Discussion

Philosophy of the Social Sciences
2023, Vol. 53(5) 439–446

DOI: 10.1177/00483931231193201
journals.sagepub.com/home/pos
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Causal vs. Conceptual Heterogeneity: Reply to Turner

James Mahoney[1]

Abstract

Professor Turner's reply to my article focuses on the ways in which set-theoretic analysis can be used to help solve problems of *causal heterogeneity* in social science research. By contrast, I discuss the ways in which set-theoretic analysis can be used to help solve problems of *conceptual heterogeneity*. I identify conceptual heterogeneity as a ubiquitous problem that is disguised by psychological essentialism. The seriousness of this problem must be recognized for scholars to appreciate the advantages of constructivist set-theoretic analysis for the social sciences.

Keywords

essentialism, constructivism, set-theoretic analysis, categories, causality

In this essay, I respond to Stephen Turner's comment on my article, "Constructivist Set-Theoretic Analysis: An Alternative to Essentialist Social Science" (Mahoney 2023). Professor Turner's comment mainly focuses on my preferred approach to social science—constructivist set-theoretic analysis—and its application to the study of intelligence, race, and poverty avoidance in the work of Ragin and Fiss (2017). Professor Turner and I agree

Received 24 July 2023

[1]Departments of Sociology and Political Science, Northwestern University, Evanston, IL, USA

Corresponding Author:
James Mahoney, Departments of Sociology and Political Science, Northwestern University, Scott Hall, 601 University Place, Evanston, IL 60208, USA.
Email: james-mahoney@northwestern.edu

with respect to the advantages of a set-theoretic approach at handling subgroup heterogeneity in causal analysis. In particular, we agree that set-theoretic analysis is well-equipped to address equifinality, in which different combinations of INUS conditions are associated with the same outcome. These advantages of a set-theoretic approach apply regardless of whether one is an essentialist or a constructivist.

However, I also want to argue that the gravity of the problem of subgroup heterogeneity is more profound than most social scientists realize. In order to appreciate the extent of this problem, we need to recognize that psychological essentialism leads us to believe that the social world consists of homogenous entities that possess inner essences that endow them with a common identity and nature. When we lift the illusion of psychological essentialism, we are left with a social world that is radically heterogeneous in its composition.

Set-theoretic analysis is an appropriate method for the social sciences not only because it is well equipped to address issues of *causal homogeneity*. It is also well equipped to deal with issues of *conceptual heterogeneity*—i.e., heterogeneity at the level of individual categories and specific variable values (cf. Goertz and Mahoney 2012). Whereas an essentialist approach exasperates problems related to conceptual heterogeneity, a constructivist approach embraces this heterogeneity as a standard feature of social reality.

1. Causal Heterogeneity

Professor Turner offers a nice discussion of the ways in which Ragin and Fiss's work *Intersectional Inequality* (2017) uses set-theoretic analysis to identify subgroup heterogeneity when assessing the causes of poverty avoidance for individuals in the United States. His discussion is particularly valuable because it compares combinatorial causality using set-theoretic analysis to net effects causality using mainstream statistical analysis. When studying net effects in a non-experimental mode, as he points out, Simpson's paradox lurks as an ever-present threat to validity. Researchers must identify and control for all relevant confounders to address this threat. Yet doing so is practically impossible in many research domains, including the one under discussion, which requires separating the effects of race, class, and intelligence on poverty avoidance.

The Ragin and Fiss example shows how set-theoretic analysis can help the analyst to identify heterogenous subgroups within a larger population of cases. Set-theoretic analysis focuses attention on distinct *combinations* of conditions that that are each consistently followed by the same outcome. From the standpoint of a statistical design, these distinct combinations can be seen as heterogenous subgroups within the larger population. Such subgroups often must be recognized and controlled for in order to correctly estimate causal effects within the population as a whole. Set-theoretic analysis helps

researchers locate distinct subgroups and thus better meet assumptions of causal homogeneity in their research.

Professor Turner suggests that one can make these points about the utility of set-theoretic analysis without having to wade into the murky waters of ontology. He discusses the arguments in my article about psychological essentialism and scientific constructivism only briefly. I think Professor Turner and I agree that social scientists should generally not engage in issues of ontology unless it leads to some kind of substantive payoff; we already have enough to worry about without delving into metaphysics. However, in this particular case, I think we must consider ontology in order to appreciate the extent to which social phenomena are heterogenous. An appreciation of heterogeneity at the level of individual categories calls attention to the advantages of constructivist set-theoretic analysis.

2. Conceptual Heterogeneity

This section discusses the problem of conceptual heterogeneity and explains why constructivist set-theoretic analysis offers a solution to this problem.

2.1. The Homogeneous Variable Value Assumption

To keep things simple, let us imagine that we are working with a dichotomous category, such as *country*. Typically, we would say that a territory (or other kind of case) is either a country or a not-country. The category *country* can be represented as a variable, X, with two possible values, X_{C} and $X_{\sim\mathrm{C}}$.

