

**Between Complexity and Parsimony:
Limited Diversity, Counterfactual Cases, and Comparative Analysis**

Charles C. Ragin and John Sonnett
Department of Sociology
University of Arizona
Tucson, AZ 85721 USA

Forthcoming in:

Sabine Kropp and Michael Minkenberg (eds.), *Vergleichen in der Politikwissenschaft*. Wiesbaden: VS Verlag für Sozialwissenschaften, 2004.

Overview

Counterfactual analysis has a long and distinguished history in comparative research. To some, counterfactual analysis is central to comparative inquiry because such research typically embraces only a handful of empirical cases (Fearon 1991). If there are only a few instances (e.g., of revolution), then researchers, of necessity, must compare empirical cases to hypothetical cases. The affinity between counterfactual analysis and comparative research, however, derives not from its focus on small *Ns*, but from its configurational nature. Case-oriented explanations of outcomes are often combinatorial in nature, stressing specific configurations of causal conditions. Rather than focus on the *net effects* of causal conditions, case-oriented explanations emphasize their *combined effects*.

To support an argument emphasizing combinations of causal conditions, it is necessary for researchers to compare cases that are closely matched with each other. The ideal comparison is between pairs of cases that differ on only one causal condition (Mill 1843). Such comparisons help researchers establish whether or not a specific causal condition is an integral part of the combination of conditions that generates the outcome in question. It is very difficult to match empirical cases in this manner, however, due to the limited diversity of empirical social phenomena.

In this paper, we discuss the impact of limited diversity on comparative case-oriented research. We show how limited diversity is conceived in Qualitative Comparative Analysis (QCA; see Ragin 1987, 2000), and link QCA strategies for

addressing limited diversity to counterfactual analysis. We distinguish two kinds of counterfactual cases, "difficult" and "easy," and demonstrate procedures for incorporating "simplifying assumptions" into QCA based on the analysis of "easy" counterfactual cases. We illustrate these methods with comparative data on international fishing regimes collected by Olav Schram Stokke (2004).

Limited Diversity

Naturally occurring social phenomena are limited in their diversity. In fact, it could be argued that limited diversity is one of their trademark features. It is no accident that social hierarchies such as occupational prestige, education, and income coincide, just as it is not happenstance that high scores on virtually all aggregate indicators of wealth and well being are clustered in the advanced industrial countries. Social diversity is limited not only by inequities of wealth and power, but also by history. For example, the colonization of almost all of South America by Spain and Portugal is a "cultural given" for social scientists who study this region. Likewise, the concentration of African Americans in the U.S. South and in northern cities reflects their history, first as slaves and then as economic migrants. Some regions of the U.S. have relatively few African Americans, just as others have relatively few Hispanics, and so on.

While limited diversity is central to the constitution of social phenomena, it also severely complicates their analysis. If the empirical world presented social scientists with cases exhibiting all logically possible combinations of relevant causal conditions, then social research would be much more straightforward. For example, by matching cases that differ on only a single causal condition, it would be possible to construct focused comparisons that greatly facilitate the assessment of causation. Unfortunately, as we illustrate in this paper, the empirical world offers relatively few opportunities for constructing these focused comparisons.

Even very simple forms of causal analysis are stymied by limited diversity. Consider, for example, Table 1 which shows hypothetical country-level data on two causal conditions, strong left parties (yes/no) and strong unions (yes/no), and one outcome, generous welfare state (yes/no). The table presents all four combinations of the two presence/absence causal conditions, but in this example there are empirical instances of only three of the four. Specifically, there are no countries that combine the presence of a strong left party with the absence of strong unions. Simple inspection of the table reveals that there is a perfect correlation between presence of strong left parties and the presence of generous welfare states, suggesting a starkly parsimonious explanation.

Table 1: Simple Example of the Impact of Limited Diversity

Strong Unions (U)	Strong Left Parties (L)	Generous Welfare State (G)	N of Cases
Yes	Yes	Yes	6
Yes	No	No	8
No	No	No	5
No	Yes	?	0

Notice, however, that an alternate approach to the evidence yields a different answer. If the question is: "Are there relevant causal conditions that are shared by all instances of the outcome (generous welfare states)?" we find that there are two shared conditions, strong left parties *and* strong unions. Further, none of the negative cases (instances of the absence of a generous welfare state) share this combination. This second analytic strategy indicates that it is the combination of strong left parties and strong unions that explains the emergence of generous welfare states, not strong left parties by itself.

Which explanation is correct? A conventional quantitative analysis of these data points to the first explanation because it is not only more parsimonious, it also is "complete" from an explained variance viewpoint--there are no unexplained cases. Case-oriented researchers, however, are not so enamored of parsimony and prefer causal explanations that resonate with what is known about the cases themselves. Typically, when cases are examined in an in-depth manner, researchers find that causation is complex and very often involves specific combinations of causal conditions. Thus, they would no doubt favor the second explanation over the first. The second explanation also would be preferred by case-oriented researchers on analytic grounds. The search for causal commonalities shared by a set of cases with the same outcome is often the very first analytic move in case-oriented inquiry.

At a more formal level, which answer is correct depends on the outcome that would be observed for cases exhibiting presence of strong left parties combined with absence of strong unions--that is, if such cases could be found. If these cases displayed generous welfare states, then the conclusion would be that having strong left parties, by itself, causes generous welfare states. If these cases failed to display generous welfare states, then the conclusion would be that it is the combination of strong left parties and strong unions that explains generous

welfare states. Notice that even though the example is very simple--there are only two causal conditions and only one of the four causal combinations lacks cases--it is impossible to draw a firm conclusion about causation because of the limited diversity of empirical cases. Furthermore, which answer is "correct," in the eyes of contemporary social science, is a matter of taste. Scholars who seek parsimony would favor the first answer; scholars who seek a closer connection to cases would favor the second.

