience

Having identified the multiple levels of analysis organization principle, we can turn to the question of how exactly SN helps to inform social outcomes. What exactly is the determinism that SN has in mind when it moves from neurons to behavior? The principle of *multiple determinism* suggests that an event at one level of organization "may have multiple antecedents within or across levels of organization."[74] The development of theories of aggression provide an

[71] Marr 1982, 24.
[72] Ibid, 19.
[73] Cacioppo and Berntson 1992, 332.
[74] Cacioppo and Berntson 1992, 334.

interesting example.[75] As Cacioppo and Berntson note, aggressive behavior is multiply determined within and across levels. Aggressive behavior can be the result of neurochemical events in the brain, such as in the case of Charles Joseph Whitman, responsible for killing 14 people by shooting from the observation deck of the University of Texas tower in 1966, whose behavior was allegedly partially indicated by a glioblastoma tumor in the hypothalamus. Aggressive behavior can also be the result of frustration or paranoid delusions at the psychological level. Joseph Stalin, for instance, allegedly suffered from moderate to severe paranoia throughout his life and some attribute this as a causal factor in Stalin's political aggression.[76] Alternately, at the social level, contexts such as overcrowding, maternal defense, or territoriality can quickly lead to aggressive behavioral outcomes.[77]

What this suggests is that integrative research that helps to specify the conditions under which each set of factors, and at what levels, contribute to a social behavior is a crucial part of theory-building. Indeed any social behavior that is observed can, and likely does, have multiple determinants within and across levels. SN adopts the view that assessing the conditions under which each level is *likely* contributing helps to provide a more complete picture of the social behavior. It recognizes the complexity and multiple determinism of social behavior and argues that these multiple pathways are worthy of investigation.

The second principle of determinism of social behavior from a neuroscientific perspective is *nonadditive determinism*. This principle suggests that properties of the collective whole are not necessarily predictable based on the parts *unless* the properties of the whole have

[75] Cacioppo and Berntson also note the development of theories of emotion provides a nice example of this principle. Early theorists of emotion believed that emotions were generated by somatovisceral reactions to an event that is exciting in one form or another (James 1894). Baldwin (1894) pointed out that not all emotions followed this pattern and indeed at least for some types of emotions associative processes could lead to emotional reactions. The key point here for our purposes is that one event (emotional response) could be engendered through multiple processes (somatovisceral reaction or associative processes).
[76] Birt 1993.
[77] Cacioppo and Berntson 1992, 334.

been documented and well studied across levels.[78] Put simply, focusing on a particular level of analysis may mask properties of other levels that provide insight into the larger social phenomenon. This is similar to an old truism of social science: the questions one asks determines the answers one receives. Cacioppo and Berntson cite a study that exemplifies this point.[79] The researchers analyzed public and private responses of individuals from both individualist and collective cultures to questions regarding how enjoyable it would be to participate in a time-consuming behavior, such as visiting a friend in the hospital. In the public condition, the cultural context did not affect what individuals reported. All of the subjects reported that they would find it enjoyable to sacrifice their time in the hypothetical situation. Interestingly, however, only individuals from the collective culture reported that these behaviors would be enjoyable in the private condition. This suggested to researchers that the sociocultural context can be quite powerful on self-administered answers: the condition of being in public would change self-construal. But this insight was only possible because the researchers considered the role of emotion *across levels of organization*. As Markus and Kitayama point out, if the analysis had been conducted only at the cultural level of analysis one would likely have derived a mistaken conclusion, such as "culturally divergent individuals inhabit incomparably different worlds."[80]

Similar illustrations exist with different levels of analysis. As mentioned above, a famous study noted that administering an amphetamine to primates produces no reliable effect unless the primate's social status is taken into account. Those high in the social hierarchy are affected by an amphetamine in that their dominant behaviors increase. Those low on the social hierarchy are affected in the opposite direction, with submissive behaviors increasing. The point here is that the physiological changes at first appeared unreliable or chaotic to researchers. It was only after

[78] Cacioppo and Berntson 1992, 340.
[79] Triandis 1989.
[80] Markus and Kitayama 1991, cited in Cacioppo and Berntson 1992.

considering an additional level of analysis, the social level, that the physiological level was informed. Indeed without that social level of analysis it is likely that a pure physiological study would reliably produce chaotic results.

Third, the principle of *reciprocal determinism* suggests that there can be a reciprocal relationship between multiple levels of analysis, specifically between the microscopic and macroscopic. For instance, recent research in behavioral genetics and genomics suggests that there are many genetic influences that remain dormant until certain environmental factors are expressed). Put simply, "brain and behavioral processes are a function of particular genetic factors, the expression of which is governed by environmental agents."[81] Importantly, genomics research has moved beyond relatively simple statements that "both genes and environment matter," and recognition of feedback loops, to a more nuanced understanding of precisely *how* environment matters and under what conditions the environment can affect gene expression or the *genes themselves*.

