Chapter 4

Causation and Causal Complexity

Mello, Patrick A. (2021) *Qualitative Comparative Analysis: An Introduction to Research Design and Application*, Washington, DC: Georgetown University Press, Chapter 4.

Embrace the messiness, the complexity: the real rather than the ideal.

Rani Lill Anjum and Stephen Mumford [1]

Causation is a contested issue in the philosophy of social science. Having in mind the mantra *correlation is not causation*, many empirical researchers working in a positivist tradition decide to avoid using causal language, focusing on statistically identifiable empirical relationships instead (Pearl and Mackenzie 2018, 1-6). Likewise, constructivists and interpretivists, in their departure from positivist-empiricist assumptions often also reject the use of causal language (Bevir and Blakely 2018, 35; Kurki 2008, 86). Yet, recent years have seen what could be termed a *renaissance* of causal thinking in the social sciences, with contributions from a variety of different perspectives (Anjum and Mumford 2018; Baumgartner 2009; Beach and Pedersen 2016; Bennett 2013; Collier et al. 2010; Gerring 2005; Guzzini 2017; Illari and Russo 2014; Jackson and Nexon 2013; Lebow 2014; Mahoney 2008; Morgan and Winship 2007; Pearl 2009; Peters 2020; Rohlfing 2012).

Against this backdrop, the first part of this chapter provides an overview on four major *theories of causation* in the philosophy of social science. This is followed by an introduction to the characteristic features of *causal complexity* as the core methodological assumption on which QCA rests. Together, these parts establish a foundation from which to assess current debates about *causal analysis*, as will be addressed in the final part of this chapter and picked up again in Chapter 9, where some critical interventions will be looked into.

Before proceeding, one caveat is in order: while this chapter focuses on causation, this should not be taken to imply that QCA must be applied for causal inference. Clearly, the method can also be used fruitfully for *explorative* or *descriptive* purposes, as introduced in Chapter 2, without striving for causal claims (Berg-Schlosser et al. 2009, 15; Thomann and Maggetti 2020, 10). Many empirical researchers would probably place their own set-theoretic applications rather in the area of explorative-descriptive work.[2] Nonetheless, causal language is frequently used by QCA proponents (e.g. Ragin 1987, 167) and "causal analysis" is stated as an explicit aim of the method (Schneider and Wagemann 2012, 13).[3] Hence it is vital to clarify the basis on which causal claims can or cannot be made with QCA. This resonates with recent efforts at connecting empirical research methods with a coherent set of philosophical criteria (Haesebrouck and Thomann forthcoming; Illari and Russo 2014; Rohlfing and Zuber 2019).

Relatedly, what is explicit or implicit in many accounts of causation and their related methods is their grounding in a *neopositivist* understanding of science, defined broadly as a perspective where human behavior is seen as governed by observable regularities that can be objectively assessed by the researcher. However, the prevalence of neopositivism in many fields should not deny the existence of alternative perspectives, like pragmatism, analytic eclecticism, interpretivism, or critical realism (Bevir and Blakely 2018; Jackson 2011; Kurki 2008; Sil and Katzenstein 2010). Clearly, a discussion of the intriguing ontological and epistemological questions raised by these perspectives is beyond the scope of this book (as in "what is the world made of" or "what can we know?") – the works just cited provide excellent treatments of these questions.

However, while it seems fair to say that QCA broadly resonates with neopositivist assumptions, I want to highlight that its methodology is open to other meta-theoretical perspectives. In that light, it should be noted that *critical realism* has recently made some inroads into set-theoretic methods and the number of studies that embrace a critical realist perspective continues to grow (Byrne 2009; Gerrits and Pagliarin 2020; Gerrits and Verweij 2014; Harvey 2009; Olsen 2014; 2010; Rutten 2019; 2020; Stevens 2020). At the most general level, critical realists share the ontological commitments that there is a reality that is independent of the mind of the researcher, that beliefs and knowledge are the product of social processes, and that it is possible to evaluate competing theories, despite inherent limitations (Bennett 2013, 465).[4]

Theories of Causation in the Social Sciences

We can distinguish four major conceptions of causation, emphasizing either *regularity*, *probability*, *counterfactuals*, or *mechanisms*.[5] Philosophers of social science are in dispute about which of these approaches to causation and their underlying theories should be given preference – a subject matter that is complicated by the fact that "proponents sometimes treat them as competing or even contradictory" (Brady 2008, 218). Yet, for the purposes of *applied* social science, which is the perspective that motivates this book, each of these approaches can be valuable: they all "capture some aspect of causality" (Brady 2008, 218), and empirical research methods may identify multiple "symptoms of causes" that are rooted in different conceptions of causation (Anjum and Mumford 2018, 232). Finally, differences between the perspectives should not be overdrawn. On a closer look, it becomes apparent that they are not as mutually exclusive in their assumptions about causation as they are sometimes made up to be.[6]

Regularity

The *regularity approach* to causation is traditionally associated with the work of 18th Century philosopher David Hume. Hence, as a shorthand, reference is often made to a "Humean" approach, even though modern variants may differ from what Hume had in mind. According to Hume's first definition of causation, we may conceive of a *cause* as "*an object, followed by another, and where all the objects, similar to the first, are followed by objects similar to the second*" (Hume 2010 [1772], 146, original emphasis). Given this lean definition, two criteria must be met before we may say from a regularity perspective that "A caused B": A must precede B in time, and all objects of type A must be followed by objects of type B.[7] With this definition, Hume turned the relationship between correlation and causation on its head: rather than explaining covariance through reference to causation, Hume argued that the observation of regular co-occurrence explains causation (Mumford and Anjum 2013, 16), or at least that part of causation that is observable "in the world", without reference to metaphysics (Psillos 2009, 133).

