Structural Realism and the Social Sciences

Harold Kincaid†

After sorting different structuralist claims, I argue that structural realist ideas are instantiated in the social sciences, providing both clarification of social science research and support for some components of structural realism. My main focus is on three distinct ways that the social sciences can be about structural relations—exemplified by claims about social structure, reduced form structures in causal modeling, and equilibrium explanations—and on the implication of structuralist ideas for thinking about issues concerning causal explanation and nonreductive pictures of the unity of the science.

Structural realism has been a lively research program in philosophy of science since Worrall's (1994) revival of the idea. This article asks what relevance various structural realist ideas might have for thinking about the social sciences. I argue that structural realist ideas are instantiated in the social sciences, providing both clarification of social science research and support for some components of structural realism. My main focus is on three distinct ways that the social sciences can be about structural relations and on the implication of structuralist ideas for thinking about issues concerning causal explanation and nonreductive pictures of the unity of the science.

Let me begin by saying something about what structural realism in general is. I take it that structural realism can involve multiple hypotheses differing in their logical strength and that it comes in both epistemic and ontic forms (see Ladyman et al. 2007). Among the key claims are:

1. Structures can be known without knowing the intrinsic nature of the entities related by the structure.
2. Changes in theories over time may not involve changes in structure.

†To contact the author, please write to: Department of Philosophy, 900 13th Street South, University of Alabama at Birmingham, Birmingham, AL 35294; e-mail: kincaid@uab.edu.

Philosophy of Science, 75 (December 2008) pp. 720–731. 0031-8248/2008/7505-0019$10.00
Copyright 2008 by the Philosophy of Science Association. All rights reserved.

https://doi.org/10.1086/594517 Published online by Cambridge University Press

3. The no miracles argument thus can show that the structures described by mature science track the truth despite past radical changes in ontology.
4. There can exist well-confirmed complete theories that posit only structure and no things related by the structure—individual things are redundant.
5. Fundamental physics—quantum mechanics and general relativity—is one such theory.
6. Structures can be analyzed as modal relations that do not involve any very thick notion of causation.
7. Focusing on structures can provide a coherent account of how the sciences are unified.

There are, of course, numerous issues about how such claims are to be spelled out. However, my target here is the general research program of structural realism, not specific instantiations, and I think that we can ask about its relevance to the social sciences while staying at this level of generality.

Two of these theses I will not consider. Obviously thesis 5 is directly not relevant to my topic. Thesis 3 in the form stated above seems to me to embody a mistaken project of using inference to the best explanation (Day and Kincaid 1994). I think we have good reason to reject any general argument of the form "Science X preserves the same structures through theory change, and thus those structures must be tracking the truth." Studies in the history and sociology of science make it clear that sciences, especially the social sciences (Mirowski 1989), can adopt the same formalisms for reasons that have little to do with truth and evidence. This does not preclude the possibility that preservation of structure across theories in specific cases may exist because science is on the right track. But the argument for that conclusion will have to be a local one specific to the science at hand that can give good reasons to think that such things as fad and fashion are not the source of common structure across theories. Thus I will defend only a more restricted form of thesis 3. All the other structural realist claims, I shall argue, gain some support from and help clarify issues in the social sciences.

I turn now to discuss three general instances of structural realism in the social sciences: the ubiquitous appeal to "social structure" in the social sciences, the use of reduced and flexible form equations in causal analysis, and explanations by appeal to equilibrium outcomes. What I hope to show is that there is a meaningful sense in which social scientists explain by social structure alone—thus instantiating theses 1 and 4—and that structural relations may be preserved across theories, thus supporting thesis 2 and a weaker version of 3.

https://doi.org/10.1086/594517 Published online by Cambridge University Press

Social scientists frequently appeal to something they call "social structure" in explaining both microphenonema and macrophenomena. However, the term seems to have many meanings and often goes completely undefined. The most useful notion of social structure for my purposes is exemplified by this quotation from Karl Marx: "To prevent possible misunderstandings, a word. I paint the capitalist and landlord in no sense coleur de rose. But here the individuals are dealt with only in so far as they are the personifications of economic categories, embodiments of particular class relations and class interests" ([1867] 1992). The key idea here is that structure consists in a relation not between individuals but between positions or statuses and roles. A position or a status is a socially designated category into which individuals or groups of individuals fall. Obvious examples are producers and consumers, the elements of the organizational chart of an institution, and social groupings such as ethnic groups, economic elites, and so on. Roles are descriptions of traits and behaviors associated with the position, where relative access to resources of different types and characteristic outputs are usually important. In short, there is a division of labor—labor broadly understood as social activity—that characterizes any organized social system or society.

