The Self-Organizing Social Mind

John Bolender

foreword by Alan Page Fiske

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Foreword

Thoughts about thoughts about thoughts about social relations . . .

In this extraordinarily original book, John Bolender outlines not simply a new explanation of the forms of social relations, but an entirely new *kind* of explanation. Science is the process of looking for patterns, and Bolender describes a fundamental set of patterns—and patterns of patterns—in social life. He explains the fundamental structures of social life—and the systematic relations among them—in terms of their symmetries and the breaking of those symmetries. Electrons are symmetrical to positrons; matter is symmetrical to anti-matter. Symmetries structure crystals and galaxies, the movements of planets and the oscillations of waves, the shapes of flowers and seashells, the anatomy and the locomotion of animals. Bolender draws our attention to the symmetries of social relationships and observes that some relationships are more symmetrical than others. Moreover, the symmetries of some relationships are subsets of the symmetries of other relationships, such that when one of the symmetries of a relationship is broken, the remaining symmetries form another type of relationship. So the symmetries of the four fundamental types of social relationships are ordered in a nested series. In short, Bolender shows that symmetry breaking—a fundamental principle of physics—also structures the universe of social relationships—or, actually, the cognitive models for social relationships and, he plausibly argues, patterns of neural activity that generate the relational models.

When I set out relational models theory (Fiske 1991), I underlined their homology with the four basic types of measurement scales and suggested that their homogeneity and uniqueness under specific transformations also makes them especially well suited to coordinating social relations. I observed that the respective relational models formed a descending, nested series with successively fewer degrees of uniqueness. (For a bibliography of research on relational models, see www.rmt.ucla.edu.) Bolender points out that what measurement theorists call uniqueness under a transformation is what physicists call a symmetry, and that the four fundamental relational models are linked to each other as a chain of descending symmetry subgroups—the property of structures that result from spontaneous symmetry breakdown. Thus he brings sociality into the realm of brain physics.

This chain of symmetries explanation is entirely distinct from theories of sociality based on natural selection, behavioral ecology, genetics, neuroanatomy, neurochemistry, learning or socialization, ontogeny, culture, economy, or communication. In a certain respect, it is a deeply cognitive account, but it takes an entirely novel approach to cognition. Great scientific advances are based on conceiving entirely new approaches to basic phenomena, often by applying perspectives from fields previously thought to be distant to the phenomena at hand. Bolender's approach is entirely new to social science, although it is fundamental to physics and evident in biology as well. Recognizing these nested symmetry subgroups does not deny other sorts of patterns in human life, but provides new insights that in turn raise intriguing new questions. In particular, Bolender's analysis of symmetries and asymmetries in mental representations of social relations forces us to consider whether this explanation contradicts existing theories, and in any case whether it is a better explanation than existing theories. If it complements existing theories, we have to figure out how the theories fit together.

My view is that to fully understand any phenomenon—and certainly to understand social relations—we need to understand how human relationships are shaped by cultures, biology, minds, *and* physics. I believe that social relations are joint products of all of these processes. What Bolender does is to show that there is a truly fundamental self-organizing physical process underlying social relationships that has hitherto been ignored. And he links this fundamental physics to neuropsychology, hypothesizing that the structures of social relations are produced by a pattern generator in the brain. In any case, Bolender transcends the divide between structural and dynamic explanations: mental representations of social relations are structured by symmetries, which break in determinable order, yielding descending subsets of previous symmetries. This theory thus explains what is simple in social relations and it explains how—and in one sense why—more complex forms of social relations emerge.

In contrast to nearly all previous accounts of social relations, it is not a functional account. Indeed it offers an account of the neurocognitive bases of sociality that in some respects aims to displace, and in other respects complement, adaptationist functionalism. Bolender's discussion of the respective roles of physics and natural selection in the genesis of mental representations of social relations is sophisticated, well informed, and challenging. It will make some functional-adaptive evolutionists squirm (it made me squirm), but it will make everyone think more deeply about what evolution explains, what it doesn't explain, and how the two fit together.

My own view is that natural selection "utilizes" the symmetries and symmetry-breakdowns of physics for their adaptive functions—but only when they *are* adaptively functional. From this point of view, the symmetries of limbs and gaits are products of natural selection working in a world whose physics determines that efficient but flexible locomotion requires symmetrical support and motion. In water, the physics is different; the most efficient but flexible locomotion there favors a different symmetry, that of a single oscillating tail. In several phyla, natural selection independently converged on oscillating tails for swimming, and in several other phyla converged on symmetrically gaited legs for walking. Some phyla have actually gone back and forth between the two realms: the remote ancestors of mammals swam, but some mammals re-entered the water and re-evolved swimming tails. Cetaceans eventually lost their external limbs. Neither physics alone nor natural selection alone can explain these symmetries, or their history, but the interaction of physics with natural selection does explain them.