Hume's definition also entails the distinction between singular and general causation. Humean regularity emphasizes *general causation*, also known as *type-level*, *regular*, or *generic* causation. This perspective seeks to arrive at causal claims by subsuming cases under a general law or regularity. Here, observations are not seen as singular cases (though they might be single cases) but as representations of classes of phenomena ("objects, similar to the first"). From this perspective, a relationship can be deemed causal only if cause and effect are observed repeatedly in a regular fashion. By contrast, *singular causation* seeks to derive causal claims from a singular case without assuming a larger, more general pattern. This is why it is also known as *token-level*, *actual* or *single-case* causation (Illari and Russo 2014, 41-44; Pearl 2009, 309-10; Psillos 2009, 146-48). This distinction becomes important for instance in legal studies, where individual responsibility for a specific action needs to be shown rather than establishing a general claim or tendency.

The difference between general causation and singular causation can be illustrated with research on democracies and military coalitions. While some studies formulate general research questions such as "*what are the causes of democratic coalition defection?*", others formulate questions that focus on specific cases, as in "*what caused Prime Minister José Zapatero to announce Spain's withdrawal from the Iraq War coalition on April 19 of 2004?*" (on research questions, see Chapter 2).[8] To answer these, different inferential strategies and causal evidence are needed. While the former would resonate with a large-*N* statistical analysis based on aggregate data, the second research question requires an examination of the specific circumstances under which decision-making occurred in the respective case, which calls for small-*N* case studies and process tracing.[9]

Following in Hume's footsteps, most modern successors of the regularity approach seek to observe the joint and regular occurrence ("constant conjunction") of dependent and independent variables, measured in *statistical correlation* as the standardized form of covariance (Brady 2008, 219; Mumford and Anjum 2013, Ch. 2). Moreover, proponents of regularity-based approaches aim for type-level generalization and the identification of nomological statements (Hempel and Oppenheim 1948).[10] While the regularity understanding of causation has exercised a lasting influence on the development of the sciences, it has also received sustained criticism for its shortcomings, including the problems of common causes and "spurious", non-causal correlations (Moses and Knutsen 2019, Ch. 2). Among post-positivists, "Humeanism" has turned into a foil against which to argue for alternative understandings of causation (Bevir and Blakely 2018; Jackson 2011; Kurki 2008). The limitations of Humean regularity, especially the problems that arise from multiple causes, led John Mackie (1965; 1980) to propose an alternative based on INUS conditions, which are defined as "an *insufficient* but *necessary* part of a condition, which is itself *unnecessary* but *sufficient* for the result" (Mackie 1965, 245, original emphasis). While Mackie's framework sheds light on configurational causation, and has resonated widely because of it, the INUS approach entails some limitations of its own (Brady 2008, 227-30; Pearl 2009, 313-16). We will return to these when discussing causal complexity in the next section.

Probability

The *probabilistic approach* to causation replaces the deterministic Humean notion of a constant conjunction between cause and effect with the conception of probabilistic dependency (Williamson 2009). Hence, rather than triggering an effect each time the cause is present, the occurrence of the cause merely *increases the likelihood* that the effect also occurs. This is useful in settings characterized by uncertainty. For instance, we may stipulate that the consumption of junk food will lead to health problems, but we do not know when that will happen, nor whether it will affect each and every junk food consumer (since regular exercise or an otherwise healthy lifestyle may outweigh the detrimental effect). However, based on existing studies, we may safely say that junk food consumption makes it *more likely* for a person to develop health problems at some stage in their life.[11]

In essence, "probability is the formal language of uncertainty" (Moore and Siegel 2013, 175). A primary distinction is made between *objective* and *subjective* probability. While the former relates to factual knowledge (for instance, when you roll a six-sided die or flip a coin), the latter refers to beliefs and dispositions of individuals (as in someone's risk acceptance or their propensity to develop health problems). In formal terms, the conditional probability that event B occurs when event A has occurred is expressed as $P(\mathrm{B}|\mathrm{A})$. Based on a probabilistic understanding of causation, it can thus be said that "A causes B" if the conditional probability that B occurs when A has occurred is greater than the conditional probability that B occurs when not-A (¬A) has occurred (Selvin 2019, 2), which is expressed as: $P(\mathrm{B}|\mathrm{A}) > P(\mathrm{B}|\neg\mathrm{A})$.[12]

The probabilistic approach to causation overcomes problems of the Humean regularity account. Most importantly, it tackles the issue of exceptional cases (e.g., black swan events), as it suffices to identify a general tendency without having to establish a deterministic relationship between the purported cause and effect. This is useful, because for many phenomena it is easy to think of at least one *deviant case* where the assumed relationship between cause and effect does not manifest itself. This is one of the reasons why probabilistic causation has become a mainstream approach in the social sciences and is sometimes equated with *the* scientific method, writ large (e.g., Slantchev et al. 2005).[13]

That being said, there are at least three important limitations of the probability approach to causation. First, a probabilistic statement may not be of much help when the aim is to explain a *single case* or *specific cases* out of a larger population. To account for the decision-making of President Barack Obama before the military intervention in Libya in 2011, general statements about democracies and their conflict behavior can only get us that far. What would be more helpful are accounts of the political environment in which decisions were made and personal characteristics of the people involved. Relatedly, probabilistic methods often conceal *substantial heterogeneity* at the case-level. Consider the long-standing debate about the "democratic peace" in International Relations. While the voluminous body of quantitative research has established a host of correlations between "democracy" and various indicators of conflict behavior (e.g., Brown et al. 1996; Ray 2000; Russett and Oneal 2001), this kind of research typically neglects variance *within* the group of democracies, despite the fact that conflict involvement is limited to a minority of states.[14] Finally, probabilistic methods do not provide appropriate tests for *deterministic theories*. To continue with the example, some theoretical accounts suggest that democratic institutions impose structural constraints against certain kinds of conflict involvement. If taken seriously, then it follows that whenever such constraints are in place, then a certain kind of conflict behavior should not merely become less likely but that it simply should not happen.[15]

Counterfactuals

As the name implies, the *counterfactual approach* to causation is based on thought experiments about what would have happened if the world had been different (Paul 2009). Interestingly, Hume complemented his first definition of "cause" with a counterfactual definition: "Or in other words, *where, if the first object had not been, the second never had existed.*" (Hume 2010