One of the clearest examples of this reciprocal determinism principle is found in honeybees. Bees share many components of the nervous system with humans yet have a fraction of the number of genes, allowing researchers to experimentally work with a manageable amount of data.[82] One of the clear findings is that determination of which genes are active and how they are activated (gene expression) is affected by the environment. Specifically, in about 40% of the population, genes will change their activity and subsequently change the "role" that bees play. Young bees spend time helping out around the hive and then will switch roles later in life to forage outside of the hive. A number of factors affect this switch, including age and environmental factors. Older worker bees, for instance, can release pheromones to slow young

[81] Cacioppo and Berntson 1992.
[82] Whitfield et al. 2003; Robinson et al. 2005.

bee switching. Some of this can be predicted by looking at the genetic level, some of it cannot. In some instances the environment itself can physically *change* genes through epigenetic factors. For instance, it was once thought that identical twins share 100% of their DNA with each other. Scientists have recently discovered that while the genes are very similar in identical twins, epigenetic modifications suggest that the ways genes are expressed and changed can account for significant differences between twins, even changing the DNA itself.[83] All of this suggests that the interplay between nature and nurture is not adversarial (nature *versus* nurture) but rather complementarily dynamic (nature *and* nurture).

In humans this reciprocal determinism is easy to demonstrate. In a famous study a group of students were taught to juggle and then asked to practice every day for three months.[84] After the three months were over they were then asked to not juggle for an additional three months. Images of the brain were taken before training, after the three month practice period, and again after the three month interval of not practicing. The images displayed significant increases in size of the neo-cortex as subjects learned to juggle. When the subjects stopped practicing the same areas of the brain atrophied. Therefore in a very real sense our biology, reflected in the brain, is constantly responding to the environment.[85]

Unveiling these principles of social neuroscience is helpful for three reasons. First, they help to establish the epistemological philosophy of the scientific endeavor. They help to inform the type of knowledge social neuroscience seeks and the source of that knowledge. This is useful because it clearly answers key questions of the skeptic, such as indeterminate microfoundations or reductionism that seeks to reduce all social behavior to biological levels. Second, SN's views on determinism should comfort the critic who is concerned that SN seeks to win the

[83] Bruder et al. 2008.
[84] Draganski et al. 2004.
[85] Schreiber 2010.

nature/nurture debate by removing the soul of the individual. If anything SN has adopted the view that the environment, or nurture, is as relevant for biological systems as the natural components themselves. Finally, with respect to IR, I argue that SN adopts a significantly different epistemological viewpoint from political science and this affects the way we think about importing neuroscientific (and biological generally) insights into IR. It is to this point that I now turn.

Principles of Determinism of Social Behavior in IR

The principles of determinism of social behavior in SN identified above are significantly different from the determinants of social behavior in IR, although there are correlates. This has limited, I argue, the extent to which IR theorists have been willing to adopt neuroscientific (and to some extent biological) principles into their theory-building. To begin, like SN, IR can be said to have a multiple determinism principle as well. After all, few would argue that IR outcomes are not affected by multiple levels of analysis, ranging from macro-structures to micro-structures as well as interplay between structures. Indeed, the levels of analysis problematique has been one of the organizing principles in methodology for the field at least since Waltz originally articulated the three "images" in 1959.[86] Each level of analysis has engendered its own approach and cadre of theorists who privilege one over the other. There are key differences in approaches, however. First, to a large extent IR theorists have tended to *favor* one level of explanation over the other. Generally speaking we can normally easily differentiate scholars into those who privilege macro-structures or micro-foundations.[87] Importantly, it is not just that IR theorists favor one approach

[86] Waltz 1959.

[87] Although there are numerous important exceptions. Since Putnam's 1988 work on two-level games, scholars have become increasingly interested in the interplay between levels of analysis. Barry Buzan's 1995 work reconsidering the level of analysis problem attempted to reconceptualize the role levels *should* play in scholarship, differentiating ontological levels from epistemological levels. Buzan favors a more interactive approach, one similar to what SN

or the other, but that IR has largely decided that the two approaches are in a bit of an awkward relationship to each other. For instance, scholars of microfoundations cannot very well ignore macrostructure, but rather treat the structure as a relatively fixed source of preferences, norms, etc. The problem is that structure is, at least in part, generated by microfoundations (and many different configurations of these foundations could result in the same structure; see below on multiple realizability). Therefore, microfoundation analyses are in the awkward position of arguing that the macrostructure is at once fixed (for preferences) and variable (as constituted by agents). These types of issues have largely resulted in scholars privileging either the micro foundations or macro structure, but typically not both (and for seemingly good reason given the perceived incompatibility between the two).