What about the structures of social relations? Bolender takes a bold position about the implication of the symmetries of social relations and their chain of symmetry breaking, inferring that these patterns imply that social relations result from physics, not natural selection. I hope that future discussions building on Bolender's analysis will consider whether symmetry and symmetry breaking sequences in the structures of social relations could be constructed from experience, either during one lifetime or cumulatively over many lifetimes in conjunction with cultural transmission or through natural selection. That is, would it be possible for a person, a society, or a species to discover that these four particular structures "worked better" than others? If so, would natural selection, operating though a process of Baldwinian selection, assimilate this experience into the prior expectations built into the organism? Likewise, are these forms of coordination more stable or more efficient than others? Such functional advantages might result from the coherence of their symmetries.

For example, market pricing has the structure of an Archimedean ordered field, or a ratio scale of measurement, so that it is unique up to multiplication by a positive constant. As Bolender discusses, multiplying all values by the same positive number has no effect on the structure; in a market system, prices, wages, rents, and interest rates remain the same if the currency inflates uniformly or a new currency is adopted. Surely this is a functional advantage. Likewise, equality matching has the structure of an ordered Abelian group, or an interval scale of measurement, so that adding a constant does not change the social relations. Thus if you and I each take a turn, our relationship is unchanged; if we were even before, we're even again; if I owed you two before, I still owe you two. These symmetries—the uniqueness of these structures under specified transformations—may be important functional advantages in organizing social coordination.

I also wonder whether these symmetries (and their breakdowns) could arise from cognitive or communicative processes, if their symmetrical structures made them easier to remember, think with, compute, recognize, represent, or signal. The first and only paper I ever wrote in philosophy, as a first-semester freshman at Harvard, argued that the only aspects of reality that humans could comprehend were those that consisted of wave-like patterned regularities—what Bolender has now shown me are symmetries. I may have been wrong about that: Professor Aiken gave me an "F" on the paper. But I still wonder if symmetries are functionally essential to cognitive representation, memory, and communication. We need to consider what functional advantages symmetrical forms may have under what conditions. More generally, this book raises the foundational issue of when functional explanations work, when other kinds of explanation are better alternatives, and when we need to integrate explanations based on physics (such as chains of symmetry breakings) with various functional and other types of explanations.

It is also conceivable that these symmetrical cooperative structures are stable equilibrium points of coordination systems that somehow emerge from the dynamics of competitive social interaction among selfish agents. These equilibria might not be functionally advantageous for individuals or for the group, yet still be attractors, the way that a standing wave tends toward certain frequencies under given conditions, such as the vibrations of a given length of piano string at a given tension. If so, one could search for the conditions under which these equilibria are disrupted and the social system becomes unstable until it reaches a new equilibrium compatible with the new conditions. This might help us understand why certain symmetries break before others.

More generally, I think we should *attempt* to explain the conditions under which specific symmetries break down—we should see if we can go beyond the idea of "spontaneous" symmetry breaking. This would deepen our understanding considerably, because to label a symmetry breaking as "spontaneous" is merely to state that it is inexplicable. We may not be able to do this; Bolender makes a persuasive case that symmetry breakdowns truly are "spontaneous." But we need to try, or, if possible, to show analytically why, in principle, they are inexplicable.

Because specious pseudotheories of the mind and society abound, there is a risk that serious thinkers will pass up this book, assuming that physical principles simply cannot give rise to social relational cognition. Construing social relations as patterns of successively breaking symmetries in the brain is, of course, deeply reductionist, and many social scientists, let alone humanists, will dismiss the possibility of this sort of deep reductionism without ever opening this book. That would be a mistake. If the thesis of this book is wrong, it is certainly not poorly grounded, naïve, or illogical; this book is very firmly based in empirical science, it is sophisticated in its theory, and it is reasoned with the logic of a well-trained, subtle philosopher. In fact, this book is a work of creative genius. Everyone who wants to understand the mind and society will have to take it seriously. But that does not mean that it is heavy going: quite the opposite, this book is a pleasure to read. The ideas are deep, but the writing is superb and the subtle theorizing is easy to follow. And there is treasure to be found at the end: imagine being able to explain to your friends why social relational models are more basic, indeed more necessary, than logic itself! If Durkheim must be grinning, Socrates' pupil must be positively glowing to learn that relational models are Platonic forms.

