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Why just these four ways of coordinating, and how *Homo sapiens* got them

Alan Page Fiske¹

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Invention, necessity, and innate knowledge

Many thousands of years ago, for some period of time, some population of some species of the genus *Homo* explored the possibilities for closely coordinating some sorts of social interactions. They may have had some sort of conscious intentions to coordinate better, or they may not have had that goal, as such. That is, potential benefits of close coordination may have been reflectively represented in the minds of the social explorers, or not. Most of the coordination schemes they tried would failed in one way or another. One obstacle to coordination is that it requires that all participants be ‘one the same page,’ with common knowledge of the scheme to be used. Another challenge to coordination is that it is impossible to foresee all eventualities, but all participants’ responses to any likely eventuality have to be computed in a corresponding manner. Otherwise, every new situation results in chaos.

So new coordination schemes were successful only if they were intuitive to all, because they were based on pre-existing nonsocial capacities with which they all were proficient. That is, technically speaking, the social coordination schemes were exaptations of prior nonsocial cognitive systems used for learning, foraging, navigating, time-keeping, and other ubiquitous individual activities. These prior cognitive systems include, respectively, categorizing into equivalence sets; ranking in linear orderings; matching one-to-one, with addition and subtraction (the relational structure called an ordered Abelian group); and computing ratios, rates, and proportions, with multiplication, division, and the distributive law (the relational structure called an Archimedean ordered field). All vertebrates and many invertebrates proficiently use all four of these cognitive schemas, and would not long survive without them (Olmstead & Kuhlmeier, 2015; Gallistel, 2011, 2022; Gallistel & Gibbon, 2002; Laurence & Margolis, 2024; Wiener et al., 2011). However, *Homo sapiens* is the only

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known species to use these schemas for social coordination, as such. It may have taken tens of millions of years or more for early organisms to have evolved the neurocognitive capacities to use these four mathematical structures to function nonsocially, but it need not have taken nearly so long for some early *Homo* species to borrow, reuse, and perfect them for social coordination.

The reuse of existing systems is a universal feature of evolution. Aquatic mammal flippers and avian wings evolved from limbs whose function was terrestrial ambulation, which had previously evolved from the flippers of their aquatic ancestors. Reuse is pervasive in neurocognitive evolution (Anderson, 2010, 2021). In all cases, it is far simpler, far more feasible, and far more reliable to borrow an existing functional system than it is to make an entirely new system from scratch. Then natural selection can copy the borrowed system, allowing the copy to evolve further specializations for its new functions. This is especially relevant to social coordination, where the prospective coordinators need to use the same schema to organize their respective actions, understandings, plans, motives, emotions, and evaluations. No matter how wonderful a new coordination scheme a person comes up with, it is of no use unless others ‘get’ it. This means that *the starting point for social coordination must be a schema that the participants share, and can be certain that they share*, and can be certain that they all know that they share.

Synchronizing the further elaboration of the coordination schema – even in small increments that are easy to convey and to grasp – is still a challenge, but a surmountable one. Cultural evolutionary processes can generate, explore, and test beneficial uses of the scheme, and then generate, explore, and test improvements to the scheme. Those coordination schemes that work can be observed and learned by successive generations, then genetically assimilated through a Baldwinian process (Baldwin, 1896; Morgan, 1896; Osborn, 1896a, b; Weber & Depew, 2003; see below).

Perhaps the population of *Homo* tried out other coordination schemes, but those other schemes failed. They failed either because the other cognitive schemas were too messy, insufficiently determinate, or too computationally burdensome. Moreover, to function well, a social coordination schema should be robust under many likely transformations, because different participants inevitably implement a schema in different ways. Technically, this sort of robustness is called ‘uniqueness,’ meaning that the relations that are defined remain unchanged by the relevant transformations. For equivalence sets, uniqueness means that, for example, giving each set a new name leaves unchanged the equivalence relations within each set. For linear orderings, uniqueness means that the asymmetric differences between any pair are unchanged if what each person gets is transformed by any positive monotonic function. For relations in an ordered Abelian group, after adding a constant to what each person has, those who were even beforehand remain even, a person A who owes two turns to person B still owes person B two turns, and so on. For relations in an Archimedean ordered field, uniqueness means that ratios, rates, and proportions remain unchanged if each person’s stuff is multiplied by a constant. For example, in pure currency inflation.

The uniqueness of a coordination structure means that it can be adapted to new circumstances; it can remain functional despite certain transformations in the activity being coordinated, or in the state of that activity. Uniqueness also means that there

the system works even if different participants have different representations of the relationship, so long as their respective representations are admissible transformations of each other. E.g., it does not matter whether persons A, B, and C agree on precisely ‘how much’ A outranks B, or agree on how much B outranks C – so long as their respective representations are positive monotonic transformations of each other. If A and B are taking turns, it does not matter whether A thinks this is the 24th round of turn-taking, while B remembers 26 rounds of turn taking, so long as they agree on whose turn it is. That is, their equality matching scheme is unaffected by the differences in their respective representations, so long as one of the representations is a transformation of the other consisting of adding a constant to both sides. If a set of people are using equality matching for the distribution of desired items so that at a given point each of them has received three kola nuts, they are balanced, with equal allocations. Then, when someone brings more kola nuts, giving each person two additional kola nuts maintains their equality.

Or consider a communal sharing example. A set of people are camped together at Kangaroo Springs, so, naturally, everyone calls them “The Kangaroo Bunch,” and they think of themselves as The Kangaroo Bunch. In their communal sharing relationship, they share food, they share discoveries of food sources, they share traditional knowledge, and they drum and dance together. Then the spring runs dry, so they have to move. They all go together to a shady bend of Crocodile Creek, and set up their camp there. Pretty soon they become known as “The Crocodile Creek Bunch,” and they begin to use that label too, feeling that The Crocodile Creek Bunch, well, that’s who we are. That move to a new location and the change in their group’s name leave their communal sharing relationship intact. In mathematical terms, the structure of their relational scheme is unique under the transformation of name and location.

There are only these four ways to coordinate smoothly

Measurement aficionados will have recognized that these four structures are precisely the respective structures of the four fundamental scales of measurement: nominal, ordinal, interval, and ratio (Stevens, 1946, 1951, 1958). The uniqueness under relevant transformations is crucial to their functionality as measurement scales, but also, I posit, crucial to their functionality as social coordination schemes. The other feature of these four structures that makes them work so beautifully as measurement scales is that all elements in the set have the same relational properties. This is called ‘homogeneity,’ meaning that in computations, every element in the system can be treated just like every other element. A system with different kinds of elements that entered into computations in different ways would be unworkable for measurement, or for social coordination. In contrast, homogeneous relational structures are easy to learn and easy to remember. Homogeneity also makes social coordination easier and smoother because a participant does not have to know special properties of each other individual that fundamentally determine how to coordinate with them. Homogeneity means that one can coordinate in a consistent way with anyone and everyone.

