The Logic of Counterfactual Analysis in Case-Study Explanation

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Abstract: In this paper, we develop a set-theoretic and possible worlds approach to counterfactual analysis in case-study explanation. Using this approach, we identify four kinds of counterfactuals: necessary condition counterfactuals, sufficient condition counterfactuals, negation counterfactuals, and INUS condition counterfactuals. These types entail distinctive causal claims, and they raise distinctive issues for hypothesis assessment. Our approach allows for the development of a rigorous understanding of the “minimal-rewrite” rule and new tools for specifying the level of generality of the events in a counterfactual. In addition, our framework provides a new basis for linking counterfactual analysis to causal sequences, which in turn provides greater leverage for conducting counterfactual projections.
A counterfactual is a “subjunctive conditional in which the antecedent is known or supposed for purposes of argument to be false” (Tetlock and Belkin 1996a: 4; see also Goodman 1947). A well-known example is, “If Al Gore had been elected president, the United States would not have invaded Iraq” (see Harvey 2012). In case-study research, counterfactual analysis is intended to help analysts evaluate the effect of an actual world event by considering what would have happened if the event did not occur or occurred differently. Typically, these evaluations involve the formulation of “what-if” arguments that rerun history with the counterfactual antecedent in place.

Under various guises, counterfactuals play a central role in the contemporary social sciences. In quantitative methodology, the influential potential outcomes approach is built explicitly on a counterfactual model of causality (e.g., Morgan and Winship 2015; see also Pearl 2000; Woodward and Hitchcock 2003). In the literature on historical and small-N methodology, counterfactual analysis is routinely understood as an important tool of causal inference (Fearon 1991, 1996; George and Bennett 2005; Goertz and Levy 2007; Harvey 2012, 2015; Lebow 2010; Levy 2008, 2015; Tetlock and Belkin 1996b; Tetlock and Parker 2006). Specific quantitative techniques such as the synthetic control method are also designed to test systematically a counterfactual case (Abadie, Diamond, and Hainmueller 2015). Indeed, in their applied work, researchers of all methodologies and orientations implicitly or explicitly formulate counterfactual statements when developing hypotheses and discussing findings (Tetlock and Parker 2006).

In this paper, we focus on the use of counterfactual arguments in case-study explanation in the social sciences. With case-study explanations, the goal is to evaluate the effects of particular events on specific outcomes within individual cases. Generically, one asks whether event $X$ was a cause of event $Y$ in case $Z$. A common form of counterfactual analysis proposes
that if event $X$ did not occur (or occurred differently), event $Y$ would not have occurred (or occurred differently). The assessment of the validity of the counterfactual hypothesis is understood to provide leverage for understanding whether event $X$ was an actual cause of event $Y$ in the specific case of interest.

Although an important literature on counterfactual analysis in case-study explanation now exists, basic questions concerning this mode of analysis still need to be systemically addressed. What are the different kinds of counterfactual statements that case-study researchers formulate? What are the appropriate research strategies for the evaluation of these counterfactual statements? What are the advantages and disadvantages of making more specific versus more general counterfactual statements? What are the tradeoffs between formulating more plausible counterfactual statements versus more important counterfactual statements? How can one best carry out counterfactual projections, including backward projections that flow in reverse chronological order?

This paper provides answers to these questions. It does so using a new set-theoretic and possible worlds approach to counterfactual analysis. Three concepts are at the heart of this approach: sets, possible worlds, and events. A set is a conceptual space in which a given kind of entity can have membership (cf. Lakoff and Núñez 2000). Three parts constitute a set: an interior, a boundary, and an exterior. The interior of a set includes all entities of a given kind that have membership in the set. When depicted graphically with closed shapes, the area of a set corresponds to the proportion of entities with membership in that set; larger sets contain a higher proportion of members than smaller sets. The exterior of a set includes all entities of a given kind that do not have membership in the set; its size is determined by the proportion of entities
lacking set membership. The boundary of a set is the line separating membership from non-membership.

*Possible worlds* are potential states of the world; they are the entities that have membership in sets in counterfactual analysis.\(^1\) Each possible world is a distinct state of affairs - i.e., a particular ordering of spatiotemporally related entities -- that could exist or could have existed. Possible worlds are located in conceptual space; they reflect our beliefs about how the world could be or might have been. The actual world is *one* of these possible worlds -- it is the world in which we reside. The indispensability of possible worlds for counterfactual analysis is revealed by that fact that counterfactuals reference events that do not occur in the actual world.

An *event* references actual and potential states of affairs that are grouped together as members of a single, distinct set. Events include general phenomena such as revolutions, wars, and alliances that have multiple actual world instances. Events can also be specific occurrences such as the French Revolution, World War I, and the NATO alliance that have one actual world instance and multiple possible world instances. For example, the set representing the French Revolution includes both the actual French Revolution and possible world instances that encompass potential ways in which the French Revolution could have occurred.

We use these concepts to elucidate the logic and practice of counterfactual analysis in case-study research. We first identify four kinds of counterfactuals: necessary condition counterfactuals, negation counterfactuals, sufficient condition counterfactuals, and INUS condition counterfactuals. These types entail different causal claims, and they raise distinctive

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\(^1\) On the philosophical literature concerning possible worlds, see Divers 2002; Girle 2003; Hale 2013; Lewis 1986; Menzel 2015; and Stalnaker 2003, 2012. The possible worlds approach developed here shares with Lewis (1986) a commitment to only two ontological primitives: sets and particulars. Possible worlds derive from these ontological primitives (see Divers [2002: 45-46, 86-87] for a Lewis-inspired version of this derivation).
issues for hypothesis assessment. Indeed, conducting good causal analysis with case studies requires one to be clear about the kind of counterfactual embodied in a given explanation.

We then develop tools for applying counterfactual analysis in substantive research. Among these tools is a new and more rigorous understanding of the “minimal-rewrite” rule. A set-theoretic approach makes clear the reasons why the most useful counterfactuals are often those that require the fewest changes to the actual world. New tools are also developed for specifying the level of generality of the events in a counterfactual. The set-theoretic approach reveals how the generality of events in a counterfactual is logically related to the plausibility, precision, and empirical importance of the counterfactual. Our framework furthermore provides a new basis for linking counterfactual analysis to causal sequences, which in turn provides leverage for conducting counterfactual projections. We show why counterfactual narratives often entail a sequence of increasingly important sufficient conditions that culminate in an outcome of interest. We pinpoint the problems that arise when backward projection moves from one improbable event to another, causing a ballooning effect and leading a counterfactual antecedent to exist in a possible world that is radically different from the actual world.