Limited Diversity and Qualitative Comparative Analysis (QCA)

Qualitative Comparative Analysis (QCA) is one of the few techniques available today that directly addresses limited diversity. Unlike conventional techniques, QCA starts by assuming that causation is complex, rather than simple. Most conventional techniques assume that causal conditions are "independent" variables whose effects on the outcome are both linear and additive. The key to QCA is that it sees cases as configurations of conditions and uses truth tables to represent and analyze causal configurations. Truth tables list the logically possible combinations of causal conditions and the outcome associated with each combination. Table 1 is, in fact, a very simple truth table with two causal conditions and four causal combinations. In more complex truth tables the rows (combinations of causal conditions) may be quite numerous, for the number of causal combinations is a geometric function of the number of causal conditions (number of causal combinations = 2^k , where K is the number of causal conditions).

In the language of QCA, the fourth row of the truth table shown in Table 1 is a "remainder"--a combination of causal conditions that lacks empirical cases. In QCA, the solution to this truth table depends on how this remainder is treated. The most conservative strategy is to treat it as *false* when assessing the conditions for the emergence of generous welfare states and also as *false* when assessing the conditions for the absence of generous welfare states, as follows:

presence of generous welfare state:

$$L.U \text{ ----} \rightarrow G$$

absence of generous welfare state:

$$l.U + l.u \text{ ----} \rightarrow g$$

$$l.(U + u) \text{ ----} \rightarrow g$$

$$l \text{ ----} \rightarrow g$$

where upper-case letters indicate the presence of a condition, lower-case letters indicate its absence, L = strong left party, U = strong unions; G = generous welfare state; multiplication (.) indicates combined conditions (logical *and*), addition (+)

indicates alternate combinations of conditions (logical *or*), and "---->" indicates "is sufficient for." The first equation summarizes the first row of Table 1; the second equation summarizes the second and third rows; the third and fourth equations simplify the second equation, using Boolean algebra. According to this analysis, the combination of strong left parties and strong unions explains the emergence of generous welfare states. The absence of strong left parties is sufficient for the absence of generous welfare states.

In QCA, an alternate strategy is to treat all remainders as *don't care* combinations. (The *don't care* label reflects the origin of the truth table approach in the design and analysis of switching circuits.) When treated as a *don't care*, a remainder is available as a potential "simplifying assumption." That is, it will be treated as an instance of the outcome if doing so results in a logically simpler solution. Likewise, it also can be treated as an instance of the absence the outcome, again, if doing so results in a logically simpler solution for the absence of the outcome. This use of *don't cares* can be represented in equation form as follows:

presence of generous welfare state:

$$L \cdot U + L \cdot u \text{---->} G$$

$$L \cdot (U + u) \text{---->} G$$

$$L \text{---->} G$$

absence of generous welfare state:

$$l \cdot U + l \cdot u + L \cdot u \text{---->} g$$

$$l \cdot (U + u) + u \cdot (L + l) \text{---->} g$$

$$l + u \text{---->} g$$

It is clear from these results that using the remainder as a *don't care* combination in the solution for the presence of generous welfare states leads to a logically simpler solution, while it leads to a more complex solution for the absence of generous welfare states. Thus, a researcher interested in deriving a more parsimonious solution might prefer the use of the remainder (the fourth row of the truth table) as a *don't care* combination in the solution for the presence of generous welfare states. Notice that the use of the remainder as a *don't care* combination in the analysis of the presence of generous welfare states offers the same results as a conventional statistical analysis of these same data.

In QCA it is incumbent upon the researcher to evaluate the plausibility of any *don't care* combination that is incorporated into a solution. Assume that the researcher in this example chose the more parsimonious solution for the presence of generous welfare states--concluding that this outcome is due entirely to the

presence of strong left parties. It would then be necessary for the researcher to evaluate the plausibility of the simplifying assumption that this solution incorporates, namely, that if instances of the presence of strong left parties combined with the absence strong unions did in fact exist, these cases would display generous welfare states. This is a strong assumption. Many researchers would find it implausible in light of existing substantive and theoretical knowledge. That "existing knowledge," in part, would be the simple fact that all known instances of generous welfare states (in this example) occur in countries with strong unions. Existing knowledge could also include in-depth case-level analyses of the emergence of generous welfare states. This knowledge might indicate, for example, that strong unions are centrally involved in the process of establishing strong welfare states.

The important point here is not the specific conclusion of the study or whether or not having a strong left party is sufficient by itself for the establishment of a generous welfare state. Rather, the issue is the status of assumptions about combinations of conditions that lack empirical cases. In QCA, these assumptions must be evaluated; *don't care* combinations should not be grafted onto solutions in a mechanistic fashion (because we *do* care). In conventional quantitative research, by contrast, the issue of limited diversity is obscured because researchers use techniques and models that embody very strong assumptions about the nature of causation (e.g., that causes operate as "independent" variables, that their effects are linear and additive, that parsimonious models are best, and so on).

Counterfactual Analysis

The procedure just described--assessing the plausibility of simplifying assumptions drawn from the pool of causal combinations lacking empirical cases (i.e., remainders)--may seem arcane. However, this analytic strategy has a long and distinguished tradition in the history of social science. A remainder is a potential counterfactual case; evaluating its plausibility is counterfactual analysis (see, e.g., Hicks et al., 1995).

The consideration of counterfactual cases is often explicit in case-oriented comparative research. In *Social Origins of Dictatorship and Democracy*, for example, Barrington Moore, Jr. (1966) invites readers to imagine a U.S. in which the South had prevailed over the North in the U.S. Civil War. His intention was not literary; rather, he wanted to support his larger theoretical point that a "revolutionary break with the past" (e.g., the U.S. Civil War) is an essential ingredient in the recipe for the emergence of democratic political systems. This explicit use of hypothetical cases is well known in comparative and case-study

research; it is also common in historical research, where counterfactual cases are used to accomplish both rhetorical and analytic ends.

Weber (1905) is commonly cited as the first social scientist to advocate the use of thought experiments social research. He argued that researchers can gain insight on the causal significance of individual components of events by conducting thought experiments which imagine "unreal" causes. Weber's view is based on an explicitly configurational approach to causal analysis: "...a concrete result cannot be viewed as the product of a struggle of certain causes favoring it and others opposing it. The situation must, instead, be seen as follows: the totality of *all* the conditions back to which the causal chain from the "effect" leads had to "act jointly" in a certain way and in no other for the concrete effect to be realized" (Weber 1905:187).