The key question for the issue of structural realism concerns in what sense social scientists talk about structures and not individuals. Are not roles and positions occupied by individuals? Care is called for here.

It is worth recalling some ideas from Willard Van Orman Quine that can be of help, that is, that what a theory is about is always some set of entities *under a description* and that there may be more than one way to interpret the objects of a theory when more than one set of objects suffice to make the assertions of the theory true (Quine 1986). When we ask what a theory does or does not tell us about objects over and above its claims about structure, those objects will always be objects described in some way, and what the theory is about may depend on that description. Moreover, it is possible that different kinds of entities might satisfy the same theory. Keeping these points in mind will help in making sense of the idea that the social sciences are studying social structure, not individuals.

One clear sense in which social theories may be about structures and not individuals is that social structure can relate organizations, classes, groups, practices, and so forth without any explicit reference to individuals. Of course, organizations are in some sense composed of individuals. However, that fact may give us only an anemic sense of "being about individuals" unless we have reductionist bridge laws relating social kind terms to descriptions of individual behavior.

We get more traction from adding the social science claim that, in some sense, the individuals occupying the roles or positions do not matter. So

https://doi.org/10.1086/594517 Published online by Cambridge University Press

it is Marx's view that the nature of the economic and social relations between positions is such that, for anybody to survive in the position, they have to adopt the strategies and behaviors typical of the role. Profit maximizing in the face of competition and differential survival of firms in a market seem to be his clearest case of this claim.

This kind of analysis is widespread in the social sciences. I have already cited the example of Marx. Anthropologists studying small-scale societies identify positions and roles in great detail. Evolutionary game theory and related selectionist accounts of social organization identify sets of strategies. These are different positions with different roles as described above. These ideas can sometimes be given quite formal expression, as is done in network theory in sociology, which uses the theory of graphs to identify networks and to identify which networks are structurally equivalent.

Let us see if we can give the idea that "individuals do not matter" more content. A first stab comes from the set theoretical distinction between structural equivalence and structural isomorphism. The first requires equivalent individuals and relations, the latter only equivalent relations. Individuals do not matter when two structures exist that are structurally isomorphic but not structurally equivalent.

If we combine structural isomorphism with Quine's claims that ontological commitment is always under a description, we can make further progress on the idea that individuals do not matter. The question of what theories of social structure are about must be relativized to a domain of entities under a description. We could map "capitalist" and "worker" onto two specific named individuals picked out by those names. This would give us a very weak form of structuralism of the sort identified by structural equivalence. On the other hand, we could map them onto individual entities under their role description only, either as a type or token—this particular capitalist versus capitalists. Then two systems share the same structure if capitalists in one system bear the same relations to others in the role system as capitalists do in another system. Obviously we get a stronger sense of explaining by structure alone alone when we move from explaining by reference to Karl the capitalist to capitalists simpliciter.

I propose that we can then measure the extent to which individuals do not matter along two dimensions: the extent to which fixing the facts about individual human beings fix the facts about social roles and the extent to which the facts about social roles can be multiply realized in facts about individuals. I would cash this out in terms of truths in a specified vocabulary rather than in terms of properties, for I find it much clearer and less conducive of the unfruitful debates that talk of properties promotes.

So we have two questions to answer: To what extent do true statements

https://doi.org/10.1086/594517 Published online by Cambridge University Press

about individuals in some language that invokes only intrinsic, nonrole predicates fix the truths about roles in some social structural vocabulary? To what extent do truths about roles fix truths about individuals?

How we are to think about the idea of an "extent" here? The relevant theory of individual behavior and of social roles will each determine a set of possible predicates that can apply. We can then judge the size of the set of social predicates that can apply once the truths about individuals are set and the size of the set of individual predicates that can apply once the social predicates are fixed. Similar measures might be constructed by asking not about the possible predicates that apply but about the extent to which the values of one set of variables fix the range of another.