The other reason for privileging one level of analysis over the other in IR is an issue of pragmatism. Many would likely agree that a comprehensive theory of IR that incorporates all levels of analysis would be desirable. Many would also agree that developing such a theory would be fraught with problems. Kenneth Waltz in *Man, the State, and War* recognized that all three images play a role in causing war, there is an interplay between the images, but for reasons of theory-building one must look at one image or the other.[88] In *Theory of International Politics* this was made more explicit by noting that each image of analysis brings a different perspective on the causes of war. In an attempt to build a theory that could accommodate "the same effects [following] from different causes," Waltz chose to look at the systems level.[89] The benefit here was that he could theorize continuity and structure of the system, although he could not predict

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has proposed. I would still maintain, however, that most work in contemporary IR scholarship can be understood as privileging one level over the other.

[88] Waltz 1954.

[89] Waltz 1979, 68.

any particular foreign policy outcome. Such trade-offs are normally thought to be required in theory-building.

Thus, while SN has explicitly called for a paradigm of multiple and cross-cutting levels of analyses, IR has, for legitimate reasons, maintained what I term *level-centric* paradigms. It is not that the case that cross-cutting research is not part of IR, but rather that IR theory has developed along disparate lines because of the perceived incompatibility of meshing two levels together and the practical problems associated with trying. This helps to explain, I argue, in part, IR's reluctance to embrace the notion that digging deeper into levels of analyses helps us to make sense of higher level phenomena. If digging deeper is not necessarily helpful at the aggregate level (i.e. moving from macro-structure to individuals), then it is not surprising that IR would be skeptical of a move from individual to neurons. Indeed the two disciplines, IR and social neuroscience, have developed on completely different trajectories in this regard.

IR can learn from SN's emphasis on multiple determinism in the following two ways. The first is that SN does not posit that all questions should be answered by investigating all levels of analysis. Indeed it is just the opposite. The SN view is that multiple levels need to be investigated for a complete understanding of a phenomenon, but this does not imply that every level needs the same level of investigation. Rather, the *extent of inquiry* on any particular level will depend on the question. As such neuroscientific inquiry from a SN perspective may make sense if existing analysis at various levels if not producing compelling explanations. This is akin to what I identified above as a top-down approach. Digging deeper into a particular level of analysis may help to provide insight into a common assumption or provide a new variable to look at and this may engender progress.

The second perspective would be to note that while SN does not posit that all questions should be answered by investigating all levels and digging deeper, we nevertheless do not "know what we do not know." Put another way, digging deeper into the neural level, for instance, may elucidate findings that directly contradict a common assumption or provide a new "reality constraint" on IR theory. In such instances even though we think we have a good explanation for a social outcome, digging deeper nevertheless problematizes that explanation. This is akin to the "bottom up" approach. Once again, however, the principle of multiple determinism notes that this digging deeper cannot be accomplished in a vacuum. In both perspectives, the conservative and more liberal, all *relevant* levels of analysis should be investigated.

At this point it is likely that few would disagree with what has been described. It is relatively uncontroversial to argue that from time to time we can learn more by digging deeper into levels of analysis. One of the problems that must be overcome in applying SN to IR in particular, however, is that of multiple realizability. That is, even if we can all agree that looking at neurons might provide some interesting information, we need to justify that any particular finding in the brain helps to explain social outcomes. One of the reasons macro-structure theorists privilege that particular level of analysis is precisely because particular emphasis on the micro-level is often misplaced. The reasons are straightforward. First, any given macro-structure configuration can be caused by any number of configurations of the micro-level. As Wendt notes, "The best explanation for why the window broke is that John threw a rock at it, not an analysis of the particular combination of sub-atomic particles that broke it, since many other combinations would have had the same effect."[90] Indeed there are any number of configurations of particles that would end up obtaining the same effect. Second, there are some causal

[90] Wendt 1999, 154.

mechanisms that *only* operate on the macro-level.[91] As such, one may be looking at the micro-level trying to understand a given phenomenon but they have missed the causality because it is occurring at the macro-level. There is, in other words, not necessarily a benefit from digging deeper and deeper for better explanation.

These insights about multiple realizability are important, but too often theorists have interpreted them as suggesting that micro foundations lack explanatory leverage because of them. Duncan Bell, for instance, a skeptic, makes this point. "Science cannot address, let alone solve, all our enigmas. It cannot answer many of the most important questions about what it means to be human, and, the corollary of this, what is the best way to live. Nor does it help us very much in comprehending the vast and dynamic complexity of culture and politics."[92] One of the points Bell makes in his piece refuting the use of biological sciences in politics has to do with the notion that politics is complex and it would be foolish to reduce processes that are affected by such things as culture, desires, etc. to particular configurations at lower levels. In essence, what is going on at the lower level is in some sense irrelevant to what happens at higher levels: multiple lower level states would be affected in the same way by culture, for instance. This is a valid point in that any political outcome can have multiple micro foundations and the effects of macro-structure cannot be simply reduced to lower levels, but it does not follow it always, or even often, the case that no further insight is gained by going lower.