Measurement theorists have proved that there are no other mathematical systems that have these uniqueness and homogeneity properties (Alper, 1985; Krantz et al.,

1990; Luce & Narens, 1987; Narens, 1981a, b; Smith, 1946, 1951, 1958; Stine, 1989; subtypes can be defined: Narens & Luce, 1986). Since uniqueness and homogeneity are vital for the functionality of social coordination schemes, this goes a long way to explaining why, in fact, humans use precisely these four relational models to coordinate just about everything, just about everywhere (Fiske, 1991, 2026).

Our ancestors doubtlessly tried out all sorts of coordination schemes, most of which left ambiguity and led to confusion about who was doing what, when. That is, coordination would often fail, leading to failure of the joint undertaking. Coordination failures would typically result in frustration, fault-finding, recrimination, and disinclination to join future attempts to coordinate, especially with the same participants. Coordination schemes would fail when participants could not quickly and reliably determine what they should do, especially what they should do when separated by distance or time from the other participants.

Coordination schemes work well when their principles are easy to understand intuitively, and when it is cognitively easy to figure out what to do in all sorts of unforeseen circumstances. Hence, one quality that makes social coordination smooth and predictable is that the scheme is isomorphic with a structure that participants frequently and proficiently use for non-social cognition. The prospects for a social relational scheme are excellent if everyone already knows how to think that way about non-persons, so using the scheme for relational coordination does not require learning a new and unfamiliar scheme that may be difficult to master until practice leads to proficiency.

Market pricing is coordination based on Archimedean ordered fields, isomorphic with ratio scales of measurement. In this kind of coordination, inequality matters, including the direction of that inequality; addition and subtraction matter; and ratios matter. That is, those mathematical relations are meaningful; they matter socially. Archimedean ordered fields are symmetrical under multiplication and division. So in market pricing, the ratio of the prices of entities are unchanged if we pay for everything in dollars, rands, krona, or rupees. Likewise, if applied uniformly and simultaneously to all transactions and obligations, currency inflation does not affect market pricing coordination. As long as lunch in this café costs eight times as much as a latte today, it is of no consequence if the current price of the latte is, say, three of these Zimbabwe \$50,000,000,000,000 bills (which I actually have in front of me as I write this), so long as lunch at this moment costs twenty four of these \$50,000,000,000,000 bills. (Of course, it matters quite a lot if you were paid in Zimbabwe dollars yesterday, at last week's rates, but have to pay for lunch today in Zimbabwe dollars at today's rates.) Anyway, it is of no consequence for our market pricing interaction whether I think of the purchase price of this shirt as 60 (in dollars), while the shop keeper thinks of the selling price as 605.21 (in Norwegian crowns). Market pricing coordination in the sale of this shirt works smoothly so long as we both have common knowledge of the price as a symbol for the ratio value relative to each other commodity priced in the same currency, and know the ratio of the values of the two currencies.

Measurement is a means of coordinating. Generally, measurement is for social coordination; that is its purpose. (Except for the degenerate case of communicating from the present self to future selves.) Conversely, social coordination entails

measurement. It is illuminating to recognize that each of the relational models consists in mutual measurement, a different measurement scale type for each relational model. Mutuality depends on correspondence between the ‘totals’ computed by each participant.

Additional proofs

Favre & Sornette (2015) developed a formal model of the interactions between two persons (or between social actors such as organizations). Each person can perform a social action X toward the other, perform a social action Y toward the other, or do nothing toward the other. They prove that this generates “six exhaustive and disjoint categories of relationships, four of which match the relational models of RMT, while the remaining two are identified as the asocial and null interactions” (p. 14). “We infer that the four relational models form an exhaustive set of all possible dyadic relationships based on social coordination. Hence we contribute to RMT by offering an answer to the question of why there could exist just four relational models” (p. 1).

Going even further, in a deep and revolutionary analysis of the *physics* of the relational models, John Bolender (2010) shows that the structures of the four relational models comprise a unique descending chain of nested symmetry subgroups in relational cognition. He shows how a single neurocognitive system, what he calls a social pattern generator, can readily generate all four relational models by a series of successive symmetry breakings. Without concerning himself with any details of the physical instantiation of the social pattern generator, Bolender posits that, like, say, water, or a set of stars, or any system in physics, the social pattern generator can transition between different degrees of symmetry.¹ Beginning with the myriad symmetries of the equivalence of communal sharing relations, the first spontaneous symmetry breakdown of the social pattern generator results in the linear ordering that is authority ranking. The next symmetry breaking results in the ordered Abelian group that is equality matching. The next symmetry breakdown yields the Archimedean ordered field that is market pricing. For example, in communal sharing, any two persons are either the same, or different. All differences $A \neq B$ are simply differences, symmetrical to each other. But breaking that $A \neq B$ symmetry results in a distinction – an asymmetry – between $A > B$ and $A < B$. That is, all social differences between persons are no longer symmetrical. A further symmetry breaking consists of ending the symmetry among all $<$ relations, and the symmetry among all $>$ relations, making interval distinctions among those differences. E.g., A can owe B one turn, two turns, three turns, etcetera. Where in an authority ranking linear ordering, either A gets more kola nuts than B or fewer kola nuts than B, the symmetry break that yields equality matching means that there is more to the relationships than ‘more’ or ‘fewer’: it matters how *many* more. However, A gets 4 kola nuts while B gets 2 kola

¹ At the time Bolender wrote, it was natural to assume that a neurocognitive structure must consist of a neural network, but none of his argument depends on assuming that the social pattern generator be physically instantiated as a neural network, rather than any other kind of neurocognitive system.

nuts is symmetrical to A gets 17 kola nuts while B gets 15 kola nuts. That is, $4 : 2$ is symmetrical with $4 + 13 : 2 + 13$. Breaking that symmetry results in ratios, where $4/2$ is not symmetrical with (not proportional to) $17/15$.

That spontaneous symmetry breakdowns play a prominent role in relational cognition shows how relational cognition can be partly innate (not learned) without being encoded in the genome. . . Nested subgroups in relational cognition are some evidence that self-organization is playing an important role (p. 96).

On the more familiar [natural selection] view, one needs at least four adaptationist theories, one for each relational model. If the view offered here is correct, by contrast, one needs only one dynamical to account for the emergence of all the elementary relational models. The potential gain in simplicity shows a dynamical approach to be preferable over a Darwinian one, unless an abundance of evidence pulls us in a Darwinian direction. (p. 131)

One needs to ask why the relational models have the forms they have. A dynamist [chain of symmetry-breaking] answer would be simpler than a Darwinian explanation and also wholly non-teleological (i.e., no intentional stance). (p. 169)

Bolender makes a powerful case that, in their deep necessity, the relational models

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 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 processes 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. (p. 7)

The point was made [in this book] that the elementary relational models are evidently necessary in a very deep way. Their mathematical properties make them look like something that should be studied in physics. And physics is deeper than biology. . . Scientists have underestimated how deeply necessary the models are. . .