**TYPES OF COUNTERFACTUALS**

The tools of logic and set theory help elucidate different kinds of counterfactuals. Here we focus on four types: (1) necessary condition counterfactuals; (2) negation counterfactuals; (3) sufficient condition counterfactuals; and (4) INUS condition counterfactuals. The first two types are the main kinds of counterfactuals analyzed in the social sciences; they entail counterfactuals in which the alteration of an actual world antecedent changes an actual world outcome. By contrast, the latter two kinds of counterfactuals are less central and less useful:
they entail statements in which the actual world outcome does not change when the actual world antecedent is changed or negated. Table 1 provides a guide to the discussion that follows.

**Table 1. Types of Counterfactual Statements in Case-Study Research**

<table>
<thead>
<tr>
<th>Necessary Condition Counterfactual</th>
<th>Status of Actual World Antecedent for Actual World Outcome</th>
<th>Status of Counterfactual Antecedent for Negated Outcome</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Necessary</td>
<td>Necessary</td>
<td>Sufficient</td>
<td>If George W. Bush had not been elected president, the United States would not have invaded Iraq.</td>
</tr>
<tr>
<td>Negation Counterfactual</td>
<td>Not Specified</td>
<td>Sufficient</td>
<td>If Al Gore had been elected president, the United States would not have invaded Iraq.</td>
</tr>
<tr>
<td>Sufficient Condition Counterfactual</td>
<td>Sufficient</td>
<td>Necessary</td>
<td>If the United States did not invade Iraq in 2003, George W. Bush could not have been elected president in 2000.</td>
</tr>
<tr>
<td>INUS Condition Counterfactual</td>
<td>INUS</td>
<td>Neither Necessary nor Sufficient</td>
<td>If George W. Bush had not been elected president, the United States would have invaded Iraq, but a nonessential condition for the United States not invading Iraq would have existed.</td>
</tr>
</tbody>
</table>

**Necessary Condition Counterfactuals**

One type of counterfactual “implies that if the antecedent condition had been different, the outcome would have been different” (Levy 2008: 629; see also Weber 1949; Lewis 1973). For example, consider the following statement: Without a strong bourgeoisie, England would
not have experienced a democratic route to modernity (Moore 1966: 418). Following Goertz and Levy (2007), we use the expression *necessary condition counterfactual* to designate these counterfactual propositions that assume that the actual world antecedent condition was essential for the outcome. With these propositions, the counterfactual removal or negation of the actual world antecedent ensures a different outcome.

**Figure 1.** Graphical Depiction of a Necessary Condition Counterfactual

As figure 1 shows, a necessary condition counterfactual can be depicted graphically with a set diagram. The basic rule for using these diagrams is simple: If event $X$ is necessary for event $Y$, then $X$ is a superset of $Y$, because $Y$ occurs only in the presence of $X$. With a necessary condition, it follows logically that $\sim X$ is sufficient for $\sim Y$, such that $\sim X$ is a subset of $\sim Y$. The set diagram in figure 1a illustrates these set relations. The diagram in figure 1b duplicates these
relationships but builds temporality and causality into the picture. A case must first acquire membership in set \( X \) (i.e., strong bourgeoisie) to obtain subsequent membership in set \( Y \) (i.e., democracy). A case that is a member of set \( \sim X \) (i.e., not strong bourgeoisie) is ensured subsequent membership in set \( \sim Y \) (not democracy).

With a necessary condition counterfactual, the set containing the actual world antecedent (i.e., set \( X \)) will always be larger than the set containing the actual world outcome (i.e., set \( Y \)). A core implication is that a necessary condition counterfactual proposes that it is more plausible for the world to lack the outcome than to lack the antecedent. In the context of Moore’s hypothesis, it is more plausible to imagine a world in which democracy does not occur in England than to imagine a world in which England lacks a strong bourgeoisie. According to Moore, there are no possible worlds in which democracy emerges without a strong bourgeoisie, although it is possible to conceive the absence of democracy even in the presence of a strong bourgeoisie. Under the same logic, consider the counterfactual that, “If George W. Bush had not been elected president, the United States would not have invaded Iraq.” If this counterfactual is valid, the nonactual event in which the Iraq invasion does not occur is more plausible than the nonactual event in which Bush does not win the election. No possible worlds exist in which Bush is not elected and the invasion occurs; however, there are possible worlds in which Bush is elected and the invasion does not occur.

**Negation Counterfactuals**

The non-election of George W. Bush is not equivalent to the election of Al Gore. Thus, the following two counterfactuals are not identical:

\[ C1. \text{ If George W. Bush had not been elected president, the United States would not have invaded Iraq.} \]
C2. If Al Gore had been elected president, the United States would not have invaded Iraq.

The first counterfactual (C1) is a necessary condition counterfactual: the election of Bush is a necessary condition for the U.S. invasion of Iraq; equivalently, the absence of the election of Bush is a sufficient condition for the non-invasion of Iraq. With the second counterfactual (C2), by contrast, the election of Bush is not identified as necessary for the U.S. invasion of Iraq. C2 asserts that the election of Al Gore is sufficient for the non-invasion of Iraq. But C2 does not assert that the election of George W. Bush is necessary for the invasion of Iraq. It allows for the Iraq invasion to occur without the election of either Bush or Gore.

One must therefore distinguish carefully between necessary condition counterfactuals and what we call “negation counterfactuals.” A necessary condition counterfactual embodies two logically equivalent propositions: (1) the actual world antecedent is necessary for the actual world outcome; and (2) the negation of the actual world antecedent is sufficient for the negation of the actual world outcome. By contrast, a negation counterfactual does not entail any necessity claim concerning the actual world antecedent; it only embodies a sufficiency claim about a specific negated antecedent. The sufficiency claim concerns one possible and specific instantiation of the negated antecedent. For instance, if event $X$ did not occur in one specific way, then event $Y$ would not have occurred; but if event $X$ did not occur in yet another way, event $Y$ might still have occurred.
More concretely, consider the following statements (diagrammed in figure 2): “If Al Gore had had won the 2000 presidential election, the United States would not have invaded Iraq. But if John McCain had won the 2000 presidential election, the United States would have invaded Iraq.” This example allows for possible worlds in which the non-election of George W. Bush sometimes leads to the Iraq invasion and sometimes does not. The example involves two counterfactuals with opposite outcomes: the election of John McCain in 2000 leads to the same outcome as occurred in the actual world, whereas the election of Al Gore does not. When taken together, the two
counterfactuals hold that the election of George W. Bush was not necessary for the Iraq invasion -- a McCain victory would have generated this outcome. The example shows how negation counterfactual statements can used in conjunction with other counterfactual statements to propose that some specific instantiations of the negated antecedent condition are sufficient for the negated outcome, whereas other specific instantiations of the negated antecedent condition are sufficient for the actual world outcome.