SN and philosophers of mind have had to deal with the multiple realizability problem at least since it was articulated in the late 1960s by Hilary Putnam.[93] Consider the concept of "being in pain," discussed in the previous article. This is an experience that is shared across individuals and species, a shared outcome at the individual and species level of analysis. Yet, if

[91] Ibid.
[92] Bell 2006, 509.
[93] Sober 1999; Bechtel and Mundale 1999.

we dig deeper into the physiological substrates of pain, it is obvious that very different physical states can result in the same "being in pain" experience. The problem is this: if humans and reptiles, for instance, all realize pain yet have very different brain and other physical structures, it must be the case that pain is realized by various different physical states in various species. It is also likely the case that within humans "being in pain" is realized by various different physical structures. The general principle is identified in the diagram below, with multiple mental states (M) being realized by multiple physical states (P):

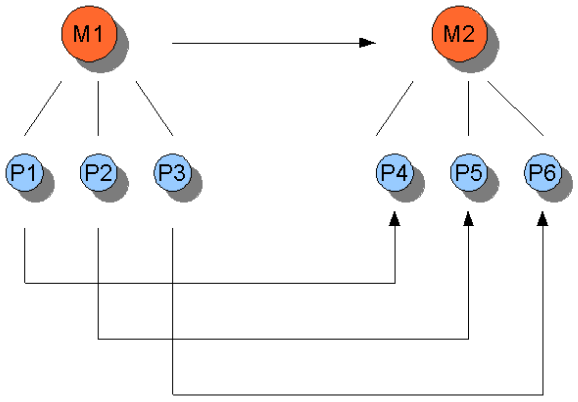

Diagram 1: Multiple Realizability

Multiple realizability is a *possible* description of reality, but it is not necessarily always an accurate description. Neuroscientists for decades have been able to delineate insights into human behaviors by looking at the brains of various types of mammals, such as macaque monkeys, dogs, etc. Contemporary neuroscience assumes a continuity in neural mechanisms between species. If it did not and multiple realizability was a genuine concern, how could neuroscience research bear fruit by looking at other species?[94] Put simply, why should imaging studies of the brains of humans and monkeys, or between humans, with resolutions capable of deducing activity at the millimeter level, show common areas of activities when psychological

[94] Bickle 1998.

tasks are performed, show common metabolic activity in common areas of the brain? If multiple realizability was a significant problem, neuroscientists would be, as Bickle points out, "hopelessly naïve": "But these procedures and tools do work (and are not hopelessly naïve)."[95] This suggests that psychological outputs are not as multiply realized as some philosophers of science would suggest. Indeed, the whole SN enterprise, in a sense, is a testament to dispelling the significance of the multiple realizability anti-reductionist argument. The neuroscientific goal has been to:

> show how functional considerations get built into developing the structural taxonomy and how that taxonomy in turn can be a heuristic guide in developing information-processing models. This project has not been impaired by multiple realization of psychological states; rather, it relies on the assumption that there is a common realization of mechanisms for processing visual information across species.[96]

What the multiple realizability argument is useful for is a corrective to those theorists who believe that one can simply dig deeper, find a mechanism, and think that this mechanism explains a social behavior. Consider the example above regarding an individual who exhibits aggressive behavior. While it is undoubtedly true that this aggression can be "realized" by any number of causal mechanisms, such as territoriality or brain tumors, digging into the potential explanations elucidates which ones are supported (i.e. was there a brain tumor or not?) and which are not. This is consistent with the principle of *nonadditive determinism* identified above. It would be a mistake to argue that the properties of the whole (the individual in this case) is predictable based on the micro foundations of chemicals *unless* we have ruled out other explanations at various other levels (i.e. territoriality). IR, in contrast, often assumes that because of the potential condition of multiple realizability, digging deeper is unhelpful from an

[95] Ibid.
[96] Ibid, 201

epistemological perspective; the multiple realizability in a showstopper, so to speak. This misunderstands the very nature of social neuroscientific inquiry: the goal is not to reduce all behaviors to chemicals and genes, but rather to elucidate the chemicals and genes that may be playing a role *when other levels of analyses are understood*.