Contemporary comparative researchers have continued to debate how to construct and use counterfactuals in research and theory development (Elster 1978; Fearon 1991; Hawthorn 1991; Tetlock and Belkin 1996). In the introduction to a volume on counterfactual thought experiments, Tetlock and Belkin (1996:4) describe five styles of counterfactual argumentation, and suggest six criteria researchers use for judging these arguments. Although the described styles of counterfactual argument range widely, none formalize the use of counterfactuals within an explicitly configurational understanding of causality. We believe that the configurational framework of QCA offers a helpful guide for using counterfactuals in social research. Our focus in this paper is on counterfactual cases conceived as substitutes for matched empirical cases. These hypothetical matched cases are identified by their configurations of causal variables.

At a more abstract level, counterfactual analysis is implicated whenever a researcher makes a causal inference based on the analysis of "naturally occurring" (i.e., nonexperimental) social data--data in which limited diversity is the norm. For example, when cross-national researchers state that "strength of left party" is an important cause of "welfare state generosity" net of other relevant causes, they are arguing, in effect, that countries with weak or nonexistent left parties such as the U.S. would have more generous welfare states if only this one feature were different. Thus, the interpretation of the observed effect invokes hypothetical countries, for example, a country that is exactly like the U.S. in all relevant respects, except that it has a strong left party.

Obviously, as nonexperimentalists, social scientists cannot create this country. They cannot assign causal conditions to their cases as an experimenter would distribute treatments across randomized subjects. They are stuck with nonexperimental data and must contend with the fact that a variety of observed

and unobserved factors usually enter into naturally occurring selection processes (e.g., which account for why the U.S. has a nonexistent left party). These naturally occurring selection processes, in turn, distort the estimation of causal effects (e.g., the impact of left party strength on the generosity of welfare states).

The problem of selection has led econometricians and statisticians to develop a general framework for understanding causation in terms of the difference between each case's value on the dependent variable when it is in the "control" versus "treatment" conditions (e.g., the U.S. with and without strong left parties).¹ Since only one of these two conditions is observable, the other must be estimated statistically, taking into account the effects of selection processes (Holland 1986; Sobel 1995; Winship & Morgan 1999; Winship & Sobel 2001; see also Brady 2003).

While we consider this use of counterfactual reasoning important and useful, our concern in this paper is much more practical in nature: the substitution of counterfactual cases for matched cases through thought experiments.² The ideal matched case is an empirical case which resembles as closely as possible another empirical case, save one feature. For example, to interpret the impact of having a strong left party on the generosity of the U.S. welfare state, the ideal matched case would be a country similar to the U.S. with respect to the causes of welfare state generosity, but with a strong left party. The search for matched cases is theory dependent because the process of matching, of necessity, must focus on causal conditions that are identified as relevant by theory.

¹ Winship and Morgan (1999:660) argue that the language of "treatment" and "control" variables is generally applicable: "In almost any situation where a researcher attempts to estimate a causal effect, the analysis can be described, at least in terms of a thought experiment, as an experiment." A more direct implication of using experimental language, which Winship and Morgan do not discuss in detail, is the restriction that "the treatment must be manipulable" (1999:663, fn.2). Citing Holland (1986), they argue that "it makes no sense to talk about the causal effect of gender or any other nonmanipulable individual trait alone. One must explicitly model the manipulable mechanism that generates an apparent causal effect of a nonmanipulable attribute" (1999:663, fn.2).

² In any event, counterfactual regression procedures have been developed for application to individual-level data and are feasible only when (1) there is a very large N , and (2) it is plausible *a priori* that each case could be in either the control or the treatment group (see Winship & Morgan 1999). Also, these procedures, like conventional statistical analyses, remain linear and additive, so they do not examine problems of limited diversity and matched cases directly. An attempt to address limited diversity, or "the curse of dimensionality," with Boolean logic and probit regression is offered by Braumoeller (2003).

To illustrate the role of matched empirical cases, consider a case-oriented researcher who argues that four causal conditions combine to produce generous welfare states: sociocultural homogeneity, corporatist institutions, a strong left party, and strong unions.³ The researcher cites the Nordic countries as relevant instances of this argument. This causal argument calls for four kinds of comparison cases: countries similar to the Nordic countries, but without sociocultural homogeneity, countries similar to the Nordic countries but without corporatist institutions, and so on (the comparison cases match the Nordic countries on three of the four causal conditions). These matched cases can be represented using Boolean algebra as follows:

the Nordic cases:

$$H.C.L.U \text{ ----} \rightarrow G$$

the four matched cases:

$$h.C.L.U + H.c.L.U + H.C.l.U + H.C.L.u \text{ ----} \rightarrow g$$

where H = sociocultural homogeneity, C = corporatist institutions, and the remaining symbols are the same as in the previous example. If the researcher is able to demonstrate that generous welfare states failed to develop in the four matched cases, this finding would greatly bolster his or her causal argument. In effect, a lack of the outcome in these four matched cases would allow the researcher to claim each condition as an INUS condition: "an insufficient but necessary part of a condition which is itself unnecessary but sufficient for the result" (Mackie 1965:245).

Ideal matched cases are often very hard to find, for some combinations of causal conditions are unlikely, and others may be practically impossible. For example, it might prove very difficult to identify a country with sociocultural homogeneity, strong unions, a strong left party, but *no* corporatism. Furthermore, when causal arguments are combinatorially complex (which is a common result when researchers examine cases in an in-depth manner), the array of matched cases necessary to support a causal argument can be substantial. Unfortunately, the empirical world is profoundly limited in its diversity, and cases that are matched on all relevant causal conditions save one are relatively rare. Thus, while logically elegant, comparative researchers usually cannot identify all the relevant matched empirical cases and must substitute counterfactual cases.

³ This may or may not be the only pathway to having a generous welfare state. The focus here is simply on the evaluation of this pathway, with its four combined conditions.