**Sufficient Condition Counterfactuals**

Assertions about individual conditions that are sufficient for outcomes are rare in the social sciences. Nevertheless, some examples do exist. For instance, Goldhagen (1996) asserts that Hitler and the Nazis were sufficient but not necessary for ordinary German citizens to be motivated to participate in the Holocaust. Alternative conditions, in particular a virulent strand of German anti-Semitism, would have led to the same outcome even without Hitler and the Nazis. This argument holds that the negation of Hitler and the Nazis would not have removed the motivational basis of the Holocaust. The sufficient condition hypothesis yields a counterfactual in which the actual world outcome remains the same. This is true because when a condition is sufficient but not necessary for an outcome, then at least one other condition (or set of conditions) is also sufficient for the same outcome. The actual world outcome is “overdetermined” (Przeworski and Teune 1970).

With sufficient conditions, one can most easily evaluate the counterfactual by negating the actual world outcome, which then requires the negation of the sufficient condition (Koivu

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2 The McCain counterfactual is a variant of a negated counterfactual in which the specific instantiation of the negated antecedent is sufficient for the actual world outcome (rather than the negated actual world outcome).
2016). For example, Goldhagen’s argument implies the following counterfactual: If Germans were not motivated to participate in the Holocaust (\( \sim Y \)), Hitler and the Nazis would not have been in power (\( \sim X \)). This counterfactual provides a basis for falsifying Goldhagen’s argument through the construction of a possible world in which Hitler and the Nazis exist but Germans are not motivated to participate in the Holocaust. Insofar as one cannot construct such a possible world -- i.e., it is impossible to imagine German citizens as unmotivated to participate in the Holocaust while Hitler and the Nazis are in power -- it lends support to Goldhagen’s argument.

Yet, in other ways, sufficient condition counterfactuals that begin with the negated outcome and then work in reverse chronological order to a negated antecedent condition are difficult to support. A core problem is that the negated outcome is consistent with many possible worlds, and the analyst therefore does not know exactly where to begin a backward projection that travels from the negated outcome to the negated antecedent. For instance, in the Goldhagen example, the starting point of analysis would have to be a possible world in which the Holocaust does not occur. Yet there are vast differences among possible worlds that lack the Holocaust, and all of these worlds are radically different from the actual world, making the task of rigorously evaluating this counterfactual challenging in practice.

**INUS Condition Counterfactuals**

One may well believe that the election of George W. Bush contributed to the Iraq invasion but was neither necessary nor sufficient for this outcome. This idea can be stated in a somewhat awkward counterfactual form: “If Bush had not been elected, the Iraq invasion would still have occurred, yet the election of Bush was a contributing (unnecessary and insufficient) condition for the Iraq invasion.” Logically speaking, one believes that the election of George W. Bush was an *INUS condition* for the Iraq invasion. An INUS condition is an insufficient but
nonredundant component of a combination of conditions that is unnecessary but sufficient for an outcome (Mackie 1980; see also Ragin 1987). INUS conditions are essential individual components of a combination of factors that is sufficient (but not necessary) for an outcome.

As with sufficient conditions, the negation of an INUS condition does not entail the negation of the actual world outcome. INUS conditions are present only when the outcome of interest is overdetermined. To change the actual world outcome, one must negate all individually sufficient conditions and at least one condition from each combination of factors that is sufficient for the outcome. For example, one might argue that, “if Bush had not won the election, the invasion of Iraq would have still occurred, but if Bush had not won the election and if containment strategies had been more successful, then the invasion of Iraq would not have occurred.” Here one assumes that neither a Bush nonelection nor more successful containment were by themselves enough to prevent the Iraq invasion. However, the negation of both of these factors closes off the two pathways sufficient to generate this outcome.

INUS conditions do not lend themselves to reverse counterfactuals in which one negates the INUS condition by negating an outcome. Rather, to develop a useful counterfactual statement with an INUS condition, must consider a counterfactual that simultaneously negates or changes multiple conditions. This fact makes INUS condition counterfactuals more complex and more difficult to evaluate than other kinds of counterfactuals. INUS condition counterfactuals that change the actual world outcome require the consideration of possible worlds in which multiple antecedent conditions are changed.
THE MINIMAL-REWRITE RULE

The minimal-rewrite rule holds that the most useful counterfactuals are those that require the fewest changes to the actual world (Tetlock and Belkin 1996a; Weber 1949). Intuitively, miracle counterfactuals whose antecedents require massive changes to history seem problematic or even absurd. For example, a miracle counterfactual is, “if Napoleon had nuclear weapons, the French Empire would have expanded across the globe.” While the counterfactual may be true, the implausibility of its antecedent renders it unhelpful for the purposes of causal analysis. A set-theoretic approach helps to show why by making explicit the logic underpinning the minimal-rewrite rule.

Plausibility, Enabling Counterfactuals, and Small Events

“Minimal-rewrite” or “plausible world” counterfactuals are preferred to “maximal-rewrite” or “miracle” counterfactuals because changing an antecedent condition requires changing other conditions in the world, including alterations to events prior to the antecedent condition itself. When evaluating a counterfactual, a core question is whether the prior counterfactual events required to bring the counterfactual antecedent into existence explain the outcome of interest as opposed to the counterfactual antecedent itself (Goodman 1947; Fearon 1991). If radical changes to the actual world are required to bring the counterfactual antecedent into existence, the researcher may be unable to use counterfactual analysis to assess a hypothesis. As Levy (2008, 634) notes, “counterfactual analysis ideally posits an alternative world that is identical to the real world in all theoretically relevant respects but one, in order to explore the consequences of that difference” (see also Weber 1949).
When a counterfactual antecedent is introduced, the researcher works to identify other aspects of the world that will change and whose alteration might affect the outcome. One cannot sustain the primary counterfactual without specifying the “enabling counterfactuals” (Lebow 2010; see also Goodman 1947) that are requisite for an antecedent to exist and for postulated causal processes to operate. For example, imagining the election of Al Gore requires one to change other aspects of the world, such as perhaps the behavior of several hundred voters in Florida. Moreover, the counterfactual requires enabling counterfactuals that connect a Gore victory to the decision to not invade Iraq. To sustain the tenability of the primary counterfactual of interest, these enabling counterfactuals before and after the counterfactual antecedent must themselves be plausible and logically coherent. Hence, the minimal-rewrite rule applies to not only the primary counterfactual but also to its essential enabling counterfactuals (Lebow 2010: 54).