Rather than being contingent on fortuitous processes of natural selection, “there are deep necessities in how we conceive of social relations. There is something inevitable about it, a sort of inevitably closer to $1 + 1 = 2$ ” than to the probability of any historical event (p. 3).

At a minimum, Bolender's analysis makes a profound case for there being exactly four relational models – precisely these four, consisting of successive nested steps in a unique chain of symmetry breaking subgroups. If the four relational models have a necessity in physics, that certainly accounts for the inevitability and universality of human use of them to coordinate social relations.²

Cultural evolution leading to genetic assimilation

Regardless of whether the relational models emerge from a chain of symmetry breaking, our ancestors' explorations of schemes for close coordination surely operated through a cultural evolutionary process in which the better a given scheme worked, the more disposed people were to continue to use it, and to try it out to coordinate other joint activities. The better a coordination scheme functioned, the more likely others were to copy it, such that it diffused across populations. The better a scheme worked, the more implementations of it people developed, and the more domains that people used it to coordinate. These cultural evolutionary processes made the relational models ubiquitous within and across cultures (Fiske, 1991, 2026).

This made it imperative for children to know them, and to know them reliably, without fail. If learning something is important to an organism's fitness, natural selection will favor the genomes of those who learn it rapidly and reliably. Step by incremental step, natural selection will result in the organism learning the crucial knowledge more and more quickly and certainly. Eventually the organism will reach the point where innate prior knowledge replaces learning. In evolutionary theory, this is called genetically assimilating knowledge through Baldwinian selection (Baldwin, 1896; Morgan, 1896; Osborn, 1896a, b; Weber & Depew 2003). In particular, "if any social behavior is . . . valuable to them as individuals, then Baldwinian selection will favor those who learn it most swiftly and reliably, until ultimately it is universal and 'innate'" (DeJager, 2016:215).

Surely this is what happened with the relational models. Furthermore, as noted above, like other vertebrates, our ancestors must have had the capacities for cognizing equivalence relations, linear orderings, ordered Abelian groups, and Archimedean ordered fields. Like other vertebrates, our ancestors must have used each of these structures constantly and proficiently when foraging, navigating, computing time, and making all sorts of nonsocial decisions. So it would not have been a huge step for Baldwinian selection to have borrowed and reused these cognitive capacities to construct adaptations for social coordination.

² Bolender muses about the possibility of a fifth relational model, "oceanic merging" (OM) encompassing everything, a limitlessly symmetrical predecessor to communal sharing. This would not affect the rest of the CS – AR – EM – MP chain; it simply adds OM, such that the chain of nested symmetry subgroups would be OM - CS – AR – EM – MP. But I believe that the equivalence relation of communal sharing does not logically or empirically entail the existence of any boundary excluding persons or entities who are not equivalent; hence, there is no logical distinction between communal sharing and oceanic merging.

Infants know how to recognize the relational models and know how people interact in each of the relational models

In the last decade, many labs using many stimuli have demonstrated and consistently replicated that preverbal infants recognize at least three of the four relational models, *and* know how people interact distinctively in each of the three respective relational models (Thomsen & Carey, 2013; Thomas, 2025). (Researchers have only just begun to study infant recognition and core knowledge of the fourth relational model, market pricing; so we don't yet know much about that.) For some typical studies among the many showing that infants recognize communal sharing and know how people will interact in a communal sharing relationship, see Spokes & Spelke, 2017, Cirelli et al., 2017 and earlier studies, Liu et al., 2017, Pun et al., 2021, Thomas et al., 2022, Bian & Baillargeon, 2022, Steele et al., 2024.

Infants instantly recognize and make correct inferences from many of the universal cues that identify particular relational models, such as, in authority ranking, superiors' wearing a tall headdress and subordinates bowing to superiors, as well as subordinates' ceding temporal precedence to superiors (Fiske, 2026; see below). This, despite the fact that the infants tested have never seen headdresses, bowing, or ceding temporal precedence to superiors. In short, humans have adaptations for recognizing and cognizing at least three of the four relational models. For infant recognition and knowledge about authority ranking, some typical studies are Thomsen et al., 2011, Mascaro & Csibra, 2012, Pun et al., 2016, Enright et al., 2017, Margoni et al., 2018, Margoni & Thomsen, 2024, Meng et al., 2019, Stavans & Baillargeon, 2019.

Infants expect a third party to distribute cookies evenly to a pair of recipient agents; but infants do not expect a distributor to create even piles of cookies in front of two inanimate objects. Nor do infants expect that when they simply observe an existing state of affairs, two agents will simply have the same number of cookies; what they expect is for a distributor to make an even *distribution* – and they expect even distributions long before they have observed or experienced them in their own lives. Typical studies demonstrating infant recognition and understanding of equality matching include Geraci & Surian, 2011, Sloane et al., 2012, Somerville et al., 2013, Meristo et al., 2016, Ziv & Sommerville, 2017, Surian & Franchin, 2017, McAuliffe et al., 2017, Buyukozur Dawkins et al., 2019, Surian & Margoni, 2020, Strid & Meristo, 2020, Ziv et al., 2021, Geraci & Surian, 2023a, b, Jin et al., 2024.

Thomsen and Carey (2013) and Thomas (2025) review many more studies of infant recognition and core knowledge of these three relational models providing the methodological details.

Within and across activities in any community, people, people use each coordination scheme in myriad ways. Across cultures there is considerable variation in which scheme people generally use to coordinate a given domain of life, such as marriage or work, and a wide variety of ways of using each scheme in a given domain, and in any given activity within a given domain. In a given society, people may typically organize labor with equivalence relations, with everyone in the equivalence relation simply pitching in to do whatever they can – in other words, communal sharing. Or they may organize labor using ordered Abelian groups, dividing up tasks equally. Furthermore, there are indefinitely many ways to divide a task equally, for example,

by working the same number of hours, by taking turns, by assigning tasks by lottery, or by doing the same number of units of work. If people make their labor evenly balanced by doing the same number of units of work, there are indefinitely many ways of determining what counts as equality among units of labor.

Consequently, along with infants' innate knowledge of the signs of use and commitment to a given coordination scheme, and innate knowledge of the structure of each of the four schemes, children need to learn how people in their community implement each scheme in each activity in each domain of social life (Fiske, 2000). So children have evolved a set of adaptations to discover that. This set of adaptations consists, first, of highly self-motivated sustained, intent observation of others' social interaction, connected to excellent episodic memory integrated with relevant kinds of procedural memory. The set of adaptations also includes intrinsically rewarding play consisting of playing the social roles the child has observed, such as 'mother cooking dinner,' or 'father returning from the hunt and handing over the carcass of an animal he has killed.' Through this imitative play children practice and perfect the implementations they have observed of the coordination schemes that people around them are using. Extensive ethnological comparison demonstrates that in traditional societies, this self-motivated, self-initiated observation and play is entirely sufficient to enable children to develop into socially competent, moral adults (Over & Carpenter, 2013; Correa-Chávez et al., 2015; Hamlin & Fiske, n.d.; see also Boyd et al., 2011). In many traditional societies, neither parents nor anyone else ever teaches children social norms, or explains anything – social coordination or anything else (Lancy, 2016, 2022, 2024). This absence of active socialization is especially marked in societies where production is entirely for family use and sharing with close associates, that is, people are not involved in the market economy for commodities, labor, or land (Maynard et al., 2024). In most such societies adults never explain or teach anything, and children learn very early not to ask questions (Lancy, 2016, 2022, 2024).