[1772], 146, original emphasis). Against this backdrop, Judea Pearl suspects that "Hume was not completely happy with the regularity account" and therefore provided an additional definition based on a different logic (Pearl 2009, 238). Be that as it may, to date Hume has mostly been associated with the regularity account. While early traces of counterfactual reasoning can also be found in the writings of Max Weber (1922),[16] the modern counterfactual approach goes back to the work of the philosopher David Lewis (1973). In essence, Lewis turns around the statement "A caused B" by formulating a counterfactual: "B would not have occurred without A". The counterfactual perspective conducts a "mental exercise" to assess the plausibility of possible alternative worlds (Pearl 2009, 238-40). For example, we may propose that "[i]f kangaroos had no tails, they would topple over", to use Lewis' own example (1973, 1). This means that in a possible world that is most similar to ours but where kangaroos are not gifted with tails, we would assume that they would fall over. In general terms, we can ask whether the outcome could occur without a specific condition.

The counterfactual approach to causation has equally inspired quantitative and formal work, as well as qualitative scholars. Among the former, counterfactuals have formed a starting point for the *potential outcomes model*, also known as Neyman-Rubin model that aims at identifying average causal effects of a "treatment" or manipulation when compared to a control group (Morgan and Winship 2007; Sekhon 2008; Woodward 2009). The potential outcome framework has become a standard tool for causal inference in quantitative social science (Imai 2017, Ch. 2). Yet, it should be noted that the potential outcomes model does not entail a counterfactual analysis at the level of individual cases, as highlighted by Goertz and Mahoney (2012, 117). This is the realm of qualitative case-based research, where counterfactual reasoning has an established pedigree. For example, Frank Harvey (2012) provides an exhaustive counterfactual analysis on the questions of what would have happened if Al Gore had won the contested election against George W. Bush in 2000.[17]

Among other benefits, the counterfactual approach to causation, unlike the regularity approach, does not require the observance of a constant conjunction between cause and effect in the sense of a universal law. According to Lewis (1973), causes are *difference-makers* and the counterfactual perspective allows analysts to explore the specific conditions under which the absence of a cause leads to the absence of an effect or outcome. Because of these advantages, variants and refinements of the counterfactual approach have received favorable treatment among methodologists (Brady 2008; King et al. 1994; Rohlfing and Zuber 2019; Toshkov 2016). Nonetheless, proponents of the counterfactual approach are adamant about the fact that the "fundamental problem of causal inference" remains (Holland 1986, 947; Imai 2017, 47). Translated to a case-based perspective this means that we can never observe the presence *and* the absence of a cause in the same case at the same time. Hence, despite all our efforts at rigorous research design, "we can never hope to know a causal effect for certain" (King et al. 1994, 79). Apart from this general limitation on deriving causal inference from observational data, commentators have highlighted systemic interdependencies and dynamics that complicate and potentially undermine counterfactual reasoning (Jervis 1996), as well as psychological biases that may affect the construction of counterfactuals (Olson et al. 1996).

Mechanisms

Finally, the *mechanism approach* to causation aims at opening the "black box" between cause and effect. The mechanistic perspective seeks to uncover the causal process or the interacting parts of a system that link a cause to an effect. For some, identifying a causal mechanism is considered the "gold standard for establishing and explaining causal connection" (Glennan 2009, 315). How does this differ from other approaches? Among other distinctions, regularity, probability, and counterfactual accounts have difficulties with *causal pre-emption*, which describes a situation where one cause happens just before another cause and thus pre-empts the latter – a situation that is also described as causal *overdetermination* (Mumford and Anjum 2013, 60). A widely used example in the philosophical literature helps to explain the challenge posed by causal pre-emption:

> A man takes a trek across a desert. His enemy puts a hole in his water can. Another enemy, not knowing the action of the first, puts poison in his water. Manipulations have certainly occurred, and the man dies on the trip. The enemy who punctured the water can thinks that she caused the man to die, and the enemy who added the poison thinks that he caused the man to die. In fact, the water dripping out of the can pre-empted the poisoning so that the poisoner is wrong. (Brady 2008, 241-42)

This setting poses a problem for regularity approaches because the constant conjunction between poisoned water and death (and, respectively between lack of water and death) do not help to discriminate between the *real cause* and the *pre-empted cause*. Similarly, probabilities may provide information about the average lethality of poisoned water and a lack of water, but this would not say much about the actual case at hand. The example also challenges counterfactual approaches, because the counterfactual "if the water had not been poisoned, the man would not have died" is *false* (because the man would still have died of thirst), just as the counterfactual "if the water can had not been punctured, the man would not have died" is *also false* (as the man would have died of poisoning). Apparently, because of their focus on the "effects of causes", counterfactuals cannot sufficiently explain why the effect happened (Brady 2008, 242). This is where mechanisms come in. To continue with the example, it would have required a close examination of the case at hand. For instance, an autopsy would have revealed that the water must have run out before a lethal quantity of the poison could have been consumed.[18]

How then are causal mechanisms defined? Matters are complicated by the fact that there is a *plethora* of different understandings of causal mechanisms in the social sciences (Elster 2015; Falleti and Lynch 2009; George and Bennett 2005; Gerring 2010; Goertz 2017; Goertz and Mahoney 2012; Hedström and Swedberg 1998; Machamer et al. 2000). Peter Hedström defines a causal mechanism as "a constellation of entities and activities that are organized such that they regularly bring about a particular type of outcome" (Hedström 2008, 321). A similar definition is offered by Peter Machamer, Lindley Darden, and Carl Craver (2000), who define mechanisms as "entities and activities organized such that they are productive of regular changes from start or set-up to finish or termination conditions" (Machamer et al. 2000, 3). The mention of "regularity" in both definitions may prompt the question whether mechanisms are truly distinct from a Humean regularity account. However, Machamer and colleagues underscore that explanation "is not merely to redescribe one regularity as a series of several", but rather that "explanation involves revealing the *productive* relation" (Machamer et al. 2000, 21-22, original emphasis). These definitions highlight an understanding of causal mechanisms as a *generative process* where several elements interact to bring about an outcome. In that sense, the causal mechanism approach is closely related to *process tracing*, as a within-case method aimed at the identification of a causal link between a condition and an outcome (Beach and Pedersen 2013; 2019; Bennett and Checkel 2015; Blatter and Haverland 2012; Collier 2011; George and Bennett 2005; Rohlfing 2012).