The minimal-rewrite rule explains why small events, accidents, and contingent choices allow for plausible counterfactuals. With these kinds of occurrences, one can imagine a world in which the event does not occur but that is otherwise quite similar. As an illustration of more maximal and more minimal rewrites, consider the two different necessary conditions that Soifer (2015) identifies to explain the emergence of a strong state apparatus in Chile: 1) a highly centralized urban population; and 2) the deployment of competent officials from the center to the peripheries to execute state-building projects. Of the two conditions, the latter is associated with a minimal-rewrite counterfactual: it is relatively easy to imagine state officials in Chile not overseeing the deployment of competent officials to the peripheries. By contrast, the counterfactual attached to the former condition requires a more maximal-rewrite: many
historical and geographical features would have to change for Chile to shift its pattern of population settlement.

Going back to our earlier example, the victory of Gore in the 2000 American election is also a plausible counterfactual antecedent because the vote was so close; it is relatively easy to imagine this counterfactual event. In general, events such as an assassination, an individual policy choice, the outcome of a specific military battle, and a natural disaster often lend themselves to plausible counterfactuals. Empirical illustrations of path dependence, such as the adoption of the QWERTY keyboard format or the choice of agricultural modernization strategies in Central America, invoke historical explanations that call attention to early small events that easily could have turned out differently (Arthur 1994; David 1985; Mahoney 2000; Pierson 2004). Critical juncture analyses commonly focus on choices and agency in which one can readily imagine a different path being selected at a key historical moment (Capoccia and Keleman 2007; Capoccia 2015). The correspondence between small/contingent events and plausible counterfactuals directs this kind of explanation toward singular occurrences and more idiographic causes as opposed to explanations and variables associated with more general theories (Levy 2015). Analogously, the quest to use plausible counterfactuals may lead one to emphasize contingent choice and agency rather than structure.

Yet the results of a counterfactual analysis need not lead to the conclusion that small events are the decisive causal movers in history. It is quite possible that a counterfactual positing a small event as an antecedent will be deemed implausible upon empirical investigation. For example, Harvey’s (2012) careful analysis of the Gore counterfactual leads him to the conclusion that the invasion of Iraq would have occurred even under a Gore presidency. His analysis points to the causal power of historical and situational forces that favored this outcome regardless of
whether Gore or Bush was elected. When initially plausible counterfactuals are deemed implausible, one may conclude that large events, structure, history, or impersonal situational forces carry considerable explanatory weight.

**Set Theory and Minimal-Rewrites**

The tools of set theory help elucidate why small and contingent events offer plausible antecedents in counterfactual explanation. In figure 3, two necessary condition antecedents are diagramed. In both cases, \( X \) is a superset of \( Y \) (and thus a necessary condition for \( Y \)). In the diagram on the left, however, \( X \) is a large superset in relationship to \( Y \). With this diagram, there are many possible worlds in which \( X \) takes place but \( Y \) does not occur. \( X \) is necessary for \( Y \), but it does not come close to also being sufficient for \( Y \). It is easy to imagine scenarios in which \( X \) occurs but \( Y \) does not. In the diagram on the right, by contrast, \( X \) is a superset of \( Y \), but \( X \) comes close to perfectly overlapping with \( Y \). Consequently, there are few possible worlds in which \( X \) takes place but \( Y \) does not. \( X \) is necessary for \( Y \), and it comes close to being sufficient as well.

**Figure 3.** Small Events and Plausible Counterfactuals
The utility of a necessary condition counterfactual varies depending on whether $X$ is a large or small superset in relationship to $Y$. A trivial counterfactual employs a necessary condition antecedent $X$ that is a very large superset of $Y$, such that it is easy to imagine $X$ occurring without $Y$. For example, the following counterfactual is trivial: “If George W. Bush had not been elected president, the United States would not have invaded Iraq at sunrise on March 20, 2003.” The trivialness in this example is related to the specificity of the outcome: the outcome is so specific that countless small changes could generate its absence. When the outcome is a very small set (as in the diagram on the right side of figure 4), a necessary condition counterfactual can avoid trivialness only by referencing an actual world antecedent that is also a very small set – i.e., only by referencing an improbable and unexpected event.

**Figure 4.** Outcome Specificity and Trivialness
For the purposes of empirical assessment, a necessary condition counterfactual becomes more important to the degree that the actual world antecedent approximates a sufficient condition as well as a necessary condition (Goertz 2006; Hart and Honoré 1985; Mahoney 2008; Ragin 2008; Schneider and Wagemann 2012). With an important necessary condition counterfactual, it is difficult to imagine the outcome occurring without the actual world antecedent. For instance, the counterfactual holding that a non-Bush election would have led to a non-invasion is more empirically important to the extent that one believes that a Bush election nearly ensured (i.e., was sufficient for) the invasion. A core upshot is that when two necessary conditions for a given outcome are proposed, one often can say something about their relative importance using counterfactual analysis. In particular, if one condition entails a minimal-rewrite and the other entails a more considerable rewrite, then the former is more important empirically if both are deemed necessary for the outcome.

The End of the Cold War

As an illustration, consider the debate about the causes of the end of the Cold War between English (2007) and Brooks and Wohlforth (2007a; 2007b). English asserts that materialist factors, in particular the long-term economic decline in the Soviet Union, “were a necessary but clearly insufficient condition for the Cold War’s peaceful end” (2007: 239). He argues that ideational factors -- especially Gorbachev and “new thinking” -- were also necessary for Soviet retrenchment. As he puts it, “whatever one believes about the old thinker’s acquiescence in Gorbachev’s initiatives, it remains inconceivable that they would have launched similar initiatives without him” (p. 245). He suggests that ideational factors were more important than materialist factors in producing the end of the Cold War. Ideational factors were
the more important causes in part because they “developed and operated independent of material pressures” (p. 249).