There is no need for adults to teach children how to be social, nor to motivate children to 'internalize' 'norms' that motivate them to be moral. **Young children don't internalize norms, they actively externalize their innate cognitive, emotional, motivational, and moral adaptations for social relations.** Children do this at their own initiative, without needing any praise or inducement. Infants are inherently social and moral beings (Woo et al., 2022); they just have to observe, imitate, play, and practice to learn the specifics of how to realize their sociality in the myriad coordinations of their specific society at the point in history where they find themselves.

As people make the historical shift to production for the market, parents and others begin to teach and explain, explicitly imparting social norms (Maynard et al., 2024). When schools emerge and literacy spreads, this trend is reinforced. But the point is that, without intervention or support from anyone, children can use their innate adaptations for social coordination to develop into capable adults – provided that, in their community at that point in history, they do not need to be literate, numerate, or knowledgeable about matters that are not directly observable to them. And for many thousands of years this is what children have done, attaining adult social proficiency with no instruction whatsoever.

Phylogenetic antecedents to the relational models

There are prior adaptations that fostered the cultural and then natural selection of capacities and dispositions for the respective relational models. One preadaptation is dominance hierarchy. Unless they are entirely solitary, most mammals form linear dominance hierarchies, which consist solely in temporal priority of access to preferred resources, when the resources are not sufficiently plentiful to permit all animals in the vicinity to freely partake simultaneously. In contrast to human authority ranking, nonhuman dominance hierarchies rarely, if ever, entail superiors taking responsibilities to lead, guide, or stand up for subordinates, or even explicitly make decisions on behalf of the group. Human authority ranking is often based on age, gender, other social roles, or rational-legal criteria, and not on either force or prestige as such, or even on number and rank of allies, as dominance rank is among some apes. That is, ranks in human authority ranking relations are institutionally established, not established ad hoc by individual-to-individual contests among the persons concerned. This is a result of a subtle combination of genetically and culturally evolved mechanisms. In short, starting with simple priority-establishing dominance hierarchies, humans culturally evolved and genetically assimilated the cognitive competencies, emotions, motives, and moral sentiments that constitute authority ranking.

The foundational mammalian and avian adaptation is maternal care for offspring. In most birds and a small percentage of mammal species, in addition, mates form more or less enduring affiliative pair bonds, and the father bonds with his offspring, as well. Beyond maternal suckling, mammalian maternal bonding to offspring (and paternal bonding, where it occurs) involves licking or grooming, cuddling to keep warm, protecting from predators, and bringing food back to the den and actively sharing it with offspring. In a very small percentage of species, such as some canids, siblings from the previous litter may also participate in care of their younger siblings. It is not known why so few mammalian species, and no great apes, have pair bonding, paternal care, or sibling helpers at the nest, but in the species that have evolved this, inclusive fitness – kin selection – surely underlies it. Presumably, the neurocognitive systems, affects, and hormones involved were a platform from which human communal sharing relations first culturally and then genetically evolved.

A great many mammals and other vertebrates live in troops, including most primates and, in particular, many but not all apes. Such troops consist of toleration of the proximity of other members of the troop and tolerating their feeding nearby, along with efforts to maintain proximity with fellow troop members, while often avoiding members of other troops. Troop members may jointly defend a territory, or drive off nonmembers, and they may participate in mobbing predators. All of this surely provided a fecund foundation for the human cultural evolutionary and genetic evolution of communal sharing. But note that none of it strictly implies that troop-living animals are cognizing equivalence relations as such. So communal sharing relationships were a big step beyond living in troops.

“Space, time, number, rate and probability. . . have now been shown to play a fundamental role in the mentation of nonverbal animals and preverbal humans” (Gallistel, 2011, p. 3). Given that vertebrates and at least some invertebrates have the mathematical capacities requisite for each of the relational models, why is Homo

sapiens apparently the only living species that uses them generatively for social coordination among nonkin? Each of the relational models has possible homologies in non-human animals, or at least convergent analogies (Haslam, 2004; Earl et al., 2025). Notably, the bee dance system is social coordination composed of symbolic communication of ratio-scaled distances, quantities, and time rearding a food source. That's very close to market pricing, so why didn't bees develop it into a general, flexible system of social coordination? We don't know.

The genus *Homo* naturally uses communal sharing, authority ranking, equality matching, and market pricing to coordinate nearly everything. And must have been doing so for many tens of thousands of years, perhaps hundreds of thousands of years. That is the only explanation for contemporary human infants' innate core knowledge of the relational models. These cognitive and affective adaptations for relational models could only have evolved if they were beneficial for most infants, wherever they were born, for a great many generations. This means that the contemporary existence of these relational models adaptations provides a window into Holocene and probably Pleistocene *Homo* social organization – the clearest window we have into that.

The genus *Homo*'s discovery of the four relational models, and the limitless ways of using them, occurred through cultural evolution, in synergy with language

Let us more deeply consider the processes of cultural evolution that likely resulted in the Baldwinian genetic assimilation that created the adaptations for the relational models. These processes must have been synergistic with the evolution of human language, because complex, flexible, limitlessly generative, and trusting social coordination is impossible without language. Hence, once early *Homo* began to explore the potentials for such coordination, the benefits of complex, flexible, limitlessly generative, and trusting social coordination created very strong natural selection for human language. If organisms are not coordinating, human-like language has little use and confers no substantial fitness advantages: what does an organism have to say if it has no social relations with others? Conversely, if an organism has the essentials of human-like language, this creates very strong natural selective opportunities for social coordination, because language creates limitless opportunities for highly beneficial social coordination. This synergy helps to solve the twin puzzles of why only humans evolved the capacity for complex, flexible, limitlessly generative, and trusting social coordination, and why only humans evolved the capacity for generative language that enables them to communicate just about anything. The solution to the puzzle is that these two adaptations evolved together, synergistically.³

It is possible to use the relational models without language, and some species of early *Homo* must have begun to do so. Relational models-based coordination would have been beneficial to fitness, but, without language, the benefits would have been

³ Hereafter, I use the word "language" to mean the genetic adaptations that enable and reliably secure the learning and deployment of the sort of infinitely generative languages that humans speak or sign.

quite limited. Language permitted early humans to explain *how* they proposed using, say, equality matching, to divide the catch from a fish weir they might build together, and how they might apportion responsibilities for harvesting the fish and transporting it back to camp. Equality matching cannot be implemented as such, without further specifications: Does using equality matching to build the weir mean that each participant brings an equal number of sticks, of equal length and flexibility? And/or does it mean that they will assemble, start work at the same time, and stop at the same time? Are they going to use equality matching to decide where to build the weir? If so, does that mean that when they build a new weir each month, they will take turns in successive months deciding where to build it? Or will they vote? Or make suggestions, and use a lottery to choose? Who gets to participate in this equality matching fish weir project? Language is necessary for participants to sort out all that.