As an aside, we should note that the study of mechanisms has some affinity with the meta-theoretical perspective of *critical realism* (Bhaskar 2008; Kurki 2007), sometimes also referred to as *scientific realism* (Haig 2018; Wight 2007). Yet, philosophical realists hold different conceptions of mechanisms. Milja Kurki (2008, 233) describes mechanisms concisely as "complexes of causes", a definition that is intended to be broad enough to cover multiple interpretations of the concept. Some process tracing methodologists have drawn a connection between their ideas about causal mechanisms and realist conceptions (Bennett 2013; George and Bennett 2005, 136).

While the mechanism approach has some distinct advantages, like other perspectives on causation it is not without limitations. To begin with, there remains "substantial ambiguity" about what constitutes causal mechanisms (Jacobs 2016, 13), and its many different conceptions add to the challenges associated with the mechanism approach (Gerring 2007). Moreover, a fundamental problem of causal mechanisms is that they are "ultimately unobservable" (George and Bennett 2005, 137; Toshkov 2016, 151).

This means that it is up to the researcher to provide a *substantive interpretation* that certain empirical observations can be regarded as evidence of a causal mechanism at work.[19] While this is difficult enough in its own right, the task is complicated when theorizing explanations that entail multiple mechanisms.[20] Relatedly, at times it is not clear how a causal mechanism approach ought to be distinguished from a regularity perspective based on the observance of covariation. In practice, mechanism-based approaches typically introduce additional links in what is conceived as a causal process between a condition and an outcome. Critics might object that this simply means that instead of examining a single covariational relationship several of these are linked together (Gerring 2010, 1516).

Irrespective of these limitations, the analysis of causal mechanisms via process tracing is considered to be one of the most fruitful methods to establish causal claims for individual cases (Bennett and Checkel 2015; Blatter and Haverland 2012; Collier 2011). There is also a natural affinity between QCA and process tracing, because their combination provides a way to integrate cross-case and within-case inferences in multi-method research designs, as mentioned in Chapter 2 (Beach et al. 2019; Beach and Rohlfing 2018; Schneider and Rohlfing 2013).

Causal Complexity

The discussion in the first part of this chapter prompts the question: how does QCA relate to these perspectives on causation? The answer requires a short detour, because we need to take a look into the evolution of the method. When Charles Ragin developed QCA, it was meant to take a *holistic* perspective on cases and to examine "the combinatorial complexities of social causation" (Ragin 1987, 170). This was a conscious departure from so-called "variable-oriented" research that aimed for causal generalization and the identification of causal effects of single variables, without a deeper concern to understand or account for individual cases. QCA was devised to address settings that were characterized by "multiple conjunctural causation", involving various combinations of conditions that bring about an outcome (Ragin 1987, 26). While the term multiple conjunctural causation remained in use (Berg-Schlosser et al. 2009, 8; Ragin 2000, 104), it has over time been replaced by the shorthand *causal complexity* as an umbrella concept that entails the specific methodological assumptions that QCA rests on (Ragin 2000, Ch. 4; 2008, 124; Schneider and Wagemann 2012, 78).[21]

What are the defining features of causal complexity? Ragin offers the following definition:

> *Causal complexity* is defined as a situation in which a given outcome may follow from several different combinations of causal conditions – from different causal "recipes." (Ragin 2008, 124)

Elaborating on this concise description, the concept of causal complexity entails three methodological assumptions that are constitutive for QCA: the first is *conjunctural causation*, which describes a setting where single conditions do not individually suffice to generate the phenomenon of interest but where specific combinations of conditions are *jointly sufficient* for the outcome. This is what John Stuart Mill described in *A System of Logic* (1843) as "chemical combination" and "conjunct action of causes" (Mill 2006, 370-71). As Mill elaborates:

> [M]ost of the uniformities to which the causes conformed when separate, cease altogether when they are conjoined; and we are not, at least in the present state of our knowledge, able to foresee what result will follow from any new combination, until we have tried the specific experiment. (Mill 2006, 371)

What Mill emphasizes here resonates with a holistic perspective that sees *cases as configurations* rather than as collections of individual factors (Ragin 2000; Rihoux and Ragin 2009). The quote also highlights that isolated effects may disappear when combinations are formed. This contrasts with a perspective where the aim rests on identifying the average effects of single variables (Mahoney 2010). When such a "net effect" perspective is adopted, a researcher may overlook patterns of conjunctural causation because no single variable may be able to account for the outcome. This is why QCA entails a systematic study of all logically possible combinations of conditions through the construction of the truth table and its subsequent minimization via Boolean logic (this part will be developed in Chapter 7).

The second methodological assumption entailed in causal complexity is *equifinality*, which relates to a setting where multiple paths comprised of individual conditions or combinations of conditions independently lead towards the same outcome. While equifinality or "multiple causation" is ubiquitous among social and political phenomena, its methodological implications have long been neglected (Anjum and Mumford 2018, 54-56; George and Bennett 2005, 161-62; Ragin 1987, Ch. 2).[22] Importantly, research designs that seek to reduce empirical phenomena to single causes will be weakened by the presence of equifinality in their data. As Alexander George and Andrew Bennett stress, "Equifinality challenges and undermines the common assumption that similar outcomes in several cases must have a common cause that remains to be discovered" (2005, 161).[23]

Instead, the analytical routine of QCA is designed to *reveal* rather than obscure equifinality, which is a fundamental asset of the method. In addition to the identification of alternative paths towards an outcome, QCA also allows researchers to determine the degree of equifinality and the empirical weight of the existing "paths" or "recipes". In some settings there may be several mutually exclusive combinations of conditions leading towards the same outcome, each of them populated by numerous cases. In other situations, there may be a high degree of empirical overlap between different paths (indicating overdetermination), or the majority of cases may belong to just one of the solution paths.