Brooks and Wohlforth do not deny that ideational factors may have been a necessary ingredient (2007a: 196). However, they argue that ideational factors were not decisive causes; they mainly shaped the specific form of retrenchment, rather than whether or not retrenchment occurred. Brooks and Wohlforth contend that materialist factors, especially the long-term economic decline in the Soviet Union, represented a more important cause of the Soviet retrenchment. “We found that the Soviet Union’s declining material fortunes was the key factor that made the new thinker’s ideas saleable to those skeptical of retrenchment” (2007b: 263). They argue that “the Soviets reoriented their foreign policy in large part in response to changing material incentives” (2007a: 200). “Many of the basic causal mechanisms that are featured in ideational models of this case are to a significant degree endogenous to material changes” (2007a: 235).

Figure 5 offers a stylistic reconstruction of Brooks and Wohlforth’s argument from a set-theoretic perspective. The figure is intended to diagram the logic underpinning these authors’ view that new thinking is endogenous to material factors, and thus that the connection between new thinking and retrenchment is less important than the connection between economic decline and retrenchment. In the figure, both economic decline and new thinking are necessary for Soviet retrenchment. However, economic decline is the more important necessary cause because it is closer to also being a sufficient cause. In fact, in this reconstruction, economic development is fully sufficient for new thinking, ensuring that this necessary condition comes into being.
Figure 5. Stylistic Summary of Brooks and Wohlfarth’s Argument

Figure 6. Stylistic Summary of English’s Argument
Although English allows that economic decline may have been necessary for new thinking, he argues that it was not close to sufficient. He regards other causal factors -- such as Gorbachev’s personality, a fast pace of events, public opinion, and weaknesses among hardliners -- as more important in allowing for new thinking (2007: 253). When compared to material factors, moreover, he suggests that new thinking is the more important cause of Soviet retrenchment. Figure 6 illustrates the set-theoretic logic of this argument. Here both conditions are again necessary for Soviet retrenchment, but new thinking comes closer to also being sufficient; it is now the more important of the two necessary conditions. One way to think about the key change in figure 6 (compared to figure 5) is that new thinking is now only slightly endogenous to material factors.

The question then arises: How can we know which necessary condition (material conditions versus new thinking) really is more important? How can we know whether the depiction in figure 5 or in figure 6 is more likely correct?

These questions can be addressed using comparative counterfactual analysis (Harvey 2012). Specifically, one can use the minimal-rewrite rule to compare the plausibility of the counterfactual claims assumed by the two arguments. In support of English’s argument, one can argue that it is more plausible to imagine a world without Gorbachev and new thinking than a world without Soviet economic decline. While one can formulate minimal-rewrite scenarios in which Gorbachev does not come to power, it is difficult to do the same for scenarios in which the Soviet Union does not decline economically. Thus, a comparative counterfactual argument using the minimal-rewrite rule suggests that the true relationship more likely follows the set diagram in figure 6, not the one in figure 5. In figure 6, new thinking appears as a relatively exceptional event, as indicated by the fact that its set is smaller than the set for not-new thinking. By
contrast, economic decline appears as a more typical event, as indicated by the larger size of its set in comparison with its negation. Under this representation, it is fairly easy to imagine a world in which new thinking does not take place, whereas it is difficult to imagine a world without Soviet economic decline. On this basis, English has the upper hand in the debate because new thinking appears as the more important of the two necessary conditions for Soviet retrenchment.

In response, however, Brooks and Wohlforth might argue that Gorbachev and new thinking were *not* necessary for the end of the Cold War. In fact, in a rebuttal to English, they stress that their argument is best understood probabilistically rather than deterministically (Brooks and Wohlforth 2007b: 266-68). This assertion suggests that they believe that the causes of the end of the Cold War were all INUS conditions, each one contributing nonessentially to the outcome. If so, a counterfactual assessment of the plausibility of their argument relative to English’s argument depends on the other conditions that combine with economic decline to produce the outcome and the other conditions that combine with Gorbachev and new thinking to produce the outcome. One can assess the relative importance of the two INUS conditions (economic decline versus Gorbachev/new thinking) based on the degree to which they approximate being individually sufficient for the outcome (Mahoney, Kimball, and Koivu 2009).

For example, if economic decline needs to combine with relatively trivial additional causes to produce the outcome, whereas Gorbachev and new thinking need to combine with many important structural causes to produce the outcome, then one may conclude that materialist factors are the more important INUS condition: materialist factors nearly produce the outcome by themselves (i.e., they are nearly sufficient), whereas ideational factors require the presence of additional and hard-to-come-by causal factors.
The implication of this analysis is that the debate over the end of the Cold War depends heavily on the specific causal claims of the authors involved. If both economic decline and Gorbachev/new thinking are necessary conditions, then comparative counterfactual analysis suggests that English has the upper hand in the debate: Gorbachev and new thinking are associated with a more plausible counterfactual argument. By contrast, if economic decline and Gorbachev/new thinking are INUS conditions, then Brooks and Wohlforth have the stronger argument: materialist conditions probably come closer to sufficiency than Gorbachev and new thinking.

A more general point about comparative counterfactual analysis follows. A comparative analysis of two necessary condition counterfactuals will tend to favor small events and contingent happenings; by contrast, a comparative analysis of two INUS condition counterfactuals will tend to favor more generalizable causal factors. Opposite findings about relative causal importance can emerge depending on whether one believes the actual world antecedent is a necessary or an INUS condition for the outcome of interest.

**THE LEVEL OF GENERALITY OF EVENTS**

The level of generality at which the events in a counterfactual proposition are formulated is linked to both the precision of the counterfactual and the empirical importance of the counterfactual. First, the precision of a counterfactual proposition increases as the events it proposes are cast in more specific forms. The most precise counterfactuals are those that reference events that are highly specific. However, as a given counterfactual statement becomes more precise, it also becomes less plausible (cf. Elster 1978; Levi 2015). This tradeoff between precision and plausibility can be neatly explicated and illustrated using set-theoretic tools.
Second, the *empirical importance* of a counterfactual increases to the extent that its antecedent and outcome have a similar level of generality. The most important necessary condition counterfactuals have antecedents that are only slightly less general than their outcomes; the most important INUS condition counterfactuals have antecedents that are part of a combination of conditions that is only slightly less specific than the outcome. A set-theoretic approach again allows us to see the logic behind these relationships and draw conclusions about the appropriate level of generality to use when formulating counterfactual statements.