With language, a person who comes up with an idea for their cooperative undertaking can explain it to others. With language, participants can put their heads together to critique and develop the idea, and decide to try it out, or not. Building a fish weir out there on the river, in real time, people can work out errors and miscoordinations, and they can come up with, propose, discuss, and decide upon modifications and extensions of the scheme. After the fact, they can linguistically report their episodic memories of what happened, do a post-mortem to figure out how do it better next time, and decide whether to try again with modifications, or drop it. Furthermore, if someone has seen others elsewhere with a more effective weir design, they can use language to tell the others about it, and explain how it works and under what circumstances it would be the best choice to adopt. Hearing what happened in another group's weir project, a person can learn why it did or did not work as well as hoped, and discuss how to fix and improve it.

Furthermore, having worked out how to coordinate a fish weir project with a given relational model, implemented in given way, humans with language can propose using equality matching in analogous ways to coordinate a big-game drive, chasing the antelope into a killing zone. Then they can discuss whether to implement equality matching for the big-game drive the same way they did for the fish weir, or another way. Will each participant bring 26 sticks? Sticks of what size and from what bushes?

Without language, none of that would be possible. People wanting to coordinate could not pick a relational model, let alone agree on how to implement it. Implementations of the relational models could not be efficiently chosen jointly, jointly evaluated, or discursively critiqued. Effective, beneficial uses of the relational models would diffuse very slowly and with high rates of copying errors. Improvements and new combinations would be virtually impossible to bring off. That is, without language, there would be little, slow cultural evolution of social coordination.

Furthermore, language makes possible an extremely useful new level of social coordination that would be impossible without it: verbal contracts consisting of "if you do this, I'll do that." Planned conditionality requires language; language, and only language, makes commitment possible. On solving social dilemmas by trustworthy mutual commitment, see (Schelling, 2007; Hirshleifer, 1987; Frank, 1988; Nesse, 2001). Mutual verbal commitments and less formal shared and agreed-upon plans take social coordination to a whole new level. Furthermore, whether coordinat-

ing an immediate activity or a long-term arrangement, language permits negotiation of the terms of agreements. “OK, that’s good, but I’ll need a little more than that to make it worth my while.” Without language it is barely possible to barter about an exchange of goods, but that may be slow and clumsy. And without language, people cannot negotiate about anything beyond material goods that are present here and now. Without language, a person cannot make the offer, “If you come back tomorrow with two fish that size, then I’ll give you the duiker skin I told you about, and some of that soothing herb you asked for.” With witnesses whose judgments have consequences, contracts make possible all manner of new coordinations across time. Language also enables people to ask questions. For example, “Did you get the bark you need to completely tan that duiker skin so it’s soft and supple?” Or, “Do you know where you could get a nyala skin?”

Another use of language in social interaction is moment to moment coordination. Hauling in a net, “OK, pull! Slowly now. Stop!” Carrying a heavy canoe up out of the water, “Ready, lift the bow. Now, lift the stern. Let’s go – walk up to the beach.” Hunting an elephant, “We’ll go around to the left to make sure he doesn’t head toward the swamp.” “OK, we’ll approach from behind, yell, and shoot arrows to keep him moving.” “We’ll be waiting by the twin baobabs to rush in underneath him and spear him in the belly. Make sure he goes right between those baobabs.” And then, “Look out, he’s turning around! Stop him!!” With language, they kill the elephant and have meat to eat, to invite their neighbors to feast on, and to preserve with smoke, assuring ample protein for weeks to come. Without language, they don’t. And again, if the band was not attempting to coordinate in the first place, what use would they have for language? Language would confer hardly any selective advantage in the absence of social coordination.

There are three more uses of language that multiply the quality and value of coordination with the relational models. The first is that language makes it possible to punish transgressors at little or no cost to the punisher(s). Punishment can stabilize social coordination (Boyd & Richerson, 1992; Boyd et al., 2003), but if punishment is costly to the punishers, natural selection should favor non punishing, while free-riding on others’ punishing. Evolutionary theorists have not seen any solution to this conundrum, but our ancestors who had language had a solution: they could report the transgressions to others who had not observed the transgressions. Reporting has virtually no cost – speech is cheap. The transgression-reporter can report secretly, minimizing the risk of retaliation. When others learn that person X has defected, they will lose trust in X and avoid cooperating with X in the future. If there are sufficient alternative participants in potential coordination activities, there is no cost to those who exclude X. A very similar point has been theorized with the misleadingly named concept of “indirect reciprocity,” operating through reputation (Boyd & Richerson, 1989; Milinski et al., 2002; Panchanathan & Boyd, 2004; Nowak & Sigmund, 2005). Language is the only way to efficiently and widely spread reputation. and thereby enable indirect reciprocity.

The second synergy between relational models coordination and language is that language is necessary to conspiratorial execution of transgressors. Boehm (2009, Wrangham, 2021) theorizes that our hunting and gathering ancestors maintained equality in their bands by targeted conspiratorial killing of domineering rapacious

narcissists. Language is the medium for conspiracy; conspiracy without language is virtually infeasible. Note also that Boehm explores targeted conspiratorial killing of men who illegitimately assert dominance, in societies that proscribe all social hierarchies. Boehm does not raise the issue, but in communities that regard certain hierarchical social relations as legitimate authority ranking, targeted conspiratorial killing can be an ultimate sanction for violation of the authority ranking model. E.g., in accord with the authority ranking model, the community might regard elders as legitimately superior to younger adults, and a properly selected chief as superior to all. In the authority ranking framework, chiefs should wisely lead, guide, stand up, and look out for their subordinates. Judging that a particular chief's rapaciousness, irresponsibility, incompetence, and alcoholism was a danger to the community, community members might organize a conspiracy to assassinate him. Many a ruler has been killed by cabals that were committed to the legitimacy of a system of rulership, and judged that they had to kill the ruler to preserve that system. Language make that possible.

Furthermore, linguistically enabled conspiratorial execution is a way to prevent exploitation by egregious transgressors of communal sharing, equality matching, and market pricing.