Finally, the third methodological assumption in causal complexity is *causal asymmetry*, which means that a recipe for the outcome can usually not be mirrored symmetrically to explain the non-outcome, but instead requires a separate analysis (Berg-Schlosser et al. 2009, 9; Schneider and Wagemann 2012, 81-83). By contrast, *causal symmetry* is characterized by a "fully reversible causal linkage", as Stanley Lieberson states (1985, 176).[24] Only under such circumstances should the presence or absence of the outcome respond in a symmetric manner to the presence or absence of certain conditions or conjunctions. However, many empirical research settings in the social sciences are rather characterized by causal asymmetry.

What does this mean in practice? The implication is that empirical applications of QCA should entail *separate analyses* for the outcome and the non-outcome. Researchers should be cautious not to leap to inferences about the non-outcome simply from examining the solution for the outcome (and vice versa). This may be tempting, but in most empirical settings the linkage between conditions and outcome will not be symmetric. There are different reasons why that may be the case in "real life" settings, but the most important one is *limited diversity*, which simply means that some logical combinations of conditions are not filled with empirical cases, a point that we will further explore in Chapter 7.

Causal complexity and the meaning of its constituent concepts of conjunctural causation, equifinality, and causal asymmetry should become clearer with an illustration. In the previous chapter, the *truth table* was introduced as a central analytical device in QCA. Building on this, suppose we have a truth table with three conditions A, B, C, an outcome Y, and seven cases, as shown in Table 4.1. At this stage, we do not need to know about the details of the analytical procedure, but simply work with the elements discussed in the previous chapter on set theory.

Table 4.1 Causal Complexity: Truth Table Example

Row	Conditions			Outcome	Number of Cases
	A	B	C	Y	
1	1	1	1	1	1
2	1	1	0	1	1
3	1	0	1	1	1
4	0	1	1	1	1
5	1	0	0	1	1
6	0	0	1	0	1
7	0	0	0	0	1
8	0	1	0	?	–

Now our analysis may reveal that condition A is *individually sufficient*, whereas conditions B and C are *jointly sufficient* for the outcome Y. In formal terms, we write this as:

$$A + (B \cdot C) \rightarrow Y$$

This scenario is shown in panel (a) of Figure 4.1. This means that we have a setting that brings together *equifinality*, since there is more than one path towards the outcome, indicated here by separate arrows directed at the outcome, as well as *conjunctural causation*, because conditions B and C are only sufficient for the outcome Y when both of them occur together, as indicated by their linkage.

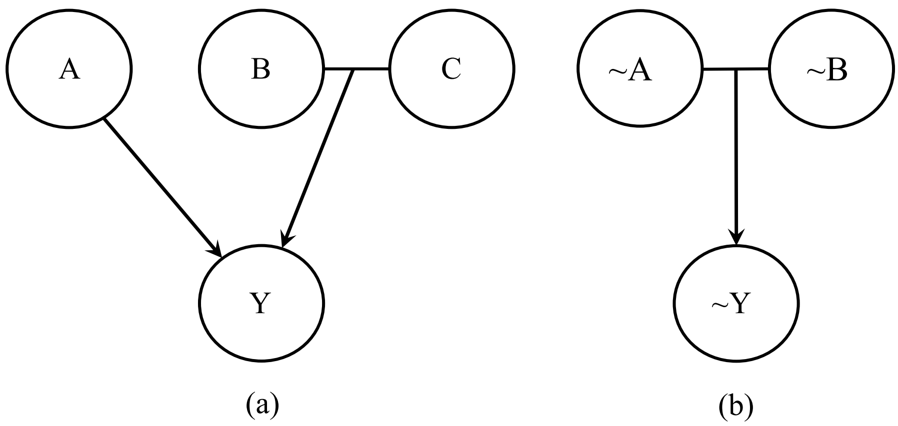
What about causal asymmetry? As we can see from panel (b), in this empirical setting with hypothetical data there is only a single path towards the non-outcome ~Y, which entails the joint absence of A and B, written as such:

$$(\sim A \cdot \sim B) \rightarrow \sim Y$$

This is so because the underlying data for this example entails a single *logical remainder*, as in one logically possible combination without an empirical case. As we can see from Table 4.1, each of the logically possible configurations in the truth table is represented by one respective case, except for the configuration in row 8 (indicated by a question mark in the outcome column). To keep matters simple, the solutions depicted in Figure 4.1 treat the logical remainder as false. By comparison, if we had a fully specified truth table, with row 8 showing the non-outcome, the solution for the outcome would remain the same and the solution for the non-outcome would be as follows:

$$(\sim A \cdot \sim B) + (\sim A \cdot \sim C) \rightarrow \sim Y$$

Figure 4.1 Causal Complexity: Graphical Representation



In formal terms, the conditions B and C are "INUS" conditions, which means that each of them is "an *insufficient* but *necessary* part of a condition, which is itself *unnecessary* but *sufficient* for the result", to use the definition proposed by Mackie (1965, 245). INUS conditions are the nuts and bolts of QCA solutions, as we typically find combinations of two or more conditions that are individually insufficient but jointly sufficient for the outcome.[25] INUS conditions resonate with many theoretical frameworks in the social sciences, where multiple conditions can plausibly be conceived of as elements in combinations that are jointly sufficient for the outcome, but where it is not possible to derive more specific expectations from theory, prior to the empirical analysis (see also Chapter 2).

The logical complement to INUS conditions are "SUIN" conditions. James Mahoney, Erin Kimball, and Kendra Koivu (2009) define these as "a *sufficient* but *unnecessary* part of a factor that is *insufficient* but *necessary* for an outcome" (Mahoney et al. 2009, 126). SUIN conditions can be considered "constitutive attributes" of a necessary condition (ibid.). For example, the analysis may reveal that condition A is necessary for the outcome and there are two conditions F and G, each of which can bring about A. In this scenario, F and G would each be SUIN conditions.[26] SUIN conditions are interesting from a theoretical perspective, and sometimes they are also made part of the analytical routine, but most empirical applications do not explicitly conceptualize them.