This book lays the foundation for a whole new paradigm for social science. New paradigms open up new vistas to explore, and the frontiers of descending chains of mathematical groups in relational cognition await the pioneers who will discover what they offer. My hope is that the settlers who follow will build on these discoveries and connect them to the classic and emerging paradigms of social science, eventually constructing an integrated, encompassing metatheory. I could go on, but the more I write, the longer I delay the reader setting out into the beautiful landscapes of this book. This book is going to set people to thinking about the physics—and even the metaphysics—of sociality and stimulate fruitful debates about causality in human behavior. Read it and debate!

Alan Page Fiske

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This book began as an attempt to expand upon two articles of mine (Bolender 2007, 2008), although I believe it has gone well beyond that. Parts of these articles will nonetheless crop up occasionally in what follows, although typically very much remolded. I thank the publishers of *Psychologia* and *New Ideas in Psychology* for permission to reprint.

Introductory Chapter

There is reason to suspect that there are deep necessities in how humans mentally represent social relations.

Some necessities are deeper than others. One and one equal two. That is either absolutely necessary or as close to being absolutely necessary as we need to get for present purposes. Very little, if anything, needs to be assumed to appreciate the necessity of two equaling one plus one. On the other hand, there is also some sense in which the Wall Street Crash of 1929 was probably necessary. But, if so, it was necessary only relative to certain events and generalizations about human behavior that were themselves only necessary relative to certain other events and other generalizations, and so on. If the Wall Street Crash of 1929 was necessary, it exhibited a relatively shallow necessity. In other words, a lot is required to get the necessity going.

Between these two extremes, there are degrees. It is not conceptually impossible for light to move in complex tangled patterns. Its moving in such a way would not be like one and one equaling three. But there is a simplicity and neatness in its traveling the shortest distance between two points. Light taking the shortest distance doesn't seem to need much or any explanation; if light were to take a complex path, this would cry out for explanation. This is a relatively deep necessity, because it is the simplest possible arrangement. Physicists have found that expecting to find deep necessities is a good research strategy in devising theories.

Part of this deep necessity is symmetry. Symmetry is a kind of inevitability and hence a kind of simplicity. "Consider a snowflake. It is beautiful and symmetrical because it remains the same when we rotate it by 60 degrees. But more important, this symmetry is also extremely practical. If we are only given a piece of the snowflake, we can reconstruct the entire crystal by repeating a piece of it six times" (Kaku 2005). Symmetry is sameness; once again, a kind of simplicity.

Expecting to find symmetrical equations in laws of nature—in other words, equations with interchangeable values—has proven to be the right research strategy even when it superficially seems to clash with the evidence:

> When faced with two alternative equations, one ugly, one beautiful, physicists choose the more beautiful. It has happened several times in the history of physics that the ugly equation, rather than the beautiful one, agrees with experiment. But later, it would turn out that the experiment was performed incorrectly. The ugly equation was wrong. It has also happened several times that physicists later discovered that the ugly equation is only an approximation of a more exact and beautiful equation. (Zee 1992, 816)

There is evidence of such deep necessities in biology. One example is the tendency of the protein coating of certain viruses to take the shape of an icosahedron. In the case of the adenovirus, genes manufacture proteins that will make up the capsule that encases the viral genetic material. Natural selection is a huge factor here; genes encode adaptations to the ancestral environment. But adenoviral genes give no instructions for forming the proteins into a shell. The proteins self-assemble into a shell. In so doing, they inevitably form one of the most beautiful shapes, an icosahedron—one of the two most symmetrical of the Platonic solids. Another likely example is the repetition of logarithmic spirals, not only in organic structures such as snail shells and sunflower florets, but also in inorganic structures such as spiral galaxies.

If it seems strange or counterintuitive to speak of such deep necessities in thought, that is probably due to an unconscious tendency to see the mind as radically set apart from nature, especially inorganic nature. To a lesser extent, we even tend to think of life as set apart from the rest of nature. Are such tendencies reasonable? They are less reasonable than they used to be. If there was a time when social psychology failed to reveal symmetries in its empirical work, that time has passed. The core of social-relational cognition evidently exhibits beauty, as physicists use the word "beauty," a concept to be expounded upon as we go along, but which for now one can equate with symmetry. The point of the book is to defend and reflect upon this claim.

The first step in appreciating the beauty in social cognition is to understand the importance of thinking about *relations* in social cognition. Social cognition is classically conceived as interpretation or perception of another person. Gordon Moskowitz, for example, describes social cognition as “interpersonal perception.” He continues by noting that “the main concern of this area of investigation has not varied—analyzing processes of attribution. An *attribution* is the end result of a process of classifying and explaining behavior in order to arrive at a decision regarding the reason or cause for the observed behavior” (2004, 3). In the same spirit, social cognition has been characterized as “how people think about people” (Wegner and Vallacher 1977, viii), and as “the process of understanding or making sense of people” (Worchel, Cooper, and Goethals 1989, 50).