Causal Complexity and Counterfactual Analysis

As previously noted, the search for matched cases is necessarily theory dependent. The theoretical argument guiding the search for matched cases in the example just presented maintains that there are four causal conditions that must be combined to produce the outcome, generous welfare states. Most theories in the social sciences, however, are vague when it comes to specifying how causal conditions combine to produce outcomes. Typically, researchers develop a list of potential causal factors from a number of theoretical perspectives relevant to the outcome in question. Because there is little theoretical attention to combinatorial complexities, researchers, by default, treat each causal condition as an independent cause of the outcome. They view their primary analytic task as one of assessing which among the listed causal conditions are more important. That is, they try to identify the best "predictors" of the outcome, based on statistical estimates of the net effect of each variable in the list. The estimate of the net effects is based on the assumption that each cause, by itself, is capable of influencing the outcome (i.e., it is assumed that the causes are independent and additive in their effects).

QCA, by contrast, remains true to the combinatorial emphasis of case-oriented research--to the idea that causation may be complexly combinatorial and that the same outcome may result from a variety of different combinations of conditions. This principle is implemented in "truth tables," which consider all logically possible combinations of relevant causal conditions. For illustration, consider a researcher investigating four causal conditions (A, B, C, and D) and one outcome (Y). This time around, however, imagine that the researcher does not have a well-specified combinatorial argument. Instead, he has only a simple listing of four causal conditions, drawn from relevant theoretical perspectives. In this scenario, the researcher must consider the possibility that each cause, by itself, is capable of producing the outcome.

The configurational question remains, however: Can each cause generate the outcome regardless of the values of the other causal conditions or are combinations of causal conditions required? To answer this question for four causal conditions, it would be necessary to examine all sixteen of the logically possible combinations of conditions (number of combinations = 2^k , where k is the number of causal conditions). With five causal conditions, there would be 32 combinations; with six, there would be 64 combinations, and so on. If each causal condition is capable of producing the outcome independently, then the only combination without the outcome should be the one with all conditions absent.

When the number of cases is small to moderate, it is common even for a truth table with only 16 rows (based on four causal conditions) to have rows without cases (i.e., "remainders"). Having a large number of cases is no guarantee,

however, that remainders can be avoided. In fact, limited diversity (i.e., an abundance of remainders) is the rule, not the exception, in the study of naturally occurring social phenomena. Ragin (2003), for example, demonstrates that a large- N , individual-level data set ($N = 758$) populates only 24 rows of a 32-row truth table (five causal conditions) and that 13 of these 32 rows contain almost all the cases (96.7% of the total N). In an analysis of individual-level data on musical tastes ($N=1606$), Sonnett (2004) similarly finds that 22 of 64 rows in the truth table (34% of the rows) contain the bulk of the respondents in the sample (90%). Braumoeller (2003:229) also finds evidence of "complex covariation" in a data set with 8,328 observations. From this viewpoint, it is easy to see why counterfactual analysis is essential to social research. Any analysis that investigates combinatorial complexity will almost certainly confront an abundance of remainders and thus a wealth of potential counterfactual cases.

Limited diversity is endemic in the study of naturally occurring social phenomena. The question is what to do about it. One route is to retreat to the laboratory and avoid nonexperimental data altogether. This path seeks to create matched cases through experimental manipulation. Another is to use statistical techniques such as those discussed by Winship and Morgan (1999) to estimate unknown data (i.e., the value of either the control or treatment condition), based on a statistical model that controls for underlying selection processes. This path seeks to replicate experimental procedures for observational data. The third is to engage in counterfactual analysis (i.e., thought experiments). The laboratory route entails severe restrictions on the kinds of questions social scientists may ask. The statistical route requires not only a large number of cases and a specific type of causal variable, but also a number of strong assumptions about the nature of causation. The thought-experiment route seems unattractive because it involves dealing with hypothetical cases. In the remainder of this paper, we demonstrate that the third route is not as unattractive as it may seem. As we show, many counterfactuals can be considered "easy" as long as researchers have well-developed theoretical and substantive knowledge at their disposal.

"Easy" Versus "Difficult" Counterfactuals

Imagine a researcher who postulates, based on existing theory, that causal conditions A, B, C, and D are all relevant to outcome Y. The available evidence indicates that many instances of Y are coupled with the presence of causal conditions A, B, and C, along with the absence of condition D (i.e., A.B.C.d ---> Y).⁴ The researcher suspects, however, that all that really matters is having the

⁴ There can be other, unspecified combinations of causal conditions linked to outcome Y in

first three causes, A, B and C. The fourth condition (d) is superfluous in the presence of A·B·C. However, there are no instances of A, B, and C combined with the presence of D (i.e., no instances of A·B·C·D). Thus, the decisive matched case for determining whether or not the *absence* of D is an essential part of the causal mix simply does not exist.

Through counterfactual analysis (i.e., a thought experiment), the researcher could declare this hypothetical combination (A·B·C·D) to be a likely instance of the outcome. That is, the researcher might assert that A·B·C·D, if it existed, would lead to Y. This counterfactual analysis would allow the following logical simplification:

$$\begin{aligned} A \cdot B \cdot C \cdot d + A \cdot B \cdot C \cdot D & \text{---->} Y \\ A \cdot B \cdot C \cdot (d + D) & \text{---->} Y \\ A \cdot B \cdot C & \text{---->} Y \end{aligned}$$

How plausible is this simplification? The answer to this question depends on the state of the relevant theoretical and substantive knowledge concerning the connection between D and Y in the presence of the other three causal conditions (A·B·C). If the researcher can establish on the basis of existing knowledge that there is every reason to expect that the presence of D would contribute to outcome Y under these conditions (or conversely, that the absence of D should not be a contributing factor), then the counterfactual analysis just presented is plausible. In other words, existing knowledge makes the assertion $A \cdot B \cdot C \cdot D \text{---->} Y$ an "easy" counterfactual, because it is merely adding a redundant cause to a configuration which is already known to lead to the outcome. Assuming this "easy" counterfactual allows the simplification of $A \cdot B \cdot C \cdot d \text{---->} Y$ to $A \cdot B \cdot C \text{---->} Y$.