Causal Analysis

The previous section introduced the methodological assumption of *causal complexity* that is central to QCA. What we have not discussed yet is how QCA relates to the different theories of causation. As a set-theoretic method, QCA is based on Boolean algebra and the logic of necessary and sufficient conditions (Goertz and Mahoney 2012; Mahoney 2008; Ragin 1987; Schneider and Wagemann 2012). However, while most introductions to set-theoretic and configurational comparative methods employ causal language of one form or another, explicit references to theories of causation are seldom made.

For instance, *Fuzzy-Set Social Science* (Ragin 2000) devotes an insightful chapter to causal complexity but there is no further discussion of theories of causation in the social sciences. Likewise, the edited volume *Configurational Comparative Methods* (Rihoux and Ragin 2009) contains a chapter that spells out key assumptions of QCA (Berg-Schlosser et al. 2009), but these are not placed in the context of broader conceptions about causal relations in the philosophy of social science. Finally, while *Set-Theoretic Methods for the Social Sciences* (Schneider and Wagemann 2012) has become the standard textbook on QCA, it entails no part about how "causal analysis" – as one of the stated aims of QCA – relates to established theories of causation (Ibid., 8; see also Oana et al. 2021). Arguably, these omissions have created some uncertainty about whether causal claims can be made and how these could be justified in QCA applications.

Against this backdrop, recent contributions have initiated a debate about the prerequisites of causal inference with set-theoretic methods, in the context of discussions about the accuracy of QCA solution terms (Baumgartner and Thiem 2020; Duşa 2019; Haesebrouck 2019; Haesebrouck and Thomann forthcoming; Schneider 2018). This section aims to give an overview on these exchanges and to connect them with the broader discussion about theories of causation introduced in the first part of this chapter. This ties in with considerations about QCA solution terms and counterfactual analysis, to be discussed in Chapter 7, and the critical reception of QCA addressed in Chapter 9. Here, rather than following the technical steps and detailed aspects of each individual contribution, emphasis is placed on the contours of the exchanges and their practical implications for applied QCA studies. I should mention at the outset that the current state of the scientific debate does not warrant a conclusive attribution of QCA to one of the existing theories of causation. However, some alternatives have been formulated and we will certainly see future development in this area.

A first challenge to causal analysis with set-theoretic methods arises from the circumstance that set theory, in its origins, is a conceptual language of mathematics (Cunningham 2016; Whitesitt 2010). This suits the purpose of describing relationships between sets, including set membership in complex configurations of conditions, and the notions of necessity and sufficiency, which can be expressed in set-theoretic terms. However, to allow for *causal attribution*, set theory should be embedded in a theory of causation and a theoretical rationale should be provided as to how the cause brought about its effect.

Against this backdrop, it has been suggested that due to the deterministic logic that underpins necessity and sufficiency, namely that a condition is either always present when the outcome is present (necessary condition) or that its presence always implies the simultaneous presence of the outcome (sufficient condition), QCA is "best anchored in a regularity theory of causation", as Ingo Rohlfing and Christina Zuber suggest (2019, 22), and that regularity theory is "the most obvious theory for underpinning QCA", as Tim Haesebrouck holds (2019, 2766). The studies by Rohlfing and Zuber and Haesebrouck both refer to the regularity account developed by Michael Baumgartner (2009; 2015). This resonates with the categorizations by Derek Beach and Rasmus Pedersen (2013, 28), who classify QCA as "regularity-deterministic", and Patrick Jackson (2011, 68-69), who sees the method as rooted in a "covariation definition of causality".

Undeniably, there is an affinity between QCA and regularity theory. To begin with, Ragin (1987, Ch. 3) developed *The Comparative Method* on the basis of Mill's methods of agreement and difference, which also had a lasting influence on research approaches in comparative politics and other areas of the social sciences (Lijphart 1971; Przeworski and Teune 1970). To be sure, Mill's work was firmly rooted in a regularity understanding of causation (Psillos 2009, 139). However, with the inception of his new comparative approach, Ragin (1987, 42) went beyond Mill's scientific methods, arguing that, among other deficiencies, these were "incapable of handling multiple and conjunctural causation". As shown in the previous section, these concepts form the very core of causal complexity, and they are among the key strengths of QCA. Adding to this, Mill's methods cannot accommodate degrees of set membership and empirical data fraught with limited diversity.

Another reason why QCA has been associated with a regularity understanding of causation lies in the frequent references to John Mackie (1965; 1980) and his work on INUS conditions.[27] INUS conditions embody both equifinality and conjunctural causation – as such they can be seen as constitutive of causal complexity. To be sure, Mackie's conception of INUS conditions is a helpful *heuristic* to make sense of causal complexity. Yet, this does not mean that QCA must be based on regularity theory. In fact, the INUS concept has been embraced by critical realists, among others (Kurki 2008, 56-57). In this light, it is revealing what Mackie said about the reception of his theory of causation in the preface to *The Cement of the Universe*:

> My position is in some respects intermediate between those of the best known rival schools of thought about causation – it has, understandably, been attacked both *for being too Humean* and *for not being Humean enough* […] (Mackie 1980, iix, emphasis added)

What this quotation indicates, is that Mackie himself did not regard his theory of causation as a Humean regularity account in an orthodox sense. Indeed, Stathis Psillos (2009) suggests that Mackie "thought there is a lot more to causation than regularity", emphasizing instead, among other differences to the traditional Humean notion of regularity, a conception of "*complex* regularities" (Ibid., 150, original emphasis). Another difference to Hume is that Mackie (1980, Ch. 3) is understood to have given *causal primacy to single cases* whereas Hume deduced causal relationships from regularities observed across cases (Illari and Russo 2014, 44).