The third synergy between language and relational models concerns "altruism" toward nonkin in each of the four relational models. To explain why natural selection sometimes favored organisms acting to benefit others, Trivers (1971) proposed that it would be adaptive for individual A to benefit B if A correctly expected that B's survival benefitted (A). Precisely, A's conferring a benefit is adaptive if A's cost of conferring a benefit to B is less than the product of the probability and the magnitude of B's benefitting A *because of* A's prior conferral of the benefit to (B). That theory seemed to have broad explanatory potential, but since then, extensive search has turned up only a couple of clear cases. Host fish benefit from cleaner fish who remove their ectoparasites, so it can be construed as reciprocal altruism if the host fish refrains from eating the cleaner fish. Other explanations are possible; perhaps the cleaner fish are toxic. The other good case of reciprocal altruism is among vampire bats. Vampire bats depend on finding a large mammal every night and sucking its blood. If they fail, they barely have the energy to fly out and search the next night, and do not survive two consecutive nights of failure. But when a vampire in the roost is hungry, it begs food from a roost mate, who may have a low or zero coefficient of relatedness. What Wilkinson (1984, Carter et al., 2015) found is that a solicited bat is highly likely to regurgitate food for a hungry associate if and only if the beggar has previously regurgitated blood for the solicited bat. Other than these two cases, there are few, if any, well-validated cases of reciprocal altruism in nonhuman animals. This is probably because it is rarely possible for an organism to confer a benefit that costs so little to confer that the cost is less than the expected gain to the donor from the recipient's reciprocal benefit bestowal directly resulting from the original altruism. Recipients of a benefit may die, depart, be unable to reciprocate, or decide not to reciprocate; if so, the donor bears a cost without receiving any compensating benefit at all. Or the recipient of the original benefaction may be stingy, 'cheating' by giving back less than it received, or nothing at all.

However, language makes reciprocal altruism easy, safe, and sure. If A tells B how to find an ample but difficult to locate resource of great value, A incurs no cost at all, while B receives a large benefit. If that benefit keeps B alive and motivates B to reciprocate, there may come a time when B knows about the location of an ample but difficult to locate resource of great value, and can, at no cost, tell A, who reaps a great benefit. And there are innumerable other ways that language speakers can confer great benefits at zero cost: warning of dangers (tigers by the river crossing), explaining a technology (volcanic clay on the basket makes it hold water), explaining why someone else did something (she thought you had cheated on her), and so forth and so on. Without language, reciprocal altruism is rarely feasible, and rare in fact. With language, reciprocal altruism is commonly feasible, and common in fact among humans.

Note that there is nothing in Triver's model that requires that the benefits received equal the benefits bestowed. To be adaptive, all that is required is that the cost of bestowing a benefit on a recipient be less than the gain expected (probability times the magnitude) from the recipient contingent on the original bestowal. So with reciprocal altruism based on bestowing benefits though language should greatly amplify the selection for each of the four relational models.

In short, language increases the benefits of relational models coordination – increases the benefits by orders of magnitude. And relational models increases the benefits of language by orders of magnitude. Language has only marginal benefits outside of relational models coordination, and would not have been likely to evolve in a species that was not evolving complex, flexible, limitlessly generative, and trusting social coordination.⁴

The relational models are multiply determined

Relational models theory posits that the adaptations for the relational models are integrated products of natural selection; phylogeny; ontogeny; cultural reproduction, agentic resistance-rejection, or transformation; emotion, motivation, moral sentiment, cognition-representation; neurochemistry; and mathematical necessity.

Conversely, relational models theory was always intended to be comprehensive, encompassing all sorts of coordination in all cultures across time. It encompasses social functioning and dysfunctioning. Relational models theory inductively builds on, and in turn illuminates, a vast array of social-relational phenomena. By the same token, relational models theory provides a common framework connecting the various social and behavioral sciences. Furthermore, relational models theory is nearly unique in explaining how evolved psychological universals of sociality intrinsically entail culturally diverse particularity in the implementation of the psychological universals (Fiske, 2000). That is, innate psychosocial universals, called “mods,” *neces-*

⁴ It is also likely that the adaptations for relational models and for language synergistically evolved because the two adaptations utilize some of the same cognitive capacities: recursion, symbolism, iconicity, indexicality, and what I have called mods: evolved adaptations that presuppose and depend on cultural complements, without which the mods cannot be realized (Fiske, 2000).

sarily generate unique cultural particulars because the realization of the mods depend on “preos” that are essential to specify *how* to implement a relational model in a given context.

Relational models theory was primarily constructed, and continues to be developed, inductively from my ethnographic participant observations and myriad others’ descriptions. I have always given the greatest weight to induction from the widest available range of descriptive sources of the widest range of types from the widest range of sources, checking multiple descriptions of the same phenomena against each other whenever possible. Relational models theory is based on ethnographic participant observation; exceptionally wide ethnological and historical comparison; linguistic typology and etymology; paleoanthropology, archeology and art history; comparative literature focusing on ancient and classical texts; new theory and findings on the cultural evolution of emotion-evoking social practices; cognitive social science of everyday life, including emotion science; infant social cognition research; as well as everyday social errors of all sorts, and data on social deficits in personality disorders, in schizophrenia, and in frontotemporal dementia.

At crucial junctures, of course, I have made deductive leaps. Then I have tried to verify those deductive inferences by inductive search. By the same token, I have always made the theory essentially descriptive. I have always sought to make my exposition clear, precise, and definite, articulated with minimal hedges, such that readers can all see, and agree on, what the theory is, and agree on how it delineates phenomena in the real world. A theory ought to be clear, explicit, and precise enough to make the theory readily ‘falsifiable,’ in the sense that there is minimal doubt about whether the theory corresponds to maximally objective, parsimonious, exact descriptions of naturally occurring, ‘real world’ phenomena.

That said, I also believe in the uniquely informative value of well thought out, well designed experiments, along with diary studies, experience sampling, cognitive neuroscience measures and images, and other controlled methods. I value such methods as ways of *checking* inductive inferences, *after* one has made myriad observations in the field, read as many others’ field observations as feasible, discovered patterns in the observations, and inductively derived descriptive general theories.

In recent years, especially, relational models theory and research have aimed to operate, so far as feasible, in a distinctive epistemological and ontological framework. One premise of that framework is that people have little or no direct, conscious, articulable, reflective awareness of the structures they are using for social coordination, the emotions that modulate their coordination, most of their social relational motives, or the basis and nature of the moral sentiments that regulate their social coordination and their evaluation of others’ conduct (see Carruthers, 2011). If this premise seems implausible, consider how obvious it is with regard to language where, for example, people are not aware of the existence of phonemes, have no conception of how they produce or recognize phonemes, do not know that there is such a thing as grammatical mood (such as the subjunctive mode), and cannot state the general syntactic rules in their language, such as for transforming a proposition into a question. Language use, as speaker or listener, does not require *conscious knowledge* of how language functions. Likewise, relational models theory posits that engagement in social rela-

tionships does not require conscious knowledge of how social relations function. And, indeed, people utterly lack the intuitive capacity to articulate the fundamental structures and processes of their social relationships.