It is important to point out that what has been accomplished using Boolean algebra in this example is routine, though often implicit, in much case-oriented research. If conventional case-oriented researchers were to examine the empirical instances just listed ($A \cdot B \cdot C \cdot d \text{---->} Y$), they would likely develop their causal argument or narrative based on factors thought to be linked to the outcome (that is, the presence of A, B and C). Along the way, they might consider the possibility that the absence of D (i.e., d) observed in these cases might be integral in some way to the production of Y by A·B·C. They would be quite likely to conclude otherwise, given the presumed state of existing knowledge about the four causal

this example. There is no assumption that this is the only combination linked to the outcome (Y).

conditions relevant to outcome Y, namely that it is the presence of these causal factors, not their absence, that is linked to the outcome. Thus, they would quickly arrive at the more parsimonious conclusion, that A.B.C ----> Y. The point is that counterfactual analysis is not always explicit or elaborate in case-oriented research, especially when the counterfactuals are "easy." It is routinely conducted by case-oriented researchers "on the fly"--in the process of constructing explanations of a specific case or category of cases.

Now consider the opposite situation. The researcher observes instances of A.B.C.D ----> Y, but believes that D is superfluous or redundant in the production of outcome Y given the presence of A.B.C. What would happen if D were absent? Unfortunately, there are no cases of A.B.C.d, and the investigator must resort to counterfactual analysis. Existing theoretical knowledge, however, connects the presence of D to outcome Y. Is it reasonable to assert that A.B.C.d, if it existed, would lead to Y? This counterfactual is "difficult." The researcher would have to mount a concerted effort, with detailed argumentation and empirical support.⁵ Our point is not that "difficult" counterfactual cases should be avoided; rather, that they require careful explication and justification. Sometimes researchers succeed in justifying their "difficult" counterfactuals, and such efforts can lead to important theoretical insights and advances.

The "easy" versus "difficult" distinction is not a rigid dichotomy, but rather a continuum of plausibility. At one end are "easy" counterfactuals, which assume that adding a redundant causal condition to a configuration known to produce the outcome would still produce the outcome. At the other end are more "difficult" counterfactuals, which attempt to remove a causal condition from a configuration displaying the outcome, on the assumption that this cause is redundant and the reduced configuration would still produce the outcome. The exact placement of any specific use of a counterfactual case on the easy/difficult continuum depends primarily on the state of existing theoretical and substantive knowledge in the social scientific community at large. This knowledge helps the researcher decide which causes may be redundant by giving theoretical or empirical support for counterfactual arguments about the importance or irrelevance of a particular causal condition (Tetlock & Belkin 1996). This aspect of counterfactual analysis also highlights the theory and knowledge dependence of social scientific inquiry in general, as well as its fundamentally communal nature (Merton 1973).

⁵ Note that methodological discussions of counterfactuals often assume a non-configurational variant of the "difficult" form, as in Fearon (1996:39): "When trying to argue or assess whether some factor A caused event B, social scientists frequently use counterfactuals. That is, they either ask whether or claim that 'if A had not occurred, B would not have occurred.'"

Because limited diversity is the rule and not the exception in the study of naturally occurring social phenomena, there will be many logically possible combinations of causal conditions lacking empirical instances in most social scientific investigations. These counterfactual cases can be used to simplify results, as we have just demonstrated. Some of these counterfactuals will be relatively easy (and thus more or less routine); some will be difficult (and perhaps should be avoided). The key consideration is the stock of theoretical and substantive knowledge underlying each use.

"Easy" Counterfactuals and QCA

Researchers using QCA have two main options when confronted with limited diversity and an abundance of remainders (and thus potential counterfactual cases): (1) They can avoid using any remainders to simplify a truth table, or (2) they can permit the incorporation of the subset of remainders that yields the most parsimonious solution of the truth table. The first option bars counterfactual cases altogether; the second permits the inclusion of both easy and difficult counterfactuals, without any evaluation of their plausibility. At first glance, neither of these options seems attractive. The first is likely to lead to results that are needlessly complex; the second may lead to results that are unrealistically parsimonious due to the incorporation of "difficult" counterfactuals. Rather than rejecting these two options out of hand, however, it is important to view them as endpoints of a single continuum of possible results. One end of the continuum privileges complexity; the other end privileges parsimony. Both endpoints are rooted in evidence; they differ in their tolerance for the incorporation of counterfactual cases.

Most social scientists prefer explanations that strike a balance between complexity and parsimony. That is, they may prefer explanations that are somewhere in between these two extremes. Consider, for example, Barrington Moore's (1966) *Social Origins of Dictatorship and Democracy*, a comparative case-oriented investigation of political development in eight countries. An explanation allowing maximum complexity would conclude with perhaps eight different causal combinations linked to eight distinct outcomes. An explanation privileging parsimony, by contrast, would focus on one or a very small number of causal conditions. A researcher, for example, might cite the strength of the urban bourgeoisie as the key causal factor, arguing that the stronger and more numerous this class, the more democratic the outcome. By contrast, an explanation balancing parsimony and complexity (e.g., the explanation Moore offers) would focus on distinct paths of political development and group countries according to these paths.

Table 2: Truth Table with Four Causal Conditions (A, B, C, and D) and one Outcome (Y)

A	B	C	D	Y
no	no	no	no	no
no	no	no	yes	?
no	no	yes	no	?
no	no	yes	yes	?
no	yes	no	no	no
no	yes	no	yes	no
no	yes	yes	no	?
no	yes	yes	yes	no
yes	no	no	no	?
yes	no	no	yes	?
yes	no	yes	no	?
yes	no	yes	yes	?
yes	yes	no	no	yes
yes	yes	no	yes	yes
yes	yes	yes	no	?
yes	yes	yes	yes	?