Normally, social scientists assume that all territories with the value X_{C} share something in common beyond the fact that we have called them countries. That is, they assume that cases are countries because they share a prior property P that makes them countries. This property endows the cases with a common identity and a common nature, including certain tendencies. The property is objective in the sense that it is a fact about the world rather than a mere opinion. The variable value stands for this property: $X_{\mathrm{C}} = P$. Let us call this assumption the *homogeneous variable value assumption*. The homogenous variable value assumption says that cases that share a variable value share a common efficacious property prior to being labeled and understood as a similar kind of entity.

If the homogeneous variable value assumption is false, then problems of heterogeneity exist at the level of individual categories and individual variable values. If this assumption is false, cases that share the same variable value may not have anything in common other than the fact that they share the same variable value. Many different properties (P_1, P_2, P_3, . . .) may each be sufficient for a case to possess the same variable value: $X_{\mathrm{C}} = P_1 \vee P_2 \vee P_3 \vee P_{\mathrm{N}}$. With such heterogeneity, cases that possess the same variable value may not

exhibit similar tendencies. Indeed, conceptual heterogeneity violates the homogeneity assumptions required for valid causal inference in mainstream statistical analysis. When conceptual heterogeneity is present, findings about causal effects are apt to be unstable, inconsistent, and irreplicable.

I argue that the homogenous variable value assumption is false for many social science categories, in particular those that do not refer to approximate natural kinds. With social categories, I reject the notion that cases that share the same value on a variable must or do possess any prior property that endows them with a common identity and a common nature. For instance, the cases that are members of the category *country* do not possess any internal or externally-derived conditions that make them countries as opposed to not-countries. The cases that we call countries are made similar to one another by virtue of our shared understandings and systems of classification. These understandings and systems of classification construct heterogenous territories into similar entities with respect to the variable *country.*

2.2. Psychological Essentialism

In the article, I argue that social scientists—like all human beings—are disposed to engage in psychological essentialism. Under psychological essentialism, human beings see heterogeneous entities as sharing common properties that endow them with a common identity and a common nature, including certain tendencies. In making this argument, I draw on a large scientific literature from psychology and cognitive science (see Gelman 2003; Newman and Knobe 2019 for literature reviews). This literature considers both natural kinds (e.g., *quark*) and social kinds (e.g., *country*). Professor Turner writes that, "This is an intriguing and important line of argument that has many analogues" (Turner 2023, 2). He points out that many of these analogues assume that there is a "correct" model of reasoning that is violated by a cognitive bias. He notes that the evidence for some these biases remains thin. He does not explicitly argue that the evidence for psychological essentialism is thin. Does Professor Turner believe—like I do—that human beings live under the illusion of psychological essentialism?

Under psychological essentialism, social scientists—like people in general—believe that the homogenous variable value assumption is true. Social scientists are disposed to believe that social categories are defined by shared properties that endow them with an identity and nature, including tendencies. In the case of mainstream statistical work on net causal effects, researchers assume that variables exert causal effects because they refer to efficacious properties that cases literally possess independent of their classification. Social researchers are disposed to believe that if a case changes its value on a variable, the case has undergone a coherent change in some efficacious property literally possessed by that case.

When I discuss constructivist set-theoretic analysis as a solution to problems of heterogeneity, I am primarily concerned with the problem of conceptual heterogeneity (rather than causal heterogeneity). I propose that set-theoretic analysis can be configured as a constructivist approach that allows us to analyze categories scientifically even when the homogeneous variable value assumption cannot be sustained.

2.3. Constructivism

The category *constructivism* means different things in different contexts. I use the category to refer to a research program that embraces the proposition that shared understandings are constitutive of social categories, including the categories used in social science research. For instance, some cases are countries, and some cases are not-countries, because we understand and classify them that way rather than because they possess a preexisting identity and nature that makes them countries or not-countries. We can specify defining criteria of countries, such as sovereignty, territorial stability, and membership in the United Nations. However, these defining criteria are equally dependent on shared understandings for their existence. Cases that are members of the same category (or that are assigned the same value on a variable) need not possess any efficacious properties in common. Rather, shared understandings are constitutive of social categories at all levels of generality.

Despite what our psychological essentialism tells us, social categories do not mirror an external reality that exists independent of our minds. Rather, social categories are mind-dependent entities that lack natures, essences, dispositions, and tendencies. One consequence is that a case can change its category membership (or its specific value on a variable) without any corresponding change occurring to the properties of the case. For instance, a territory can move from being a not-country to being a country without any changes occurring other than a new understanding of the meaning of *country*. In constructivist set-theoretic analysis, sets and set boundaries are ontologically prior to the entities that they categorize.