This has profound methodological implications, because it means that researchers cannot expect research participants to provide valid abstract, formal descriptions of their social relations. For one thing, people do not consciously know that there are four fundamental relational models. Nor do people have valid concepts of their social relational emotions, motives, or moral sentiments, let alone valid taxonomies of any of these (Fiske, 2020b). For example, vernacular English does not have consistently delineated, consistent usage or meanings for words such as *anger* or *guilt*, so there is very little point in asking English-speakers if they are “angry” or feel “guilty” (Fiske, 2020a). So self-report about social relationships, especially Likert-scale ratings of vernacular lexemes, is not simply problematic, it is pretty much invalid. That means we need to devise methods that do not depend entirely on self-report relying on vernacular labels for mental states (Fiske 2020a, b). A fortiori, it is egregiously fallacious to suppose that speakers of any other language happen to have vernacular words in their language that align with each and any word in English. The lexicons of different languages simply do not align one to one with each other.

Relational models encompass myriad aspects of human sociality

Since I first published relational models theory (Fiske, 1991, 1992), scholars have written several hundred articles, chapters, theses, and books addressing the theory in quantitative and qualitative empirical studies, applying the theory to new phenomena, or offering conceptual extensions. Inexplicably, there has been little critique of the fundamentals of the theory itself. All in all, the empirical evidence and conceptual extensions have provided remarkably consistent support for the core theory, which I have seen no reason to revise. I cannot review that vast literature here, but I do want to indicate the range of social relational phenomena that the theory illuminates.

Perhaps the most amazing development has been the discovery, in the last several years, that, as I discussed above: as I predicted in 1991, humans have innate knowledge of communal sharing, authority ranking, and equality matching. Indeed, extensively replicated studies using multiple methods establish that core knowledge of at least three relational models emerges even earlier than I anticipated – certainly in the first year of life and in some respects remarkably early in the first year.

Building on the original conceptualization (Fiske, 1991; Fiske & Mason, 1990, Fiske, 2002), subsequent work considerably elaborated the thesis that moral psychology consists largely of evaluation of adherence to relational models (Rai & Fiske, 2011). Furthermore, TAGE Rai and I (Fiske & Rai, 2015) have shown that around the world and throughout history, nearly every sort of interpersonal violence is morally motivated by the relational models: the perpetrator feels a true and culturally legitimate obligation to harm or kill. Recent work theorizes the motivational aspect of relational models, particularly with respect to incentivizing in organizations (Gallus et al., 2022).

Relational models theory has always encompassed the idea that social relational emotions, motives, and moral sentiments are crucial to the functioning of social relationships. I have articulated that idea especially through the lens of frontotemporal dementia, where cognition and other affects remain intact in the early years, while social and moral emotions vanish (Fiske, 2002, 2010). But if vernacular lexemes are fallacious guides to emotions, and in any case people lack valid conceptualizations that would enable them to identify their own emotions, this implies huge epistemological challenges for studying emotions. However, my colleagues in the Kama Muta Lab and I have devised quite workable methods for studying one emotion, at least – one that we discovered, detailed through myriad mini-ethnographies, extensive ethnological comparisons, and compilation of ancient and modern narratives, and extensively validated with experimental and diary studies (Fiske et al., 2017a, b; Seibt et al., 2018; Zickfeld et al., 2019; Fiske, 2019). Essentially, our epistemological advance was to define the kama muta emotion quasi-polythetically, based on the co-occurrence of five sets of features, such that no feature is necessary or sufficient to identify kama muta. Beyond the epistemological advance, a key insight for present purposes was that there is one and only one cause of kama muta: the sudden intensification of communal sharing. A person may feel kama muta when observing others' communal sharing relationship suddenly intensify, or when someone (or some being) suddenly intensifies their communal sharing relationship with the person. A person's kama muta may also occur then their "heart goes out" to another person or to a vulnerable baby animal. These and other insights into kama muta demonstrated a tight link between the relational models and emotions, albeit not a link that I ever anticipated. What the mini-ethnographies and ethnology also unexpectedly revealed was the crucial role of the cultural evolution of social practices that function to evoke kama muta, in conjunction with people's active pursuit of kama muta by engaging in these culturally evolved practices (Fiske et al., 2017b; Fiske, 2019; Fiske et al., 2019, 2024). That is, there is strong cultural selection for practices that suddenly intensify – create, or remind people of – communal sharing, *because* such practices evoke an emotion that people seek, tell others about and recruit others to participate in, and that may have valued cultural meanings. That is an entirely new observation for relational models theory and for cultural evolutionary theory, illuminating religion, ritual, music, literature and the arts, and myriad other ubiquitous practices and institutions. But that insight depended on a prior conceptualization of the communal sharing construct.

Conversely, studying kama muta has revealed a lot about communal sharing. Merely perceiving a cute infant human or animal, especially an infant that appears vulnerable, often evokes communal sharing in the viewer (Steinnes et al., 2019, 2024). This makes sense in view of the posited phylogenetic roots of communal sharing in maternal bonding in mammals, birds, and certain other vertebrates, but I did not predict it. Also, it was intriguing to discover how readily the *observation* of *others'* suddenly intensifying communal sharing evoked the same emotion experienced when one's own communal sharing suddenly intensifies. I still do not understand why that is functional, if it is functional, or how it evolved. Surprisingly, many kinds of music – and not just lyrics – consistently evoke kama muta, which has led us to discover hitherto unimagined forms of communal sharing. Also, until we

found many instances in our mini-ethnographies, I had not realized that even a small kindness, especially a kindness ‘out of the blue,’ often evokes low-intensity communal sharing. Our mini-ethnographies and ethnological compilation also revealed how intense, important, and prevalent are communal sharing relationships resulting from the discovery that another person has survived the same life-shaping, identity-defining trauma that one has survived oneself, but hitherto concealed, or the discovery that others have done shameful harm that one also has done, as in alcoholism. Before we began our kama muta research, we were unaware of any of these paths to communal sharing.

The discovery that the sudden intensification of communal sharing evokes an emotion leads us to wonder whether there are other emotion specific to the sudden intensification of equality matching and market pricing. In the sudden intensification of authority ranking, one would expect that the superior and the subordinate would experience entirely different emotions. What about other transformations of each relational model? I hypothesize that there are relational model-specific emotions evoked by the sudden termination or loss of a relationship, by the other’s violation, by one’s own violation, and by threats that others pose to the relationship. Are there relational model-specific emotions of wishing-hoping for a relationship? (For more details of this hypothesis, see Fiske, 2019.)

Relational models illuminate at least some psychological disorders. Specific personality disorders correspond with either over-use of a specific relational models or under-use of a specific relational model (Caralis & Haslam, 2004; Haslam et al., 2002; Haslam, 2004). Social functioning in schizophrenia is undermined by a deficit in implicit understanding that a given dyad tends to consistently use the same relational model across domains (Sergi et al., 2009; Green et al., 2011; Horan et al., 2011; Vaskinn et al., 2017).