One strength of QCA is that it not only provides tools for deriving the two endpoints of the complexity/parsimony continuum, it also provides tools for specifying intermediate solutions. Consider, for example, the truth table presented in Table 2, which uses A, B, C, and D as causal conditions and Y as the outcome. Assume, as before, that existing theoretical and substantive knowledge maintains that it is the presence of these causal conditions, not their absence, that is linked to the outcome. The results of the analysis barring counterfactuals reveals that combination A·B·c explains Y. That is, the presence of A combined with the presence of B and the absence of C (i.e., c) accounts for the presence of Y. The

analysis of this same evidence permitting any counterfactual that will yield a more parsimonious result is that A by itself accounts for the presence of Y. Conceive of these two results as the two endpoints of the complexity/parsimony continuum, as follows:

A.B.c A

Observe that the solution privileging complexity (A.B.c) is a subset of the solution privileging parsimony (A). This follows logically from the fact that both solutions must cover the rows of the truth table with Y present; the parsimonious solution also incorporates some of the remainders as counterfactual cases and thus embraces additional rows. Along the complexity/parsimony continuum are other possible solutions to this same truth table, for example, the combination A.B. These intermediate solutions are produced when different subsets of the remainders used to produce the parsimonious solution are incorporated into the results. These intermediate solutions constitute subsets of the most parsimonious solution (A in this example) and supersets of the solution allowing maximum complexity (A.B.c). The subset relation between solutions is maintained along the complexity/parsimony continuum. The implication in this example is that any causal combination that uses at least some of the causal conditions specified in the complex solution (A.B.c) is a valid solution of the truth table as long as it contains the causal conditions specified in the parsimonious solution (A). It follows that there are two valid intermediate solutions to the truth table in Table 2:

A.B
A.B.c A.c A

Both intermediate solutions are subsets of the solution privileging parsimony and supersets of the solution privileging complexity. The first (A.B) permits counterfactuals A.B.C.D and A.B.C.d as combinations linked to outcome Y. The second permits counterfactuals A.b.c.D and A.b.c.d.

The relative viability of these two intermediate solutions depends on the plausibility of the counterfactuals that have been incorporated into them. The counterfactuals incorporated into the first intermediate solution are "easy" because they are used to eliminate c from the combination A.B.c, and in this example, existing knowledge supports the idea that it is the *presence* of C, not its absence (c) that is linked to outcome Y, not its absence. The counterfactuals incorporated into the second intermediate solution, however, are "difficult" because they are used to

eliminate B from A.B.c, and according to existing knowledge the presence of B should be linked to the presence of outcome Y. The principle that only easy counterfactuals should be incorporated supports the selection of A.B as the optimal intermediate solution. This solution is the same as the one that a conventional case-oriented researcher would derive from this evidence, based on a straightforward interest in causal conditions that are (1) shared by the positive cases (or at least a subset of the positive cases), and (2) believed to be linked to the outcome.

As our example illustrates, incorporating different counterfactuals yields different solutions. However, these different solutions are all supersets of the solution privileging complexity and subsets of the solution privileging parsimony. Further, we have shown that it is possible to derive an optimal intermediate solution permitting only "easy" counterfactuals. This solution is relatively simple to specify. The researcher simply removes causal conditions from the complex solution that are inconsistent with existing knowledge, while upholding the subset principle that underlies the complexity/parsimony continuum, meaning that the intermediate solution constructed by the researcher must be a subset of the most parsimonious solution. The counterfactuals that are incorporated into this optimal solution would be relatively routine in a conventional case-oriented investigation of the same evidence. One of the great strengths of QCA is that all counterfactuals, both easy and difficult, are made explicit, as is the process of incorporating them into results. QCA makes this process transparent and thus open to evaluation by the producers and consumers of social research.

We turn now to an illustration of our approach--the formal incorporation of "easy" counterfactuals--using evidence on international fishing regimes published by Olav Schram Stokke (2004).

Demonstration

Stokke (2004) reports the results of a study of the conditions that promote successful "shaming" in international regimes, focusing explicitly on countries that violate international fishing agreements. He examines 10 cases of attempted shaming--five successful (that is, the targets of shaming reformed their behaviors) and five unsuccessful. His causal conditions were:

1. Advice (A): Whether the shamers can substantiate their criticism with reference to explicit recommendations of the regime's scientific advisory body.
2. Commitment (C): Whether the target behavior explicitly violates a conservation measure adopted by the regime's decision-making body.

3. Shadow of the future (S): Perceived need of the target of shaming to strike new deals under the regime--such beneficial deals are likely to be jeopardized if criticism is ignored.
4. Inconvenience (I): The inconvenience (to the target of shaming) of the behavioral change that the shamers are trying to prompt.
5. Reverberation (R): The domestic political costs to the target of shaming for not complying (i.e., for being scandalized as a culprit).

Table 3: Partial Truth Table for Causes of Successful Shaming in International Regimes (remainders not shown)

Advice (A)	Commitment (C)	Shadow (S)	Inconvenience (I)	Reverberation (R)	Success (Y)
yes	no	yes	yes	yes	yes
yes	no	no	yes	no	no
yes	no	no	yes	yes	no
no	no	no	yes	no	no
yes	yes	yes	yes	yes	yes
yes	yes	yes	yes	no	no
yes	yes	yes	no	no	yes
yes	no	no	no	no	yes

Stokke's truth table is reported in Table 3. This truth table is typical of small- N research. There are many logically possible combinations of causal conditions ($2^5 = 32$); only a handful (eight) have empirical instances; consequently, there is an abundance of remainders (24) and thus many potential counterfactuals that could be incorporated into the solution. It also follows that because diversity is severely limited, there are many different possible solutions to this truth table, all within the bounds set by the endpoints of the complexity/parsimony continuum.

Analysis of this truth table without permitting the incorporation of any counterfactual cases produces the following solution:

$$A \cdot S \cdot I \cdot R + A \cdot C \cdot S \cdot i \cdot r + A \cdot c \cdot s \cdot i \cdot r \text{ ----} \rightarrow Y$$

This complex result follows from the fact that only four of the 32 logically possible combinations display the outcome and none of the 24 remainders have been incorporated into the solution. Essentially, only one simplification has occurred: $A \cdot C \cdot S \cdot I \cdot R$ and $A \cdot c \cdot S \cdot I \cdot R$ have been joined to produce $A \cdot S \cdot I \cdot R$. This solution is the most complex possible and thus establishes the first endpoint of the

complexity/parsimony continuum.⁶

By contrast, the use of all possible simplifying assumptions (i.e., any counterfactual--easy or difficult--that helps to produce a more parsimonious result) yields a dramatically simpler solution:

$$i + S.R \text{ ----} \rightarrow Y$$

This solution states that shaming works when it is not inconvenient (i) for the targets of shaming to reform their behavior or when the "shadow of the future" and "domestic reverberations" combine (S.R) to produce a conforming response to shaming.⁷ While these are not unreasonable conclusions to draw from this evidence and they are truly succinct, they run counter to the conclusions that a conventional case-oriented researcher would draw. Notice, for example, that all four causal combinations linked to successful shaming include the presence of A, the support of the regime's scientific advisory board. This commonality, which could be a necessary condition for successful shaming, would not escape the attention of either a case-oriented researcher or a practitioner interested in using shaming as a tactic for stimulating compliance.