That being said, there are at least three additional criteria according to which QCA goes beyond Humean regularity theory. First, the deterministic assumption of "if A then *always* B" has been relaxed since the introduction of fuzzy sets and the calculation of set-theoretic measures of fit that allow for imperfect set relations (Ragin 2000; 2006).[28] This advancement recognized that social science data is inherently noisy and even where a strong set-theoretic relationship is identified, there may be individual cases that do not match the general pattern (Wagemann and Schneider 2010, 389).

Second, limited diversity and the treatment of logical remainders are an integral part of QCA, but this rests on *counterfactual reasoning* (Ragin and Sonnett 2005) – a topic that we will elaborate on in Chapter 7. The scope of limited diversity varies, but nearly all empirical studies have to engage with situations where some configurations of conditions are logically possible and of theoretical interest, but where simply no corresponding empirical cases exist. In such situations, QCA enables researchers to engage in thought experiments in a systematic fashion. Yet, counterfactuals "do not sit easily with a regularity theory", as acknowledged by Rohlfing and Zuber (2019, 32), although they do not engage with the implications that this spells for their own argument about couching QCA in regularity theory.

Finally, causal asymmetry is a core element of QCA that does not square with regularity accounts of causation. According to Rohlfing and Zuber (2019, 14) positive evidence for a causal statement derived from regularity theory would be of the symmetrical kind: A is always followed by B *and* non-A is always followed by non-B. Clearly, this is not what we would expect from a causal complexity perspective where asymmetric explanations are common (Goertz and Mahoney 2012, 66), as illustrated in the example in the previous section.

To be clear, this should not be taken to imply that there are no ties between regularity theory and QCA. Nor should it be denied that the method owes a great deal to the works of Mill and Mackie, among others. But what I hope to have underlined is that the connection to regularity theory and the philosophical lineage are not as clear-cut as portrayed in some recent contributions (Haesebrouck 2019; Rohlfing and Zuber 2019). Just as QCA is neither a purely qualitative nor quantitative approach can it be said that QCA is solely based on a regularity understanding of causation. Unlike regularity theory, QCA acknowledges (1) causal complexity, (2) incorporates counterfactual reasoning, (3) departs from a deterministic understanding of causal relations, and (4) places emphasis on the case-level rather than broad generalizations.

What does this leave us with? Of the four theories of causation that were canvassed in this chapter, QCA shows some correspondence with regularity theory, while also showing affinity towards a counterfactual perspective. The latter will be examined more closely in Chapter 7. Yet, it is important to acknowledge that crucial elements of QCA are difficult to reconcile with a regularity perspective (as outlined above) and that counterfactuals only become relevant in the context of limited empirical diversity. The bottom line is that causal claims should generally be approached with caution when working with observational data. In itself, the identification of a set-theoretic relationship of necessity and/or sufficiency does not warrant a causal claim. What is of crucial importance is the *theoretical foundation* that endows meaning upon the identified set-theoretic relationship. In that light, research design and theory are crucial elements that help to circumscribe the explanatory scope and context of a given study. We will return to these aspects in Chapter 7 and Chapter 9.

Notes

[1] Anjum and Mumford (2018, 253).

[2] The inferential value of "mere description" is underlined forcefully by Gerring (2012).

[3] De Meur et al. (2009, 160-61) discuss causality in the context of what is seen as a "black box" problem, but their text does not provide criteria for the assessment of causal claims. A cautious perspective on "causal inference" with QCA is taken in Kahwati and Kane (2020, 10-12).

[4] With regards to QCA, the critical realist perspective is most clearly expressed in the contributions to the *Handbook of Case-Based Methods* (Byrne and Ragin 2009) where Ragin (2009, 524) acknowledges in the concluding chapter that many of his ideas about case studies resonate with critical realism. Yet, a challenging aspect of critical realism is that conceptions of it vary widely and some of the more demanding ideas expressed appear difficult to put into practice in the context of comparative research designs (Bhaskar 2008; Kurki 2007; Wight 2007).

[5] This is a concise summary of a voluminous literature. The *Handbook of Causation* (Beebee et al. 2009) discusses more than 10 different approaches to causality, Brady (2008) includes manipulation- but not probability-based approaches, and Rohlfing and Zuber (2019) further distinguish between token- and type-level counterfactual approaches. See also Anjum and Mumford (2018), Beach and Pedersen (2013, Ch. 3; 2019, Ch. 1), Goertz and Mahoney (2012, Part I), Illari and Russo (2014), Rohlfing (2012, Ch. 2), and Toshkov (2016, Ch. 6).

[6] Among other overlaps, Hume's regularity definition of causation famously comprises a "counterfactual companion" (Goertz and Mahoney 2012, 75; Pearl 2009, 238), some definitions of causal mechanisms entail reference to regularities or counterfactuals (Brady 2008, 243), and regularity accounts can be reconciled with probabilistic theories of causation (Mumford and Anjum 2013, 49; Psillos 2009, 154).

[7] Notably, in the first edition of *An Enquiry concerning Human Understanding* (1738), Hume further included the criterion of spatial and temporal contiguity between A and B, but this requirement was dropped from the second edition onward (Brady 2008, 226).

[8] Related to this example, compare the general causation approach taken in Pilster et al. (2013) with the case-focused perspective in Massie (2016). A discussion of this literature is given in Mello (2020).

[9] The seemingly simple distinction between singular and general causation has fostered some intricate philosophical problems (Baumgartner 2008; Pearl 2009; Psillos 2009). Methodologists in the social sciences typically take a pragmatic view that emphasizes the need for consistency between the research aims and the inferential strategy adopted within a research project (Beach and Pedersen 2019, 48; Rohlfing and Zuber 2019, 6-8).

[10] In the social sciences, this lineage is also known as "naturalism" (Moses and Knutsen 2019). For a contemporary reassessment of regularity theories from a philosophical perspective, see Baumgartner (2008) and (2013).

[11] Another important distinction, which is left aside here, concerns the question of whether the world itself is governed by stochastic processes or whether probability is the result of researchers' inconclusive evidence (Anjum and Mumford 2018, 157).