Most importantly, the multiple realizability argument dismisses the principle of *reciprocal determinism* identified above. Bell asks how biology can inform anything as complex as politics conducted in a cultural environment. This assumes a view where biology produces an output and culture modifies it. This is a common interpretation of biological insight: biology predisposes us to certain behaviors but through culture and socialization ultimately those predispositions are overruled, so to speak. Reciprocal determinism suggests that there is an interaction effect occurring between culture and biology. Culture and socialization do not *replace* biological effects, but rather help to constitute them. Martin Seligman and Steve Maier in 1967 conducted a seminal experiment that illustrates this principle.[97] They created three groups of dogs and placed them in harnesses. Group One was put into the harness and then released a short time later. Groups Two and Three consisted of what Seligman and Maier called "yoked pairs." A dog in Group 2 would be subjected to pain through an electric shock. The dog could end the shock by pressing a lever. In Group 3 the dogs were wired, in parallel, with the Group 2 dogs and received shocks of identical intensity and duration, but pushing the lever in Group 3 did not stop the electric shock. For a dog in Group 3 the shocks were thus more or less random; nothing the dogs did would stop the shock. This Group 3 condition caused what Seligman and Maier referred to as "learned helplessness." The dogs would realize eventually that they could do nothing to stop the shocks and would exhibit symptoms, both physiological and social, similar to those found in clinical depression (they did not eat, did not play, did not socialize with each

[97] Seligman and Naier 1967.

other, etc.). In a latter part of the experiment the Group 3 dogs were placed in a shuttle-box apparatus where, to escape the shocks, all they had to do was jump over a low partition. The dogs that learned to be helpless did not jump, they merely laid down passively and whined. Similar experiments have since been replicated with humans.[98]

What the learned helplessness paradigm suggests is that contrary to what some have interpreted the interaction of culture/socialization and biology as being, namely the former updating and reflecting on the latter, the two are tied and constituted together. This informs the multiple realizability argument because it suggests that the argument is fundamentally mis-specified in some respects. The notion of particular configurations of lower levels *leading to* the same outcome misunderstands the reciprocal relationship between lower and higher levels. Lower levels do not *lead* to anything per se. Lower level and higher level action do. Thus, while it may be the case that higher levels could interact with a variety of different lower level configurations and produce the same outcome, it is also the case that multiple configurations at the higher level could result in similar lower level outcomes. Therefore, significant attention needs to be paid to *both* levels. The multiple realizability argument is not a boon for those who study higher level aggregates; indeed the SN findings suggest that multiple realizability need be a concern of all researchers attempting to explain social outcomes.

Perhaps most important from an IR perspective, reciprocal determinism calls into questions any approach that assumes a universal human nature or infinitely malleable individual. If the individual possesses certain genetic predispositions (perhaps a "human nature") but those predispositions are updated and constantly under refinement from the environment, as the neuroscience findings would suggest, this belies any universal claims about human nature that materialists would make. The brain is not a blank slate that functions according to, for example,

[98] Finkelstein and Ramey 1977.

self-interested logics, nor is it purely a blank slate that awaits being written upon by the environment. Instead, "the brain possesses several different, emotionally directed, problem-solving mechanisms with several different inferential patterns that evolved from past interactions with ancestral environments and that it is wired and rewired throughout life by its interactions with its current environment."[99] As will be discussed below, this has significant ramifications for what a SN-inspired IR might look like.

Bringing it Together: What Does a SN-Informed IR Look Like?

We can, at this point, start to build a structure of what a SN-informed IR would look like and begin to assess the promise of SN for IR theory. The following table highlights several of the IR perspectives on determinism and SN's corollary perspective:

IR Problems of Determinism	**SN Principled Response**
Macro vs. Micro Structures	Multiple determinism
Multiple realizability	Nonadditive determinism Reciprocal determinism
Hierarchical organization of systems (higher levels replace lower levels)	Heterarchical organization (higher levels represent rerepresentation of lower levels)
Self-interest vs. "Blank Slate"	Reciprocal determinism

The analysis of determinism in SN and IR suggest that the former can aid theorists of the latter in a number of ways. I will highlight three areas here: gaining purchase on the mind-body problem as it relates to social science; a middle-ground adjudication of claims about human nature; and, a new level sub-individual level of analysis to inform our assumptions and hypotheses. I turn first to the mind-body problem.

[99] Long 2006, 83; Damasio 2000; LeDoux 1996.

As Wendt's *Social Theory* makes clear, a strict materialist view of the international system is problematic. The distribution of ideas, just like the distribution of material capabilities, is important in constituting the structure of the system. Indeed, material, at some level, is rather meaningless without a particular idea, or set of ideas, attached to it. But this argument puts the relationship between ideas and material at somewhat of an awkward position. Just how much do ideas matter? When do ideas stop and material begin? These questions are tricky not just for IR scholars but philosophers as well. Cartesian dualism, the idea of irreducible separation of mind and matter, is intuitively appealing but problematic. So problematic, in fact, that as Wendt notes, few take it seriously anymore.