This second analysis provides the other endpoint of the complexity/parsimony continuum, which can now be depicted as follows:

$$\begin{array}{l} A \cdot c \cdot s \cdot i \cdot r + \\ A \cdot C \cdot S \cdot i \cdot r + \\ \hline A \cdot S \cdot I \cdot R \end{array} \qquad \begin{array}{l} i + \\ S \cdot R \end{array}$$

The subset relation can be observed in the fact that A.S.I.R is a subset of S.R and both A.C.S.i.r and A.c.s.i.r are subsets of i. (The combinations grouped at each end of the continuum are joined by logical *or*, as shown in the corresponding equations.) The next step is to specify intermediate solutions and to evaluate them with respect to the counterfactuals they incorporate. As explained previously, an optimal intermediate solution incorporates only easy counterfactuals. To find such

⁶ In fs/QCA 1.1, this solution is obtained by clicking *Analyze, Crisp Sets, Quine*; selecting the causal conditions and outcome variables, and then specifying the "Positive Cases" as "True," and all other cases as false (or exclude).

⁷ In fs/QCA 1.1, this solution is obtained by clicking *Analyze, Crisp Sets, Quine*; selecting the causal conditions and outcome variables, and then specifying the "Positive Cases" as "True", the "Remainders" as "Don't Cares" and all others as false (or exclude).

a solution, it is necessary simply to inspect each of the terms at the complex end of the continuum and determine which of the separate causal conditions, if any, can be removed from each combination.

Consider first the combination A·S·I·R. Causal conditions S and R cannot be removed because they appear in the corresponding parsimonious term at the other end of the continuum. The only candidates for removal are conditions I and A. The support of the regime's the scientific advisory body (A) is certainly linked to the success of shaming. Thus, this causal condition should not be removed. However, the fact that it is inconvenient for the targets of shaming to change their behavior (I) is *not* something that promotes behavioral change. Thus, inconvenience (I) can be dropped from the combination A·S·I·R. It is reasonable to conclude, based on existing knowledge, that the instances of successful shaming embraced by A·S·I·R would still, no doubt, had succeeded if the behavioral change had been convenient (i) instead of inconvenient (I) for the targets of shaming. Thus, causal condition I can be safely dropped, yielding the intermediate combination A·S·R.

Next consider combination A·C·S·i·r. Condition i (the behavioral change in not inconvenient) cannot be dropped because it appears in the corresponding parsimonious term at the other end of the continuum. As before, condition A (support from the regime's scientific advisory board) should not be removed because this condition is clearly linked to the success of shaming. Condition C (the offending behavior clearly violates a prior commitment) also should not be dropped, for this too is something that should only contribute to the success of shaming. Condition S (shadow of the future--the violator will need to strike future deals with the regime) is also a factor that should only promote successful shaming. In fact, only condition r (absence of domestic reverberations for being shamed) can be removed. Clearly, the presence of domestic reverberation (r) would promote successful shaming; these same instances of successful shaming still would have succeeded if there had been domestic reverberations (i.e., presence of R). Thus, this combination can be simplified by only one condition, yielding A·C·S·i.

Finally consider combination A·c·s·i·r. Again, condition i must be retained because it appears in the corresponding parsimonious term, and condition A is retained as well, for the reasons stated in the analysis of the two previous combinations. Condition r (absence of domestic reverberations) can be removed, as it was from the previous combination, for the same reason provided. Condition c (absence of violation of a commitment) can be removed, for surely these instances of successful shaming would still have been successful if there had been

an explicit violation of a commitment (c). Likewise, condition s (absence of a need to strike future deals with the regime) can be safely removed because only its presence (S) should contribute to the success of shaming. Altogether, there are three terms that can be removed, yielding the intermediate term A.i.

These three intermediate terms can be joined into a single equation:

$$A.S.R + A.C.S.i + A.i \text{ ----> } Y$$

which can then be simplified to:

$$A.S.R + A.i \text{ ----> } Y$$

because the term A.C.S.i is a subset of the term A.i and is thus logically redundant. (All cases of A.C.S.i are also cases of A.i.) These results indicate that there are two paths to successful shaming: (1) support from the regime's scientific advisory body (A) combined with the need to strike future deals (S) and domestic reverberations for being shamed (R), and (2) support from the regime's scientific advisory body (A) combined with the fact that the behavioral change is not inconvenient (i). The intermediate solution can now be added to the complexity/parsimony continuum as follows:

$$\begin{array}{r}
 A.c.s.i.r + \\
 A.C.S.i.r + \quad A.i + \quad i + \\
 \hline
 A.S.I.R \quad A.S.R \quad S.R
 \end{array}$$

As indicated previously, the intermediate solution is a superset of the most complex solution and a subset of the most parsimonious. It is optimal because it incorporates only easy counterfactuals, eschewing the difficult ones that have been incorporated into the most parsimonious solution. The intermediate solution thus strikes a balance between complexity and parsimony, using procedures that mimic the practice of conventional case-oriented comparative research.⁸

Many researchers who use QCA either incorporate as many simplifying assumptions (counterfactuals) as possible or they avoid them altogether. They should instead strike a balance between complexity and parsimony, using

⁸ Note that Stokke (2004) includes condition A in his model, based on the recommendation in Ragin (2000:105, 254) to perform necessary conditions tests prior to sufficiency tests. The counterfactual procedure described in this paper can be seen as an extension and reformulation of QCA techniques, one which locates the specification of necessary and sufficient conditions within a continuum of solutions defined by the most complex and the most parsimonious pathways.

substantive and theoretical knowledge to conduct thought experiments, as we have just demonstrated. QCA can be used to derive the two ends of the complexity/parsimony continuum. Intermediate solutions can be constructed anywhere along this continuum, as long as the subset principle is maintained (that is, solutions closer to the complexity end of the continuum must be subsets of solutions closer to the parsimony end). An optimal intermediate solution can be obtained by removing individual causal conditions that are inconsistent with existing knowledge from combinations in the complex solution, while maintaining the subset relation with the most parsimonious solution.