Professor Turner and I agree that set-theoretic analysis can help analysts identify regularities among social categories within specific communities that share an understanding of the meaning of those categories. I think we both see the identification of these kinds of regularities as a major accomplishment of the Ragin and Fiss (2017) book. However, Professor Turner is concerned that the regularities identified in Ragin and Fiss are not *causal* in nature. Rather, one must "add in" a causal interpretation for the results to be causal findings. As Cartwright (1989) put it, "no causes in, no causes out." Turner argues that the interpretation of the regularity findings as causal in nature requires a kind of essentializing: we must assume that the categories have causal properties in order to interpret the findings as causal in nature.

Here we may disagree on the meaning of the category *causality*. I allow for different definitions of causality (Professor Turner probably does too). For the social sciences, I embrace a regularity theory of causality in which causes are nothing more and nothing less than spatiotemporal regularities. Causality exists between *X* and *Y* if the following conditions apply: (a) *X* comes before *Y* in calendar time; (b) *X* is directly or indirectly linked to *Y* in experiential space; and (c) *X* is part of the ideally minimized solution set that is constantly conjoined with *Y*. I believe that Professor Turner, like many social scientists, wants something more for causality to exist. But I am satisfied with these three criteria as constituting causality, much as Hume was (in at least some of his writings), and much as contemporary advocates of a regularity theory of causality are (e.g., Baumgartner 2013; Psillos 2002).

These three criteria rule out as not-causal various spurious regularities, including the oft-cited example that certain barometer readings (e.g., a low bar reading) are always followed by certain weather patterns (e.g., a storm). The barometer-weather association only meets the first criterion of a regularity theory of causality—i.e., *X* precedes *Y* in time. The barometer reading is not spatially linked to weather outcomes (criterion 2) because one cannot trace a continuous causal process from the barometer on the ground to the weather outcome in the upper atmosphere. Moreover, the barometer does not appear in the ideally minimized solution set that explains weather outcomes (criterion 3). The process of Boolean elimination weeds out information about the barometer as redundant and unnecessary, such that it is not included as an INUS condition in the final solution set.

My satisfaction with this definition of causality is linked to my constructivist belief that social categories do not exist independently of the shared understandings that constitute them. Social categories are fundamentally cognitive phenomena. To be sure, social categories reference entities in the natural world (i.e., natural kinds). But they lack anything approximating a one-to-one correspondence with natural kinds; they do not carve nature at its joints. A social category references entities that are heterogenous in their natural kind composition. Given this ontology, the best social scientists can hope to achieve is an objective analysis of minimized regularities and spatiotemporal connections among social categories—as these categories are understood within specific communities. If these regularities feature the three criteria listed above, I believe we should call them causal regularities. In the case of Ragin and Fiss (2017), I think the causal component that is most lacking is the spatial criterion: causes must be directly or indirectly linked to outcomes across space. Here I think their analysis could benefit from process-tracing case studies that explore whether specific causal packages are linked to outcomes across space and time. (I suspect that Ragin and Fiss would welcome such case-study research).

A constructivist set-theoretic approach views social categories as corresponding to cognitive spaces in human minds that reference mostly uncomprehended natural entities in the world. The "categories" and the "sets" of set-theoretic analysis correspond to conceptual spaces in human minds (cf. Gärdenfors 2000, 2014). This commitment of the approach builds mind-dependence into the definition of social categories; social categories are inseparable from the minds that house them. This commitment also places constructivist set-theoretic analysis in a discussion with exciting research in cognitive science concerning how the human brain constructs the reality that it perceives (Barrett 2017; Barsalou 2016; Turner 2002). Whether or not Professor Turner endorses constructivism, I think we can both agree that social scientists stand to benefit from paying more attention to this literature. After all, if our social categories are mind-dependent entities, should not we want to know about the minds on which they are dependent?

3. Conclusion

Professor Turner and I discuss different ways in which set-theoretic analysis can be used to help solve problems of heterogeneity in social science research. He discusses *causal heterogeneity*; in particular, the ways in which set-theoretic analysis can help scholars identify subgroup heterogeneity within populations. I discuss *conceptual heterogeneity*; in particular, the ways in which set-theoretic analysis can help scholars work with categories that do not meet the homogeneous variable value assumption. I think we agree on the utility of set-theoretic analysis for helping with the problem of causal heterogeneity. But I suspect that I have not yet convinced Professor Turner about the utility of set-theoretic analysis for addressing the problem of conceptual heterogeneity. I suspect that I have not done so because he is not yet persuaded that conceptual heterogeneity is a ubiquitous problem that is disguised by psychological essentialism. I think the implication is that scientific constructivists like me still have more work to do to if we are to convince reasonable authorities about the gravity of the problem of conceptual heterogeneity and the role of psychological essentialism in hiding this problem from plain sight.

Acknowledgements

For helpful comments on a previous draft, I would like to thank Nancy Cartwright.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

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Author Biography

James Mahoney is the Gordon Fulcher Professor of Decision-Making in the Departments of Sociology and Political Science at Northwestern University. His most recent book is *The Logic of Social Science* (Princeton University Press, 2021). He is currently writing a book on political revolutions that uses a constructivist set-theoretic approach.