There have been other definitions of social cognition as well (Newman 2001). But even if one keeps to the classic definition of social cognition as person perception/interpretation, thinking about relations between people still proves to be an important part of social cognition. Thinking about relations between people plays a big part in how one perceives other individuals. A number of psychological studies have supported this claim, as will be discussed in sections 3.5 and 3.6. Even though thinking about individuals is powerfully shaped by one’s thinking about relations, I don’t want to risk any confusion. So I will use the term “relational cognition” to mean thinking about social relations.

In this book, I try to show that there are deep necessities in how we conceive of social relations. There is something inevitable in it, a sort of inevitability closer to 1 + 1 = 2 than to the Wall Street Crash of 1929.

In a way, deep necessities in relational cognition are exactly what one would expect. But, in yet another way, they are very surprising. First of all, why would they be expected? Why would it be unsurprising that relational cognition would be beautiful? Answer: the mind is physical, and physics is the science of the physical. Given that we find deep necessities in physics, we expect to find them in the social mind, too. All relevant controlled evidence supports the view that the mind is wholly to be accounted for in terms of states and processes best described and explained using the vocabulary and laws of physics. This includes the social mind. Relational cognition is mental, and it certainly looks like the origins of the mental are wholly biological, both with regard to the growth and development of each individual and with regard to the evolution of the species. Things began for you on the monocellular level; you were at first a fertilized ovum. Your development and growth were wholly a matter of the gathering together, loss, and replenishment of molecules as governed by laws of physics. This includes the growth and development of your brain. It is extravagant and unnecessary to suppose that additional processes and additional laws, such as those involving "spiritual beings"—whatever that is supposed to mean—played a role. This is consistent with the fact that the most direct and reliable way to affect the mind is to manipulate the brain. In other words, impinging on the brain, in ways that would make a difference from the viewpoint of physics, is the surest way to alter the mind. The examples are all too obvious: alcohol, hallucinogenic and mood-altering drugs, head injury, loss of blood, oxygen deprivation, and so on. Furthermore, given current neuroscience and the science of perception, it would certainly seem that the most reliable way to alter a subjective sensory experience, at least in principle, is to control the activity of the brain in ways that can ultimately be described and understood entirely in terms of physics—for example, electrical stimulation of brain regions.

Analogous points apply to the evolution of the species. Life was initially monocellular; most plausibly wholly explainable in terms of things, states, and processes best understood in terms of the laws of physics. Evolution was just a matter of physical materials combining in ways, which are also physically explicable, to yield more complex assemblages. At no point in the process does it appear that anything outside the realm of physics entered in. In addition to the evidently physical nature of human ontogeny (growth of the individual) and phylogeny (evolution of the species), also note that the physical sciences have displayed great success in explaining phenomena at what look for all the world like all levels of organization from the subatomic to the galactic (cf. Oppenheim and Putnam 1958).

Here is a pretty direct way to put the point. Once upon a time, there was no brain. To put it roughly, but not misleadingly at all, things smaller than brains gathered together in such a way that brains formed from them. These smaller things and their gathering together were wholly physical. Given that wholly physical causes have wholly physical effects, then the brain and its processes are wholly physical. Given that thought is most plausibly understood, for reasons given previously, as a feature of the brain, one expects thought to be understandable in wholly physical terms.[1]

Physics is beautiful. Thought should be too; it should exhibit deep necessities. This includes the social mind. It should be no surprise to find beauty in relational cognition.

But, to the contrary, it really *is* surprising. Why? It has become a popular slogan among many biologists and cognitive scientists that "Nothing in biology makes sense except in light of evolution" (Dobzhansky 1973), where "evolution" is usually equated with natural selection. Products of natural selection are noted for their lack of beauty; in other words, for their lack of deep necessity. From the viewpoint of natural selection, the necessity for the evolution of some organ is closer to the necessity of the Wall Street crash than to mathematical necessity. Given that relational cognition is biological, and assuming that nothing in biology makes sense except in the light of natural selection, then features of social cognition should exhibit quite shallow necessities. Although Shakespeare presumably knew nothing about natural selection, he was living in a time in which some people evidently considered biological necessities to be pretty shallow. In writing in the *The Tempest* of "mountaineers / Dew-lapp'd like bulls, whose throats had hanging at 'em / Wallets of flesh . . . [and] such men / Whose heads stood in their breasts," Shakespeare, at least through the character Gonzalo, seems to imply some very shallow biological necessities. The biological realm can toss out virtually anything, on such a view. François Jacob opens his famous article "Evolution and Tinkering" with a nod to the shallow necessities of sixteenth-century botany and zoology, with its "dogs with fish heads, men with chicken legs, or even women without heads" (1977, 1161).