Conclusion

When viewed from the perspective of conventional quantitative research, case-oriented comparative research seems dubious. Quantitative researchers know well that statistical analysis works best when *Ns* are large. Not only is statistical significance easier to attain, but large *Ns* also can save researchers the trouble of meeting many of the demanding assumptions of the techniques they use. Violations of these underlying assumptions are all too common when *Ns* are small or even moderate in size, as they must be in case-oriented research. On top of the small-*N* problem, there is the additional difficulty that when researchers know their cases well, they tend to construct combinatorial causal arguments from their evidence. From the perspective of conventional quantitative research, this fixation on causal combinations places even more difficult demands on skimpy cross-case evidence. It also runs counter to the central logic of the most used and most popular quantitative techniques, which are geared primarily toward assessing the net, independent effects of causal variables, not their multiple combined effects.

Comparative case-oriented work, however, has its own logic and rigor. Because it is explicitly intersectional, the examination of different combinations of conditions is essential to this type of research. This type of rigor is lacking in most quantitative research, where matching cases undermines degrees of freedom and statistical power. As we show in this paper, however, the study of combinations of causes very often involves counterfactual analysis because naturally occurring social data are profoundly limited in their diversity and researchers must engage in thought experiments using hypothetical cases. This practice may seem suspect, again especially to conventional quantitative researchers, because it runs counter to the norms of "empirical" social research. However, we have demonstrated that many of these counterfactual analyses can be considered routine because they involve "easy" hypothetical cases. We have shown how to formalize and incorporate these "easy" counterfactuals into comparative research within the configurational framework of QCA.

Our demonstration also highlights a very important feature of social research, namely, that it is built upon a foundation of substantive and theoretical knowledge, not just methodological techniques. It is this substantive and theoretical knowledge that makes it possible to assess the plausibility of counterfactuals. In essence, the techniques we outline in this paper show how existing knowledge is woven into the results of empirical analysis, especially in case-oriented comparative research.

References

- Brady, Henry E. (2003). "Models of Causal Inference: Going Beyond the Neyman-Rubin-Holland Theory." Prepared for the Midwest Political Science Association Annual Meeting, Chicago, IL.
- Braumoeller, Bear. (2003). "Causal Complexity and the Study of Politics." *Political Analysis*, 11:208-233.
- Elster, Jon. (1978). *Logic & Society: Contradictions and Possible Worlds*. New York: John Wiley & Sons.
- Fearon, James D. (1991). "Counterfactuals and Hypothesis Testing in Political Science." *World Politics*, 43:169-195.
- Fearon, James D. (1996). "Causes and Counterfactuals in Social Science: Exploring an Analogy between Cellular Automata and Historical Processes." Pp. 39-67 in Philip E. Tetlock and Aaron Belkin (eds), *Counterfactual Thought Experiments in World Politics: Logical, Methodological, and Psychological Perspectives*. Princeton, NJ: Princeton University Press.
- Hawthorn, Geoffrey. (1991). *Plausible Worlds: Possibility and understanding in history and the social sciences*. New York: Cambridge University Press.
- Alexander Hicks, Joya Misra, and Tang Nah Ng. (1995). "The Programmatic Emergence of the Social Security State." *American Sociological Review*, 60:329-349.
- Holland, Paul W. (1986). "Statistics and Causal Inference." *Journal of the American Statistical Association*, 81/396:945-960.
- Mackie, John L. (1965). "Causes and Conditionals." *American Philosophical Quarterly*, 2:245-65.
- Merton, Robert K. (1973). *The Sociology of Science: Theoretical and Empirical Investigations*. Chicago, IL: University of Chicago Press.
- Mill, John Stuart. ([1843]/1967). *A System of Logic: Ratiocinative and Inductive*. Toronto: University of Toronto Press.
- Moore, Barrington, Jr. (1966). *The Social Origins of Dictatorship and Democracy: Lord and Peasant in the Making of the Modern World*. Boston: Beacon.
- Ragin, Charles C. (1987). *The Comparative Method*. Berkeley: University of California Press.
- Ragin, Charles C. (2000). *Fuzzy-Set Social Science*. Chicago: University of Chicago Press.
- Ragin, Charles C. (2003). "Recent Advances in Fuzzy-Set Methods and their Application to Policy Questions." Working paper posted at

- <http://www.compass.org/WP.htm>.
- Stokke, Olav Schram. (2004). "Boolean Analysis, Mechanisms, and the Study of Regime Effectiveness." In Arild Underdal and Oran R. Young (eds.), *Regime Effectiveness: Methodological Challenges and Research Strategies*. Dordrecht, NL: Kluwer Academic Publishers.
- Sobel, Michael E. (1995). "Causal Inference in the Social and Behavioral Sciences," pp. 1-38 in Gerhard Arminger, Clifford C. Clogg, and Michael E. Sobel (eds), *Handbook of Statistical Modeling for the Social and Behavioral Sciences*, New York: Plenum Press.
- Sonnett, John. (2004). "Musical boundaries: intersections of form and content." Forthcoming in *Poetics: Journal of Empirical Research on Culture, the Media and the Arts*.
- Tetlock, Philip E. and Aaron Belkin. (1996). "Counterfactual Thought Experiments in World Politics: Logical, Methodological, and Psychological Perspectives." Pp. 1-38 in Philip E. Tetlock and Aaron Belkin (eds), *Counterfactual Thought Experiments in World Politics: Logical, Methodological, and Psychological Perspectives*. Princeton, NJ: Princeton University Press.
- Weber, Max. ([1905]/1949). "Objective possibility and adequate causation in historical explanation." Pp. 164-188 in Edward A. Shils and Henry A. Finch (eds), *The Methodology of the Social Sciences*. Glencoe, IL: The Free Press.
- Winship, Christopher and Stephen L. Morgan. (1999). "The Estimation of Causal Effects from Observational Data." *Annual Review of Sociology*, 25:659-706.
- Winship, Christopher and Michael Sobel. (2001). "Causal Inference in Sociological Studies." Forthcoming in Melissa Hardy and Alan Bryman (eds), *Handbook of Data Analysis*, Sage Publications.