Of course there will be various ways to do the above and various ways to trade off the two measures. However, that does not matter to our purpose of getting a clearer statements of the sense in which individuals do not matter. Obviously it is an empirical matter just how much individuals do or do not matter, one that has to be relativized to a set of predicates employed in our explanations. I believe that we can indeed find many instances where individuals do not matter and structure that does, but that would have to be argued case by case, something I cannot do here.

I want to turn now to a second sense in which the social sciences are about structure. Here my evidence comes from the practice of causal modeling and hence has potential import beyond the social sciences. Modeling complex causal processes generally involves writing a set of simultaneous equations specifying the causal relations. The model is then provided some empirical support by estimating the parameters of the equation for a batch of observational data. If the results are consistent—the signs have the right direction and the parameter sizes are reasonable—then we have some evidence that the causes are as we described them in the equation.

A constant problem however is that our models do not make detailed enough predictions to allow us to distinguish them from other possible causal models, given the data we have. This possibility is not mere speculation. We can sometimes read off from the equations we can estimate that there must be other models and say what they may be.

There are two standard ways this occurs. In one case our full causal model is what is called "underidentified," to use the technical term. For example, if we have more unknowns than equations, our model is underidentified. Economists constantly face this situation and either expend a great deal of effort or simply pull assumptions from the air to add further equations to make the model overidentified so that it can be decisively tested by the data.

The classic case illustrating this situation is estimating supply and de-

https://doi.org/10.1086/594517 Published online by Cambridge University Press

mand curves from price and quantity data. The data often allow us only to estimate total quantity as a function of price (and vice versa). So we have

$$Q = xP. \tag{1}$$

But supply and demand causal explanations postulate further variables, namely, Q_d and Q_s, which are independent functions of price,

$$Q_s = a_0 + a_1 P, \tag{2}$$

$$Q_d = b_0 + b_1 P, \tag{3}$$

and where we have independent evidence that

$$Q_d = Q_s. \tag{4}$$

We assume thus that

$$x = (b_0 - a_0)/(a_1 - b_1).$$

However, there are indefinitely many values of the a and b coefficients that satisfy this equation. So equation (1) is called a reduced form of equations (2)–(4) in terms of the observed values. We cannot recover the a's and b's from this data.

The other way such observation equivalence shows up is in the assumptions we need to make about the functional form of the equations we are estimating. Frequently the data by themselves are insufficient to pick between two different equations like those below:

$$Q = xP.$$

$$Q = xP^2.$$

These differ in their functional form.

These problems are usually seen as problems to be overcome. However, in the spirit of structural realism, we can see them as an epistemic virtue. While underidentification and unrestricted functional forms mean that we can know that there are multiple possible models consistent with the data, we also know that those models will share the same structure. That structure is specified by the reduced form equations in the case of underidentification and by the more general equation that captures the different functional forms, in our case

$$Q = xP^n.$$

My point is that reduced form equations and flexible functional form equations represent at least an interesting form of epistemic structural

https://doi.org/10.1086/594517 Published online by Cambridge University Press

realism in the social sciences. I would argue that, across a great many disputes in economics, there is substantial agreement on what the data show about reduced form or flexible form structures. We can know these structures on their own, and they specify no specific causal model beyond that which is captured in the equations.

A point that may seem obvious now but that so far as I know has been undiscussed in the structural realism literature is that we can argue for well-confirmed structure synchronically in addition to the usual diachronic argument about change over time in scientific theories. That is, structural realism can be a plausible response to arguments against realism from underdetermination.

My suspicion here is that this synchronic form is actually more important in the social sciences where real cases of underdetermination are not hard to find and where clear-cut theory change with changes in ontology but not structure are relatively rare. Obviously, making this case calls for more investigation than I have done. I have also not said exactly what kind of knowledge the resulting structures produce. Is it causal or functional only? I address this issue briefly below.