Although the biology of the sixteenth century seems bizarre and quaint today, much of biology since Charles Darwin has been similar in its rejection of deep necessities. To quote the first and last sentences of the final paragraph of *On the Origin of Species*:

> It is interesting to contemplate an entangled bank, clothed with many plants of many kinds, with birds singing on the bushes, with various insects flitting about, and with worms crawling through the damp earth, and to reflect that these elaborately constructed forms, *so different from each other*, and dependent on each other in so complex a manner, have all been produced by laws acting around us. . . . There is grandeur in this view of life, with its several powers, having been originally breathed into a few forms or into one; and that, whilst this planet has gone cycling on according to the fixed law of gravity, from so simple a beginning *endless forms* most beautiful and most wonderful have been, and are being, evolved. (1985, 458–459; emphases added)

Necessities are shallow, on such a view, for two reasons: organs are adaptations to the ancestral environment, and that environment could have been any of a broad range of conditions. Furthermore, organs are concocted from whatever biological structures are already available, a process that Jacob christened "bricolage" (1977). The combination of these two factors is what Jacob has called "tinkering." A tinkerer, Jacob tells us, will not arrive at an ideal design but will rest content to produce something that scrapes by. It will not optimize, maximize, or minimize, but just make do, and there are potentially very many ways of doing that.

A classic illustration of shallow biological necessity is the structure of the middle ear (Gould 1993, chap. 6). There are three middle-ear bones in mammals. One of them, the stirrup, once served to brace the jaw against the braincase in fish. Later, it served to support the gill in jawless species of fish. So what was once a jaw brace evolved into a hearing organ. It was a stroke of luck that such a bone was available to be used for hearing. It was also a stroke of luck that the bone was near the otic capsule of the inner ear and that the bone happened to be a good transmitter of sound. Change any of these antecedents even to a small degree, or the ancestral environment for that matter, and one would have a very different sort of hearing organ. Biology as a field of study, at least in this sort of case, is a kind of history. Despite heroic efforts by Hegel and Marx, no one has convincingly shown that historical events are deeply necessary. Just as the Wall Street crash could have been avoided, so the evolution of the ear could have been otherwise.

The potential for endless forms is a challenge to the biologist trying to explain why a species, or an individual during its maturation, takes the specific form that it does:

> We face a fundamental limitation in defining objectively, let alone explaining, the overall developmental phenomena [from embryo to adult] in want of understanding. This limitation derives both from the historicity and the complexity of development. Because of the historicity, which arises from an animal embodying both its phylogeny and its ontogeny, embryologists are confronted with an ensemble of unique phenomena, about which the most general thing which can be said is that there are no non-trivial universals. This means that we cannot expect to discover a general theory (and especially not the "program") of development, no more than historians any longer expect to discover, as some once did, a general theory of history. Rather, we are faced with a near infinitude of particulars, which have to be sorted out case by case. (Stent 1985, 2)

In other words, biology can slap together almost any imaginable structure.

After hearing such remarks, it comes as something of a surprise to find certain forms commonly repeated, not only in the biological realm, but also through much of inorganic nature, the apparent implication being that some forms in biology are so deeply necessary that one finds them in the shapes of galaxies and in systems of low air pressure as well as animals' bodies. One example is the logarithmic spiral. Seashells, snails' shells, rams' horns, and the arrangement of florets in sunflowers form logarithmic spirals. But so do air pressure systems, and galaxies.

This book is an attempt to show that there are some very central aspects of relational cognition that are deeply necessary. They exhibit a kind of beauty more familiar from physics than from Darwinian biology. In some of its central aspects, the structuring of the social mind is more like the formation of a snowflake crystal than, say, the evolution of the middle ear or the eye. It may strike some as jarring, and perhaps even unreal, that etiquette, morality, fairness, jurisprudence, romantic love, racism, and nationalism, to name only a few aspects of relational cognition, could be so directly linked to the sort of process resulting in the formation of a spiral galaxy or a crystal. But what it illustrates, despite our intuitions to the contrary, is that there is a profound connection between mental and physical processes, including inorganic ones. The laws of the living are the laws of the dead. More specifically, the laws of the thinking are the laws of the dead.

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