A recent development elaborates and deepens an observation adumbrated in the original statements of the theory (Fiske, 1991, 1992) that I subsequently developed (Fiske, 2004) and then Lisa Schubert and I explicated better (Fiske & Schubert, 2012). Each relational model has a distinctive “conformation system” that functions to communicate which relational model people are using, hence getting participants ‘on the same page’ and creating common knowledge of the relational model they are using to coordinate (Fiske, 2026). Conformations are cognitive representations and external signs, acts, artifacts, architecture, or other arrangements that communicate and evoke the emotions, motives, and moral sentiments that are integral to social relational coordination. Crucially, conformations are acts of commitment that tend to motivate participants and bind them to the relationship. Each relational model’s conformation system operates in a distinct semiotic – communicative and cognitive – modality, a medium that differs from the medium of every other relational model. The conformation system of communal sharing is indexical, representing, motivating, and committing participants to their social relational equivalence by constituting them as equivalent in bodily substance, bodily surface, bodily contiguity, or whole-body synchronous movement. This I termed “consubstantial assimilation.” For example, people conform communal sharing by hugging, cuddling, kissing, caressing, by intimate sex, giving birth, suckling, or simply shaking hands, by eating or drinking communally from the same vessel, feeding hand to mouth or mouth-to-mouth, mixing and

consuming blood in blood brotherhood rites, perceiving each other to have shared ‘blood’ or genes, or dancing, marching, or rowing in rhythmic synchrony. In contrast, people conform authority ranking though the iconic use of physical dimensions such as above – below, greater mass – lesser mass, more numerous – fewer, in-front – behind, greater force – lesser force, more luminous – less luminous, temporally preceding – temporally following, and so forth. We are familiar with this in bowing to nobles, in high ranking persons taking positions on raised surfaces, in many languages addressing superiors with plural pronouns, and, meta-representationally, in speaking of leaders and followers, superiors above subordinates, great people in power, and so forth. In whatever language you speak, can you think of even one word for authority ranking that does not denote relative position on a physical dimension?

The conformation system of equality matching is concrete operations of one-to-one matching, such as voting, taking turns, distributing cookies “one for you, one for you, and one for me; one for you, one for you, and one for me.” Some of the technologies for this consist of ballots, pan balance, or the water clocks that Athenians used to give the accuser and the defendant equal speaking time. Lottery technologies are also widely used (Fiske, 2026).

For market pricing, the conformation system consists of abstract, arbitrary symbolism, where symbols are meaningful in a community only by virtue of their conventional use, together with everyone’s common knowledge of that use, common expectations of their future use, and common commitment to continued acceptance of that medium. The prototype for this is money in its various material, written, and digital forms, as well as price tags and stock quotations, letter grades, point systems for rewards, punishments, and other assessments.

There is extensive evidence of people in all sorts of cultures using these four conformation systems for thousands of years, each conformation system used specifically for its respective relational model (Fiske, 2026). Preverbal infants recognize at last consubstantial assimilation, iconic magnitudes and dimensions, and concrete operations of one-to-one matching. They recognize each conformation system even when they have never observed anyone using them, for example, bowing, or wearing a headdress that makes the wearer appear taller. Infants know which conformation system conforms which relational model.

Futures

Every theory has its limits, but I am astonished to find that I do not yet see the limits of relational models theory. It definitely can be deepened and broadened. It can be integrally connected with theories that it is not yet well linked to. With collaborators, I am planning to explore how relational models theory can be linked with network theory, giving structure and substance to the “ties” linking persons. Complementarily, how can network theory get us beyond the concept of metarelational models (Fiske, 2011)? Likewise, I am planning to explore how the concept of “social capital” can be elucidated by relational models theory, and vice versa; what relational models provide what sorts of social capital, and how does their potential and their use as social

capital shape relationships of each of the four relational models? In addition, I am eagerly launched on the exploration of many apparent links between relational models and the creation of laws, contracts, citizens' and prosecutors' deployment of laws, the decisions of judges and juries, and legal penalties. Also, I am collaborating on an exciting article on social development, the sources of human sociality, and the means by which children discover how to implement their innate knowledge of relational models in locally and contextually meaningful ways.

I have long held that morality consists of the evaluation of action, affect, and intentions with reference to relational models (e.g., Fiske, 1990, 1991; Rai & Fiske, 2011). What is moral is what conforms to proper implementation of the appropriate relational model, while what is immoral is what is inconsistent with the proper implementation of the appropriate relational model. Yet I still struggle to understand what "morality" is if, as the ethnological evidence shows, people are often held "morally" responsible for untoward consequences they did not cause, and did not know would come about (Fiske, 2023). (If this seems absurd, considerable the Christian doctrine of original sin.) Part of this phenomenon is that people often feel guilty about suffering they did not cause, could not have foreseen or prevented, and cannot alleviate. In most cultures there are diviners, oracles, and spirit mediums whom people consult to determine what transgression had the moral result of their misfortune, suffering, or death (among innumerable ethnographies the classical account is Evans-Pritchard 1937). For example, in the West until less than three centuries ago, accused witches' guilt or innocence of capital crimes was determined by procedures that entirely disregarded any concern, much less evidence, of whether the accused had any means to do what she was potentially to be held accountable for.

What sorts of "blame," "fault," and "guilt" are involved? Do we need a whole new conceptualization of "morality" that abandons the current descriptive conceptualization, which is based on Western philosophical prescription? What would that new conceptualization of morality be? I'm baffled. I encountered among the Moosé and then found to be described in a great many ethnographies an integrally related phenomena that still perplexes me: When things go wrong, people believe that someone has done something wrong. The persons who suffer a misfortune or death may have committed a transgression such that they deserve to suffer, or the sufferers may be entirely innocent victims of wrongdoing against them. Then again, the sufferers may be suffering collaterally, as a moral consequence of a kinsperson or members of the community having transgressed. A salient manifestation of this human disposition that modern Western readers recognize from the history of their ancestors' practices is holding a witch morally responsible for someone's death. But, teaching seminars in which graduate students located and interviewed people who have had something bad happen in their lives – all sorts of things – I've found that even modern, well educated, scientifically minded persons intuitively feel that bad things are moral consequences of transgressions. Even cancer, or being struck by lightning. Consequently, people feel angry or guilty about their misfortune, even while acknowledging that this makes no sense in terms of their explicit beliefs. If I ever get real insight into these two mysterious human dispositions, I will write about them. But since I haven't figured them out for 45 years, I don't know if I ever will. Help would be welcome.

In another direction, I am planning to write on the necessity for observation-based wide-sample induction in the social sciences. Throughout my career, most of my insights and theories have been based on observations motivating inductive explorations, so I want to encourage this insufficiently-used approach that I have found so fruitful.

There is much more to discover. This symposium consists of exemplary developments that transcend previous understandings of relational models. Let's develop these and keep exploring in all directions!

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Declarations

Competing interests I have no competing interests.

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