One option for getting around the problem is quantum physics. This approach is helpful because quantum provides a very different ontology of the world than does classical physics. Indeed the mind-body problem seems to *only* really be a problem for the classical world. Reality, in quantum, is not "out there" independent of human involvement but rather is represented "as an immaterial wave of potential realities that only become fixed with material properties when the subject observes them."[100] This suggests the separation of subject/object and mind/matter is overturned.[101] This has a variety of ramifications for epistemology, causation, methodology, etc. But do we need to go so far as quantum physics to mitigate the mind-body problem? I suggest that a more materialist perspective, one that SN provides, can help us to bridge the mind-body gap. Admittedly, it may not do so as comprehensively as quantum does, but it allows us to *pragmatically* gain purchase on the issue without throwing the classical physics baby out with the bathwater.

[100] Long 2006, 83-84.
[101] Wendt 2010.

The place to begin is by questioning what the analytical, as opposed to meta-theoretical, problem of mind-body is for social scientists and IR scholars specifically. I argue that for most IR scholars the mind-body problem manifests itself not so much in grand questions regarding where to locate consciousness and so on, but on rather more pragmatic questions of how to navigate various approaches *that are already separated along dualist lines.* For instance, psychology seems to be separated from brain science along dualist lines, with psychology speaking of the mind and neuroscience speaking of the body. Similarly, psychology seems to be separated from sociological approaches along dualist lines, with psychology speaking of the individual (or "body" in some sense") and sociology speaking of society ("the mind").[102] The problem for IR scholars is that conceptualizing interaction between these levels is difficult not just methodologically or epistemologically (as noted above), but practically as well: how does one reconcile studying two things that are seemingly irreducible? SN can help us here by providing a new materialist perspective, one that starts with a unity of mind and body, but not in the usual materialist deterministic fashion.

A New Materialism

SN posits brain systems that are open to social and environmental updating, determination, and shaping. The principle of reciprocal determinism discussed above is crucial here. SN does not posit a traditional materialist view that everything social or ideational is caused by material, but rather that the social and ideational can cause the material, thus the reciprocal relationship between mind and matter. Work in neuroplasticity and neurogenesis exemplifies this point. The brain comes wired with a reliable structure, but it is malleable. "The brain's circuits have a structure that is weak enough to yield to influence, but strong enough not to yield all at once. The

[102] Cromby 2007.

brain is relatively stable, but its microstructure and functions can be altered."[103] Neuroplasticity refers to the altering of connections (synapses) in the brain. Scientists have known about the brain's capacity to change when it comes to storing memories, but recent work in cross-modal functional plasticity shows that the actual function of brain areas can change in response to injury or other adaptation. Importantly, "mind" events can help to shape this rewiring. Certainly experiences, such as the learned helplessness paradigm discussed above can have this effect. Amazingly, imagined events can as well. Imagined movements, for instance, if repeated enough and with great concentration, have been shown to produce the same synaptic changes as real movements.[104] One can literally use the mind to willfully shape the brain.

This materialism is a different variety than the traditional materialism that the mind-body problem critiques. Traditional materialism would hold the view that mental processes are the byproduct of brain processes; our thoughts and actions should be reducible to pure physical processes. The new materialist view that SN informs suggests that this is misleading. If the mind can affect brain in a reciprocal relationship, then the traditional materialist approach has mis-specifed the direction of the causal arrow. It should be noted that this is consistent with the findings in quantum theory as well. It too posits that the mind can affect the structure of the brain. But we need not adopt a quantum ontology to be able to use the insight from this new materialism. Indeed we need not take a stand on classical vs. quantum physics at all. The SN inspired materialism brackets that discussion in favor of a more pragmatic approach: regardless of whether classic is right or quantum is right, we now know that mind can affect the brain and this will have significant implications for how we theorize about IR outcomes.

[103] Long 2008.
[104] Schwartz and Begley 2003.

First, any claims about a static human nature will need to be reanalyzed. If the brain is constantly rewiring itself in response to environment and mind, human nature at the very least is not static nor is it fixed or determined. Rationalist claims about the "self-interested individual" as a claim about a universal human nature are problematic.[105] Any claims about our desires for power, or *animus dominandi*, like those sometimes made by realists,[106] should also be re-evaluated. The problem is *not* that individuals are not generally self-interested or not generally for maximizing domination; they may very well be. But the lack of a fixed human nature would suggest that scholars can no longer take such perspectives *as assumptions*. The claims become empirical ones. It is possible that individual brains come wired for self-interest or power-maximization. But we now know that this may be rewired over time. As such, those making claims about a human nature must account for the new dynamism of mind/brain interactions. The promise of work in this area is substantial. Rose McDermott has begun to elucidate the precise conditions under which emotional processing is involved in decision-making processes. Rather than assuming strict rationality or strict emotional processing, McDermott has changed the contours of the human nature debate; the key empirical question is not *if* there is a static human nature but *under what conditions* aspects of our human nature affect decision-making.[107]