However, despite this optimistic conclusion, we cannot infer simply from shared structure to its probable truth, for the reasons I gave earlier for rejecting a no miracles argument, that is, that other, nonepistemic explanations have to be ruled out. There are various reasons to think that econometric results have sufficient slack to allow ample room for sociological explanations for agreement across studies where the sociology has little contact with epistemic constraints. Whether reduced form structures survive such deflating explanations is not a question that has been directly investigated. It is certainly a question worth exploring, one prompted by taking structural realism seriously. In line with my remarks advocating local arguments for realism and for rejecting global philosophical ones, it is this kind of detailed study that can make a serious claim for realism.

A third place that social science invokes structures comes when it gives what Elliott R. Sober (1983) calls "equilibrium arguments." Equilibrium arguments, as he defines them, are explanations of phenomena that show that the values of a set of variables are self-consistent. Sober's example is the explanation of the sex ratio in a population given by population genetics. Dynamical systems theory describes a number of different equilibrium concepts such as local and global equilibrium, strong attractors, and so on. These have widespread application in the social sciences—for example, in evolutionary game theory, macroeconomics, microeconomics, demography, and even history.

These explanations identify structures in that they tell us about relations between variables but do so by abstracting from the actual details producing them. When an equilibrium is a strong attractor, for example, then we can

https://doi.org/10.1086/594517 Published online by Cambridge University Press

explain a current equilibrium while being ignorant of which of the many dynamic paths produced it.

Let me give one social science example of these equilibrium explanations from some of the best work on industrial organization, namely, the extensive studies of John Sutton (1998). Sutton wants to explain, among other things, the relation between R&D spending, measured by the ratio of spending to industry sales, to the level of concentration in a given industry. Sutton argues that a crucial part of the story involves an escalation mechanism. An escalation mechanism refers to the process whereby firms increase spending on R&D to improve product quality and thereby attract a greater share of the market. Escalation in this sense is opposed to the opposite strategy of proliferation, where spending is spread across different products. A firm will increase spending on improving a specific product only if it is profitable. A key factor determining profitability is the degree of substitutability in the market—fragmented markets are those with low substitutability between product types, whereas homogeneous markets are those with high similarity between product types. In a fragmented market, the argument goes, R&D escalation will not be profitable, since increases in market share will only come from selling products in an individual small-product group. In a homogeneous market, however, escalation will be profitable when market shares are low. So we should see greater concentration in homogeneous markets than fragmented ones. Thus the escalation mechanism should place a lower bound on the one-firm concentration ratio. Where that lower bound will fall also crucially involves the elasticity of the cost function for product quality, which influences the strength of the escalation mechanism.

Sutton uses game theory to study such processes. However, we know from game theory that it makes a difference to equilibrium results if we model competition as a Cournot or a Bertrand process. A Cournot process is one in which firms compete on prices, whereas in the Bertrand case firms are deciding on quantities. It is seldom possible to tell from available data which game is actually being played in the real world.

Sutton avoids this problem by arguing that either process will produce an equilibrium with certain common characteristics. He does that by defining an "equilibrium configuration" of product types (that are observable) that requires viability and stability. Viability is the assumption that the firms that survive are able to cover their fixed costs. Stability is the requirement that there be no room for arbitrage at equilibrium—no set of products can be added that will cover their fixed costs. He shows that the set of equilibrium configurations contains the set of Nash equilibriums for various different competition games that might be played. This allows him to argue that the ratio of the largest firm to industry size will have

https://doi.org/10.1086/594517 Published online by Cambridge University Press

a lower bound regardless of the game being played and that quantity can in fact be observed.

So we have an interesting instance in the social sciences where a structural relation holds up across differences in theories. There is a functional relation between industry size and largest firm market share that can be known without knowing whether the competition is Bertrand or Cournot. I do not think that examples like this do much to support the ontological versions of structural realism, because I do not see how to make sense in this case of the idea of being about structures and not individuals. However, work like Sutton's does support epistemic structural realist ideas.

I turn in the rest of this article to look at two further questions: To what extent are the structural relations described by the social sciences causal relations? What does the place of structure say about reductionism issues? Some of the issues are quite complex, so my discussion will outline issues and a sketch of a position on them.

Let me start with one of the easier issues, that is, reductionism in the guise of a claim about theory reduction. On standard accounts of theory reduction, bridge laws providing one-to-one mappings from reduced to reducing predicates are required. That requirement can be loosened up to allow mappings to analogs or corrected versions of the reduced predicates. However, something not widely appreciated is that one-to-one mappings do not suffice to reduce, ultimately because deducing from laws is not sufficient for explanation. This point was illustrated in the early debates over phenomenalism and behaviorism, where alleged reductions ultimately presupposed what they were supposedly explaining, as illustrated by defining emotions in terms of "anger behavior" and so forth.