**Precision**

Counterfactuals can be formulated in ways that are more precise or less precise. Consider, for example, the following two counterfactuals (see Lebow 2007):

C3. If Franz Ferdinand had not been assassinated, World War I would not have occurred.

C4. If no assassination attempt had been made against Franz Ferdinand, World War I would not have occurred.

C4 is more precise than C3; it refers to a more specific (less general) counterfactual antecedent. C4 is a specific way in which Ferdinand might have been not assassinated; it is one possible instantiation of C3. In set-theoretic terms, the antecedent of C4 is a subset of the antecedent of C3; it is encompassed within it. One can see this relationship in figure 7.

Counterfactual statements can always be made more precise by reconceptualizing their events in more specific ways. This is true because casting a historical event at a more specific level of generality requires reducing the number of possible worlds contained within that event set. For example, consider the following counterfactuals:

C5. If Franz Ferdinand had not been assassinated, World War I would not have occurred.
C6. If Franz Ferdinand had not been assassinated, fewer than 10,000 combatants would have died in interstate combat among the great powers between 1914 and 1920.

Both counterfactuals reference nonactual outcomes, but C6 is more precise. Its counterfactual outcome refers to a more specific historical event. C6 is one possible instantiation of C5; it is a subset of C5.

Figure 7. Outcome Specificity and Trivialness

Researchers can make counterfactuals more precise by clarifying the characteristics of events. For example, consider the following two counterfactuals:
C7. If Franz Ferdinand had not been assassinated, fewer than 10,000 combatants would have died in interstate combat among the great powers between 1914 and 1920.

C8. If Franz Ferdinand had not been assassinated, fewer than 10,000 combatants would have died in interstate combat among the great powers (i.e., Austria-Hungary, Great Britain, France, Germany, the Ottoman Empire, Russia, and the United States) between 1914 and 1920.

C8 is more precise because it clarifies the definition of “great powers” between 1914 and 1920. The clarification makes the concept more specific: it delimits the states that constitute the great powers and eliminates alternative possible definitions. In the opinion of some scholars, for instance, Italy and Japan might be considered great powers; alternatively, scholars might not regard the Ottoman Empire as a great power. C7 is ambiguous about the inclusion or exclusion of these states, thereby encompassing various possible definitions of great powers. When one defines the term in a particular way, one rules out possibilities and makes the statement more precise.

Likewise, one can make a counterfactual more precise by replacing an unspecified non-event with a specific instantiation of the non-event. A non-event is characterized by the absence or negation of positive event, such as “World War I does not occur” or “the United States does not invade Iraq.” By transforming a non-event into a positive event, one develops a more precise counterfactual. For example, “a local war on the European continent in which Russia, Germany, and Britain remain at peace” is one specific instantiation of “World War I does not occur.” Likewise, “military action limited to covert operations to assassinate Saddam Hussein” is a possible instantiation of “the United States does not invade Iraq.” The exchange of a non-event for a specific positive event adds precision to a counterfactual.
As one increases the precision of a counterfactual, however, one makes the counterfactual less plausible: precision and plausibility are inversely related for counterfactual statements (Elster 1978: 184; Levy 2015: 389). For instance, it is more plausible to imagine a world in which Franz Ferdinand is not assassinated than to imagine a world in which no assassination attempt occurs at all. The former counterfactual permits all instantiations of the latter plus additional possibilities; the former counterfactual permits an assassination attempt that fails, whereas the latter does not. Likewise, it is more plausible to imagine a world in which World War I does not occur than a world in which fewer than 10,000 combatants die in fighting. The former scenario allows for possibilities (e.g., a local war in Europe that does not become a world war) that the latter does not.

Exactly where one should draw the line between precision and plausibility will vary depending on the research question and research domain. As a practical strategy, one may first assess a less precise and more plausible counterfactual. If the counterfactual is empirically sustainable, it can be stated more precisely and reassessed in a less plausible form. By continuing the process, the researcher can work to determine how precisely the counterfactual can be formulated and still receive empirical substantiation. More precise counterfactuals are preferred to less precise counterfactuals, but all counterfactuals will reach a point where additional precision renders the counterfactual implausible and unsustainable.

**Empirical Importance**

The level of generality of the events in a counterfactual is also related systematically to the empirical importance of the causal antecedent under investigation. In the context of case-study explanation, empirical importance is defined as the extent to which an antecedent condition approximates being necessary and sufficient for an outcome (Mahoney 2008). A necessary
condition becomes more important empirically to the extent that it approximates also being a sufficient condition; a sufficient condition (including a sufficiency combination of INUS conditions) becomes more important empirically to the extent that it approximates also being a necessary condition. Figure 8 illustrates these ideas using set diagrams. By definition, the set for a necessary condition must be larger than the set for the outcome. With an important necessary condition, however, this set will be only slightly larger than the set for the outcome. By the same token, the negation set for a necessary condition must be smaller than the negation set for the outcome. With an important necessary condition, however, the negation set will be only slightly smaller than the negation set for the outcome.

**Figure 8.** Assessing the Importance of Necessary Conditions and Sufficient Conditions

Empirical importance is linked to the level of generality of the counterfactual antecedent relative to the counterfactual outcome: importance increases as the counterfactual antecedent and counterfactual outcome come closer to having the same level of generality. For instance, if the counterfactual outcome is a highly specific event, then the antecedent of the counterfactual
must also be highly specific to achieve maximum empirically importance. To substantively illustrate, consider the following two necessary condition counterfactual statements (see figure 9):

C9. If pre-revolutionary Cuba and Nicaragua did not have authoritarian regimes, they would not have experienced political violence in the 1950s and 1970s respectively.

C10. If pre-revolutionary Cuba and Nicaragua did not have authoritarian regimes, they would not have experienced social revolutions in the 1950s and 1970s respectively.