One example of where this is paying dividends is the intersection between economics and philosophy. Economists and philosophers have long struggled with explaining stable departures from utilitarian thinking. The infamous "trolley experiments" have consistently shown that individuals will choose to route a train such that it kills one person while saving six others. However, individuals are normally unwilling to push a person off a bridge in order to stop the train and save six people down the track. In both instances the number of people killed and saved

[105] Becker 1976.
[106] Thayer 2004.
[107] McDermott 2004.

is identical, yet the decision varies.[108] Rational choice theorists have had difficulty explaining this variance in outcome, yet new research in SN is shedding light on the neural correlates of the decision. One of the key questions for not only this particular departure from utilitarian judgment, but any move away from rationalist prediction is what type of processing is taking place of rationalist processing? Is it a strong emotional response to actively killing someone? Is it a moral judgment that is underway? Brain imaging has helped scholars of this problem hypothesize that there is a "dual-process" involved with moral judgments: some moral judgments are driven by emotion, others by cognitive process. When lesions are applied to the medial prefrontal cortex the likelihood of utilitarian judgment increases.[109] Similarly, manipulating cognitive task load has effects on utilitarian processing.[110] Thus in this instance SN has helped scholars move beyond assumptions of rationality and divergences from rationality to explain the precise *mechanisms* behind those diversions. Ultimately this research contributes to a broader discussion across disciplines about our human nature and decision-making.

Similarly, just as any claims about a static human nature need to be reconsidered, so to do claims regarding an infinitely malleable one need to be reanalyzed for the same reason. Our human nature is apparently *not* a blank slate waiting to be written upon by experience. A constructivist who argues that human nature is socially constructed and deeply separated from any underlying physical reality would have to deal with the SN evidence that suggests our human natures are emergent from brain structures and processes. At this point the constructivist claim about malleability of nature can come in, but the underlying physical reality must be dealt with all the same. Recent work on the "logic of habit"[111] and "logic of practicality"[112] addresses

[108] Greene et al. 2001.
[109] Koenigs et al. 2007.
[110] Greene et al. 2008.
[111] Hopf 2010.

precisely this interplay between a malleable human nature derived from process and ideational intersubjective structures. Ted Hopf illustrates how habit's microfoundations in neuroscience help to explain fundamental puzzles in IR, such as the nature of cooperation, security dilemmas, and security communities. Each of these explanations involve elucidating the causal effect of the material level (i.e. the neural) and the ideational level (i.e. intersubjective structures). This moves us beyond static debates about what matters in IR, material or ideas, to an understanding of precisely the two interact with each other.

Second, this new materialism suggests that we need to take seriously the notion that what we consider to be ideational or "mind" concepts may not only have physical roots, such as habit, but these roots can change with experience. This may severely challenge the assumptions we make about ideational concepts. Consider an ideational concept such as identity. A SN materialism suggests that the underlying basis for creating identity is in our brains. This is not a weak claim similar to "everything is in our brains," but rather a very strong one since the apparatus involved in creating a sense of identity can tell us something about identity itself. For instance, one of the claims in this article is that identity is materially created through a shared circuit of two (or many) individuals' neurons firing together. The explanatory leverage here is that we can explore empirically how and when these neurons fire and what changes occur through neuroplasticity over time. In a seminal article in *Nature Neuroscience* Elizabeth Hoffman and James Haxby demonstrated how notions of identity are strongly linked to face perception and face-to-face interaction.[113] Subsequent work has noted that responses to faces change at a physical level over time, originally invoking regions of the brain used in processing strangers (the "Other") and gradually invoking regions used in processing thoughts of the

[112] Pouliot 2010.
[113] Haxby and Hoffman 2000; Haxby and Hoffman 2002.

"Self."[114] Further, recent research with so-called "mirror neurons" has demonstrated links between observation of others and intentional action.[115] This emphasis on face-to-face interaction has significant consequences for personal diplomacy and the role of the individual in the international system. If better understanding of political intentions can be gained through increased face-to-face interaction, then there are important arguments, both explanatory and prescriptive, for when face-to-face should be utilized.[116]

Finally, there is an astounding performative implication of the new materialism for the international system. William Long has pointed out that if we take seriously the claim that the brain can be rewired through the mind, as SN suggests we should, then ultimately our human natures are *what we train them to be*.[117] Put simply, if we assume that we are indeed born with a brain structure predisposed to selfishness, anger, and fear (perhaps because this is what is evolutionary advantageous in natural selection mechanisms), but we can train ourselves out of those predispositions, this gives agency sharper teeth. Our brains, as Long puts it, are "as selfish or as altruistic as our mind trains [them] to be, and our behaviors and actions are our responsibility."[118] This is a stronger claim than saying that we can tell our genetic predispositions to take a hike. This claim suggests that we can tell our brains *what we want our predispositions to be*. If one is inclined to argue that individual psychology can have an effect on the international system or at the very least international political outcomes such as continued fighting in long-standing conflicts, this finding provides new evidence of performativity in the system and a renewed emphasis on actor-centric theory. Normatively, it may also provide