To the extent that there is empirical evidence that there are successful social explanations in terms of social structure as defined above, then there is evidence that the needed bridge laws are unlikely to be available and that the problem of presupposing social explanations is likely to be real. Social structural explanations were defined as ones in which both multiple realizations of social roles is likely and where facts stated in an individualist vocabulary do not fix facts stated in social vocabulary. That means that bridge laws are not to be had. Moreover, to the extent that explanation proceeds in terms of roles in a complex social structure, apparently individualist-looking accounts will presuppose social explanations rather than replace them. Explanations in terms of social roles are about individuals, but about individuals under a social description.

What about reductionism in the weaker sense of token identity? Is that claim defensible? The thesis applied to the social sciences would be that every social entity token is identical to some set of individuals. Arguably that claim must be weakened to include material objects in some sense, because the built environment seems an essential part of many social

https://doi.org/10.1086/594517 Published online by Cambridge University Press

institutions (just like an ecosystem is not just a collection of organisms but also includes the niches they have constructed). Furthermore, social structures suggest that token identity will have to be identity at a time, since over time the same institutional token will be realized by different individuals so long as the structure persists. Finally, explanations in terms of social structure can be sufficiently detached from the details about the individuals bringing it about that it is indeterminate exactly which individuals at a time compose the institution. This is in principle no different from the problem of trying to decide which molecules make up a particular table. Some see in this a reductio of physicalism, since it looks like everything is composed of fundamental physical entities only in the sense that the totality of the universe is identical to the totality of the physical universe. Alternatively, we might just admit there is some arbitrariness about "the" physical and, correspondingly, the individual realization. I cannot see that much of importance turns on which answer is correct.

Let us turn finally to the structuralist realist idea that structures involve no more than a commitment to modal relations. Ladyman et al. (2007) argue that the special sciences do identify causal relations but that these are ultimately bookkeeping claims to help pick out what are "real patterns" as initially defined by Daniel C. Dennett (1991) and that real patterns are modal relations that need not be spelled out in causal terms. My question is a prior one: Are structural explanations in the social sciences causal explanations in the first place? There are reasons they may not be. I focus on them.

One argument that has roots in Wittgensteinan philosophy of social science of the 1950s and that still has strong resonance among some social scientists is that social structures thought of in terms of roles describe conceptual connections and thus are not causal. In one form this claim instantiates a nonnaturalist view of meaning and mind for the social sciences that I and others have discussed at length elsewhere, so I will avoid it.[1] However, the argument has influential versions among social scientists not committed to hermeneutics and Verstehen. One particular recent influential instance is that developed by Alexander Wendt (1999) in the international relations literature.

Wendt's argument is straight forward. Causal relations are empirical and contingent. Causes must precede their effects. However, social structural relations are not like that. Social roles and institutions are defined in terms of each other: prisons hold prisoners and prisoners are supposed to be in prison. The relations constitute the role in question. Hence the relation between them is not causal but conceptual. The relation between

1. Davidson 1980 is seminal here; my discussion is in Kincaid 1996, Chapter 4.

https://doi.org/10.1086/594517 Published online by Cambridge University Press

being a bank teller and being a bank customer is conceptual, not causal. The relation between bank tellers and customers is constitutive—their relation constitutes each.

The response here is fairly obvious if we keep in mind the Quinean notion of entities referred to under a description, as has been pointed out by others in similar kinds of arguments (Davidson 1980; Sober 1984). "Fitness causes differential survival" may be a tautology, but "Long beaks in this environment cause survival" is not. Mental states as reasons may have a logical connection to actions, but neurological states do not.

We can argue something similar about the elements of social structure. We can, of course, describe structure in terms that seem to have tight conceptual linkages, such as teacher and student. But that is a fact about the language being used, not about some deep metaphysical fact. If role talk is to have any content, then we ought to be able to specify some specific behavior or traits that make up that role and to do so in nonrole terms. The relation between roles will than be a causal relation, no doubt complex, between the behaviors and traits that comprise them. Whether such a causal relation exists is a contingent empirical question, not a logical truth.