**Figure 9.** Relationship of Level of Generality and Empirical Importance

Both counterfactuals treat the authoritarian regimes of these countries as necessary conditions for their respective actual world outcomes (i.e., political violence in C9 and social revolution in C10), and it follows logically that the absence of an authoritarian regime is sufficient for the absence of these outcomes. However, the counterfactual outcome in C9 (not political violence) is more specific than the counterfactual outcome in C10 (not social revolution): not political
violence is a subset of not social revolution. Consequently, as figure 9 shows, the counterfactual antecedent in C9 comes closer to being both necessary and sufficient for its counterfactual outcome than the counterfactual antecedent in C10 does for its counterfactual outcome. One can see this by examining the size of the counterfactual antecedents relative to their outcomes. As a general rule, with a necessary condition counterfactual, one can increase the empirical importance of a counterfactual antecedent by conceptualizing the counterfactual outcome in more specific terms and/or conceptualizing the counterfactual antecedent in more general terms.

**Figure 10.** Relationship of the Specificity of Events to the Importance and Plausibility of Counterfactual Propositions

The risk one runs with such reconceptualizations, however, is that the effort to increase empirical importance will render the counterfactual implausible or false. For instance, with the example above, it is more plausible to hypothesize that the absence of authoritarian regimes in
Cuba and Nicaragua would have prevented specifically social revolutions than prevented political violence more generally.

While researchers work to achieve both empirical importance and plausibility, these goals stand in tension with one another (see figure 10). It is easier to formulate a plausible counterfactual statement if it is trivial; it is more difficult to formulate a nontrivial and plausible counterfactual statement. This section has considered the logical reasons for this tradeoff and identified the ways in which scholars can shift the generality of events to manage the tradeoff. Again, the rule is that as one increases the specificity of the counterfactual antecedent and/or decreases the specificity of the counterfactual outcome, one causes the counterfactual statement to become less plausible but more important.

COUNTERFACTUAL PROJECTIONS

Counterfactual assessment involves making judgments about the real events that would and would not change, given a false event. These judgements draw upon: (1) facts relevant to the case under analysis, and (2) generalizations that can be applied to these facts to generate predictions. By combining facts and generalizations, the analyst constructs one or more narratives composed of a sequence of events.

When constructing this sequence, the researcher begins with a nonactual event and then projects history forward or backward. In a common mode of counterfactual analysis, the starting nonactual event is the main counterfactual antecedent under investigation, and the researcher projects forward in time by formulating a sequence of causally connected events that culminate (or not) in a nonactual outcome. Alternatively, with a sufficient condition counterfactual, the analyst may start with a negated outcome and project backward in time toward a negated
antecedent. Backward projection may also be used if the main counterfactual antecedent is treated as an outcome. This kind of backward projection considers events in reverse chronological in order to identify the causes of the counterfactual antecedent itself. By establishing the relevant changes that generate the counterfactual antecedent, the analyst can better decide whether the antecedent is connected to the main outcome of interest.

**Forward Projection**

In a common mode of forward projection, a researcher explores whether a nonactual antecedent would have led to a nonactual outcome. A good example is Harvey’s (2012) analysis of the Al Gore/no Iraq War counterfactual (see figure 11). Harvey argues that had Gore been elected president, Iraq would have been a central foreign policy preoccupation. He points out that Gore himself was a foreign policy hawk, and various evidence suggests he would have appointed a hawkish national security team (e.g., Richard Holbrooke was the leading candidate for secretary of state). Under this nonactual Gore presidency, Harvey argues, assertive multilateralism with a coercive military threat would have almost certainly been carried out as a foreign policy strategy to contain Iraq. Like the Bush administration, the Gore administration would have pushed the United Nations to bring inspectors back to Iraq. Faulty intelligence about the likelihood of weapons of mass destruction being present in Iraq would have still emerged. Saddam Hussein would have carried out largely the same strategic mistakes that compounded the intelligence failures under the Bush administration. The Gore administration would have sought support from Britain and other allies for military action against Iraq, with much of the U.S. public rallying around the flag in support. The United States would have attacked Iraq.
As figure 11 shows, the logic of this counterfactual argument can be cast as a sequence of increasingly important sufficient conditions culminating in the Iraq war under a Gore presidency. As the sequence of nonactual events progresses, each sufficient condition comes closer and closer to being necessary as well as sufficient for the outcome. Thus, at the end of the sequence, the mobilization by the nonactual Gore administration of a war coalition is nearly necessary and sufficient for an Iraq war. Of course, one could add further nuance to any point in the narrative by identifying additional intermediary connecting events. (In fact, Harvey’s narrative is more sophisticated than this portrayal suggests). One could add an additional step at the very end of

Note: 1. Gore is elected president; 2. Gore appoints hawkish national security team; 3. Iraq is central foreign policy concern; 4. UN inspectors are brought back to Iraq; 5. Faulty intelligence about WMDs; 6. Hussein makes strategic mistakes; 7. USA assembles war coalition; 8. US invades Iraq. S stands for sufficient; N stands for necessary.
the sequence -- such as the launching of fighter jets -- that would bring matters even closer to necessity as well as sufficiency.

Debates about counterfactual projection often involve questions about whether the removal of certain actual world events ensures the non-occurrence of other actual world events. Critics may seek out “weak links” in the causal chain leading to the counterfactual outcome. For instance, in Goldstone’s (2006) argument, the survival of William of Orange despite being grazed by a bullet in the summer of 1690 is a necessary condition for a series of major historical events, including the Glorious Revolution, the French Revolution, Newtonian science, the Industrial Revolution, and popular democracy in Europe. In her critique of this argument, Gardina Pestana (2006) disputes specific linkages in Goldstone’s narrative. For instance, she argues that Goldstone’s counterfactual analysis depends too heavily on generalizations about the capacity of a single individual -- James II -- to remake England as he pleased. If one disagrees with Goldstone’s implicit generalization about James II’s capacities, his counterfactual narrative can unravel: England does not become semi-Catholic monarchy, France does not dominate Europe, and history is poised to follow a course similar to the one it actually followed.

A good counterfactual projection will ordinarily consist of tightly coupled events that connect the antecedent to the outcome. Events that are closely connected to one another in time and space often lend themselves to plausible counterfactual sequences (Roberts 1996; Lebow 2010). Each event should be plausible and empirically important for each subsequent event. Ideally, the empirical importance of events for the final outcome should increase with each

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3 At the same time, it bears emphasis that counterfactual arguments do not necessarily collapse if one particular link in an overall sequence is found to be faulty. With a faulty link, one must redesign the subsequent steps in the counterfactual projection, but these new steps may still lead to the same outcome.
subsequent step. Thus, in Harvey’s narrative, when the nonactual Gore administration assembles a coalition to strike, the event is nearly necessary and sufficient for the Iraq War. By contrast, at the time that Gore is elected, there are many ways in which the war could have occurred, as can be seen with the size of the event circles in figure 11.