[114] cf. Gobbini et al. 2004; Uddin et al 2005; Tanaka and Pierce 2009.
[115] There is a very large literature on mirror neurons and the links to intention understanding. For a review see Iacoboni 2009.
[116] Holmes 2011.
[117] Long 2006, 90.
[118] Ibid.

optimism for the future state of the system. The closest link between this idea and IR theory development is in Alex Wendt's argument that the international system exists in the minds of individuals.[119] If we accept a somewhat different notion of the physical and ground consciousness in quantum mechanics, an admitted "bet" at this juncture in the quantum literature, then it may be the case that the ontology of the social world is a flat one, where the "real" realities exist not out there in objects such as states, but in the virtual reality of individual minds. Therefore if the international system is in the minds of individuals, then this suggests a performativity regarding what that system looks like.

Conclusion

This article has attempted to reach two broad goals. First, it creates a framework for how we should think about the incorporation of biological generally, and neuroscientific specifically, findings into IR This has included two distinct questions. First, what is the overarching epistemological argument for the applicability of the biological sciences to IR? And second, assuming there is a compelling epistemological argument, how should we go about updating or reconstructing theory to include these findings? This has been done by arguing for two distinct trajectories of incorporating biological insights, top-down and bottom-up approaches. In the top-down model we update our theories when SN findings challenge an assumption or provide us with another variable to test. The emphasis is on making the theory more congruent with the underlying physical reality. In the bottom-up model we build new theory from the ground-up because a SN finding has elucidated a reality constraint which extant theory cannot explain away. In these instances IR must "turn back the hands of time" and reconstruct theory in light of

[119] Wendt 2010.

the new reality constraint. Which pathway is chosen will depend on the research question and the challenging evidence accrued from SN discovery. An ecumenical approach has been suggested.

The second broad goal was to defend this general framework against potential criticism. This is not easy as the criticisms are diverse and many are valid. Once again it was noted that the extent to which the criticisms apply will depend on the research question and method. There is not, nor can there be, a single epistemological justification for "digging deeper" that applies to all questions. Nor would it be desirable to have an epistemological response that deflected all criticisms. Instead, I have addressed common criticisms in political science by noting that SN has heard many of the same criticisms within its own discipline and has had to deal with them. Questions such as multiple realizability, the determinism of neural substrates, the problem of multiple-level analysis, etc. are not new to scholars of the brain. Indeed these questions have spurred foundational principles of the field. Rather than attempting to address all criticisms in a new way, I let SN do the talking, so to speak, by applying their core principles to the problems political scientists have identified. The result, I believe, is a justification for the framework that relies not on grand-theorizing and novel arguments, but careful use of what SN has been discovering for decades through introspection.

More specifically the article has outlined a framework for what a new SN-inspired IR should look like. The framework starts by suggesting that the mind-body problem is not just a theoretical issue for philosophers, but rather a deeply pragmatic issue for anyone who attempts to bring such fields as psychology and sociology together. As this represents at least two of the "images" we normally study in IR, this problem affects much theoretical work. We continually run into the problem of how ideas are constituted, when they stop and material begins, and so forth. SN helps us here by suggesting that for many of the types of questions IR is interested in

answering, we can take a materialist approach. But there is a significant twist here. The "new materialism" of SN suggests not a determinism of the ideational by the physical, but rather a dynamic and reciprocal relationship between the two. The mind and ideas affect and re-wire the brain, thus serving to create two causal arrows between mind and matter. This, I argue, has very significant implications for the study of IR in both bottom-up and top-down approaches. I have provided instances in the literature where this type of investigation is already in process and has produced significant new insights into old, vexing puzzles.

At the end of the day, if our brains are what we train them to be, many of IR's favorite claims about our human nature need to be reanalyzed. Perhaps even more importantly, many of our ideational concepts have physical manifestations that we need to understand. We have yet to look at these physical roots because we have adopted a dualist position of mind and matter being fundamentally irreducible. With a dualist position there would be no reason to investigate the underlying physical correlates of something like identity. But adopting the dualist position has meant that we have bracketed off half of what SN tells us is relevant for understanding social behavior, the physical components. In the end, Cartesian dualism has obfuscated our thinking of social outcomes in certain areas and it is necessary to rescue materialism in an updated form in order to gain additional explanatory leverage.

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