I think a much more interesting question is whether the structures identified by reduced form or flexible form equations are causal relations or some less committal modal relation. The issue is complex, because there are multiple ways to spell out causality and arguably not one sense of causation is at work in the sciences (see Cartwright 2007 for one argument for this claim). So what is causal on one perspective need not be on another, and we might expect varying implications for the causal versus modal issue.

One important sense of causation is fleshed out in terms of ideal intervention (Woodward 2003). An ideal intervention is one that basically wiggles a variable of interest with interrupting in any other causal relations. If an ideal intervention would result in a change in another variable, the variable intervened upon is its cause. Much useful work can be done with this conception.

So, are reduced form structures ones that are causal on this view? If no ideal intervention is actually possible because the modularity assumption is violated in the real world, then no causal relation of the Woodward type seems justified. However, reduced form structural relations can surely result from underlying causal processes that ensure that intervening on an element of the reduced form variable would violate the modularity assumption, then vitiating any causal claim based on the reduced form relations. However, I do not see that this means that every reduced form structural relation is one in which modularity must fail. When we have a possible complex causal model with causal structure between an inde-

https://doi.org/10.1086/594517 Published online by Cambridge University Press

pendent variable and a dependent variable—that is, occurring later in time and having its effects only via the intervening structure, the reduced form surely captures causes in the Woodward sense.

Conclusion. I have argued that there are multiple senses in which the claims of structural realism make good sense in the social sciences. I hope that the discussion not only shows an application of structure realist ideas but also points to further explication of the position itself. The Quinean naturalist interpretation of how social structure is or is not about individuals is one such possibility, and the extension of structural realist concepts to underdetermination arguments is another. I hope that in the process I have also shown that there are many fruitful investigations to be carried out in the philosophy of the social sciences around the extent to which structures are preserved across different social science theories and the extent to which they admit of causal interpretation.

REFERENCES

Cartwright, Nancy (2007), *Hunting Causes and Using Them*. Oxford: Oxford University Press.
Davidson, Donald (1980), "Actions, Reasons, and Causes", in Donald Davidson, *Essays on Action and Events*. Oxford: Clarendon, 1–19.
Day, Timothy, and Harold Kincaid (1994), "Putting Inference to the Best Explanation in Its Place", *Synthese* 98: 271–295.
Dennett, Daniel C. (1991), "Real Patterns", *Journal of Philosophy* 88: 27–51.
Kincaid, Harold (1996), *Philosophical Foundations of the Social Sciences*. Cambridge: Cambridge University Press.
Ladyman, James, and Don Ross, with David Spurrett and John Collier (2007), *Everything Must Go: Metaphysics Naturalized*. Oxford: Oxford University Press.
Marx, Karl ([1867] 1992), *Capital: A Critique of Political Economy*, introduced by Ernest Mandel and translated by Ben Fowkes. Vol. 1. New York: Penguin. Originally published as *Das Kapital*.
Mirowski, Phillip (1989), *More Heat than Light: Economics as Social Physics, Physics as Nature's Economics*. Cambridge: Cambridge University Press.
Quine, W. V. O. (1986) *Theories and Things*. Cambridge, MA: Harvard University Press.
Sober, Elliott R. (1983), "Equilibrium Explanation", *Philosophical Studies* 43: 201–210.
——— (1984), *The Nature of Selection*. Cambridge, MA: MIT Press.
Sutton, John (1998), *Technology and Market Structure*. Cambridge, MA: MIT Press.
Wendt, Alexander (1999), *Social Theory of International Politics*. Cambridge: Cambridge University Press
Woodward, James. (2003), *Making Things Happen: A Theory of Causal Explanation*. New York: Oxford University Press.
Worrall, John (1994), "How to Remain (Reasonably) Optimistic: Scientific Realism and the 'Luminiferous Ether'", in Micky Forbes and David M. Hull (eds.), *PSA 1994: Proceedings of the Biennial Meeting of the Philosophy of Science Association*, vol. 1. East Lansing, MI: Philosophy of Science Association, 334–342.

https://doi.org/10.1086/594517 Published online by Cambridge University Press