The credibility of the events and linkages in any counterfactual projection depends on the facts and generalizations on which these events and linkages are built. To support the claim that a Gore administration would have pursued aggressive multilateralism, Harvey draws on a large number of speeches and statements by Gore and other likely members of his administration. These speeches and statements convey a great deal of consensus on the threat from Hussein and the need to act aggressively. He connects this information with implicit generalizations, such as the idea that politicians and policymakers who adopt certain clear positions are likely to sustain them over time. Harvey’s argument is persuasive because it is built on good evidence and reasonable generalizations at each step along the way.

The generalizations on which counterfactual projections depend often are not stated in an explicit form in case-study explanation. The use of implicit generalizations is not a problem when the linkage between events is obvious or self-evident. However, if the linkage is not self-demonstrably true, a good counterfactual analysis should make explicit the generalizations on which it depends. In the case of the argument about the effects of William of Orange’s survival, Goldstone (2006) takes steps in this direction by providing reasons why he believes one event connects to another. Yet some of his assumptions about the capacity of single individuals to shape politics and science are not formally developed (Gardina Pestana 2006). By exposing implicit generalizations, researchers are in a stronger position to evaluate the plausibility of counterfactual assertions. Indeed, the debate between Goldstone (2006) and Gardina Pestana
(2006) -- already more upfront about underlying assumptions than most counterfactual analyses -
- would be even richer if focused explicitly on the generalizations on which the two authors do
not agree.

**Backward Projection**

The other central mode of projection with necessary condition counterfactuals and
negated counterfactuals involves considering the nonactual events that would bring the main
counterfactual antecedent into being. This kind of analysis entails backward projection in which
the investigator runs events in reverse chronological to establish what the world would look like
at the moment the counterfactual antecedent occurs. The projection identifies the background
conditions and historical context against which the analyst must connect the counterfactual
antecedent with the outcome of interest. If this context amounts to a world that is vastly different
than the actual world, the analyst may find it impossible to link the counterfactual antecedent
with the final outcome.

To illustrate, consider a miracle counterfactual such as, “if Napoleon had nuclear
weapons, the French Empire would have expanded across the globe.” The triviality of the
counterfactual is revealed as one projects backward and asks about a sequence of events that
could have led Napoleon to have had nuclear weapons (see figure 12). These events inevitably
would include scientific developments that are seemingly impossible scenarios, given the state of
knowledge at the time. In turn, these scientific developments require further disrupting
counterfactuals for their existence. The effort to project backward quickly leads to a “ballooning
effect” in which more and more unlikely counterfactual events must be introduced to arrive at a
Napoleon who possesses nuclear weapons.
Figure 12. Backward Projection with a Miracle Counterfactual

When backward projection leads to this kind of ballooning effect, it is difficult to establish what the world would look like at the moment of the counterfactual antecedent. One can be certain that the world would be radically different, but exactly how and in what ways are unclear. In turn, this lack of clarity about initial conditions at the moment of the counterfactual antecedent makes it difficult or impossible to assess the counterfactual statement. One cannot know whether the counterfactual antecedent is linked to the outcome without knowing the other conditions present in the world. For instance, if Napoleon possessed nuclear weapons, then perhaps England would have possessed nuclear weapons too. And if England possessed nuclear weapons, then we may not expect France to expand across the globe, rendering the counterfactual statement false. But unless we can know what a world in which Napoleon

Note: Dashed lines indicate an almost infinite set expanding upward.
possesses nuclear weapons looks like, we really cannot assess the validity of the counterfactual statement one way or the other.

Backward projection is therefore a tool for determining the extent to which the minimal-rewrite rule can be applied. By asking about the events that bring into being the counterfactual antecedent, one determines how similar the counterfactual world is to the actual world. The utility of small and contingent events as counterfactual antecedents again is revealed by backward projection: the world does not need to be radically changed in order to bring these nonactual events into being.

**CONCLUSION**

In this paper, we have developed a possible worlds and set-theoretic approach to counterfactual analysis in case-study explanation. In doing so, we have sought to make explicit some of the logical underpinnings of counterfactual analysis that to date have been left implicit.

Several payoffs derive from the explicit development of the set-theoretic approach. First, the approach allows for a precise distinction among different types of counterfactual statements: necessary condition counterfactuals, negation counterfactuals, sufficient condition counterfactuals, and INUS condition counterfactuals. This distinction is essential because one cannot evaluate effectively a counterfactual statement until one has made clear the kind of counterfactual embodied in the statement. As we saw with the end of the Cold War example, opposite findings may emerge depending on the counterfactual statement that is under investigation.

Second, the approach allows for the rigorous definition and use of the minimal-rewrite rule in counterfactual analysis. The approach shows visually why small and contingent events offer plausible antecedents in counterfactual analysis. It shows logically why empirical
examples of path dependence and critical junctures often call attention to small events and contingent choices that could have easily turned out differently. It allows one to link the minimal-rewrite rule to the relative empirical importance of counterfactual antecedents.

Third, the set-theoretic approach shows why and how the level of generality at which events are conceptualized shapes the precision and empirical importance of a counterfactual proposition. The approach illuminates the following basic rule: as the specificity of a counterfactual antecedent event increases, the counterfactual statement becomes more important but less plausible. By contrast, as the specificity of a counterfactual outcome increases, the counterfactual statement becomes less important but more plausible. When formulating the level of generality of events in a counterfactual proposition, therefore, one faces a systematic tradeoff between importance and precision.

Finally, a set-theoretic approach provides insights for carrying out and evaluating counterfactual projections. The approach shows how counterfactual narratives often entail a sequence of increasingly important sufficient conditions that culminate in the counterfactual outcome of interest. It calls attention to the underlying assumptions of counterfactual projection, helping analysts make explicit the facts and generalizations on which their counterfactuals depend. The set-theoretic approach furthermore provides tools for discussing the problems that arise when backward projection leads from one improbable event to another, demanding a radical rearrangement of the world in order to bring the counterfactual antecedent into being.

These various payoffs suggest how a possible worlds and set-theoretic approach provides new insights and tools for conducting counterfactual analysis in empirical research in the future.
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