[12] It might be premature to infer causality on this basis, since the data may be characterized by Simpson's Paradox, which applies to data where a statistical association for the entire population is *inverted* at the sub-population level, for instance when a group of people is subdivided by gender or age cohort (Pearl et al. 2016, 1-6). This problem can be addressed by specifying that A causes B when A increases the probability of B "in every situation which is *otherwise causally homogenous*" in regard to B (Cartwright 1979, 423, emphasis added).

[13] Probability is also at the heart of Bayesian reasoning, which rests on the principle that beliefs about the probability that a theory is true should be updated when new evidence becomes available. In that sense, Bayesianism acknowledges that all scientific theories remain fraught with uncertainty (Anjum and Mumford 2018, 158-60; Bennett 2008).

[14] For an elaboration on this point and arguments in favor of a set-theoretic perspective, see Mello (2014, 46-50).

[15] In his critique of mainstream quantitative democratic peace research, Rosato (2003; 2005) points out a mismatch between theoretical claims, methods used, and empirical findings. The probabilistic view on the democratic peace is articulated in Slantchev et al. (2005). More generally on determinism, see Mahoney (2003), Goertz (2005), Adcock (2007), and Beach and Pedersen (2019, Ch. 1).

[16] For instance, in his essay "Objectivity in Social Science and Social Policy", Weber ponders the question what would have been if Bismarck had not decided for war in 1866: "[…] was hätte werden können, wenn z.B. Bismarck den Entschluß zum Kriege nicht gefunden hätte" (Weber 1922, 266).

[17] In addition to case-based analyses (Fearon 1991; Lebow 2000; Levy 2008; Tetlock and Belkin 1996), there is work on necessary condition counterfactuals (Goertz and Levy 2007; Goertz and Starr 2003), and counterfactuals in the context of set-theoretic comparative approaches (Ragin and Sonnett 2005; Rohlfing and Schneider 2018).

[18] For a more detailed narration of this example, see Brady (2008, 241-43).

[19] A critique is given in Lieshout (2007).

[20] For a discussion of several examples of mechanistic explanations, see Blatter and Haverland (2012, 123-34) and Rohlfing (2012, 33-40).

[21] To be sure, the term *causal complexity* already appears in Ragin (1987, Ch. 2) and has since been in continuous use (see, among others, Berg-Schlosser et al. 2009; George and Bennett 2005; Gerrits and Pagliarin 2020; Koivu and Kimball Damman 2015; Mahoney 2008; Ragin 2000; Schneider and Wagemann 2012). For a discussion of multiple causality and causal complexity in the philosophy of science, see Anjum and Mumford (2018, 54-56).

[22] See also Guzzini (2017) for an interpretivist perspective on equifinality and causal relations.

[23] For a different perspective on equifinality see King et al. (1994, 87-98).

[24] On the temporal aspect of causal asymmetry, see Psillos (2009, 153). Asymmetric hypotheses are assessed in Rosenberg et al. (2017).

[25] On INUS conditions and the "multiplicity of causal pathways", see also (Brady 2008, 228).

[26] Mahoney et al. (2009, 126) use an example from democratic peace research, according to which non-democracy (as in a pair of countries that includes at least one non-democracy) is a necessary condition for inter-state war. Now, several attributes of political regimes are in themselves sufficient for non-democracy (e.g. uncompetitive elections, no adherence to human rights, etc.), which means that each of these can be conceived of as SUIN conditions.

[27] Explicit references to Mackie and INUS conditions in this context can be found, among others, in Ragin (2000, 11), Goertz and Mahoney (2012, 24), Rohlfing (2012, 57), and Schneider and Wagemann (2012, 79). The INUS concept is also widely used by QCA practitioners (e.g. Basedau and Richter 2014; Ide 2015; Kim and Verweij 2016; Kirchherr et al. 2016; Mello 2014; Mross 2019; Oppermann and Brummer 2020; Pagliarin et al. 2019; Vis 2011; Wurster and Hagemann 2018).

[28] Adding nuance to a discussion that is often cast in binary terms, Paul and Hall (2013, 15) note that even under determinism "the causes of some event do not guarantee that nothing occurs that could prevent those causes from bringing about that event".

References

Adcock, Robert. 2007. "Who's Afraid of Determinism? The Ambivalence of Macro-Historical Inquiry." *Journal of Philosophy of History* 1 (3): 346-64.

Anjum, Rani Lill, and Stephen Mumford. 2018. *Causation in Science*. New York: Oxford University Press.

Basedau, Mattthias, and Thomas Richter. 2014. "Why Do Some Oil Exporters Experience Civil War But Others Do Not? Investigating the Conditional Effects of Oil." *European Political Science Review* 6 (4): 549-74.

Baumgartner, Michael. 2008. "Regularity Theories Reassessed." *Philosophia* 36: 327-54.

———. 2009. "Inferring Causal Complexity." *Sociological Methods & Research* 38 (1): 71–101.

———. 2013. "A Regularity Theoretic Approach to Actual Causation." *Erkenntnis* 78: 85-109.

———. 2015. "Parsimony and Causality." *Quality & Quantity* 49 (2): 839-56.

Baumgartner, Michael, and Alrik Thiem. 2020. "Often Trusted but Never (Properly) Tested: Evaluating Qualitative Comparative Analysis." *Sociological Methods & Research* 49 (2): 279-311.

Beach, Derek, and Rasmus Brun Pedersen. 2013. *Process-Tracing Methods: Foundations and Guidelines*. 1st ed. Ann Arbor, MI: University of Michigan Press.

———. 2016. *Causal Case Study Methods: Foundations and Guidelines for Comparing, Matching, and Tracing*. Ann Arbor: University of Michigan Press.

———. 2019. *Process-Tracing Methods: Foundations and Guidelines*. 2nd ed. Ann Arbor, MI: University of Michigan Press.

Beach, Derek, Rasmus Brun Pedersen, and Markus B. Siewert. 2019. "Case Selection and Nesting of Process-Tracing Case Studies." In *Process-Tracing Methods: Foundations and Guidelines*, edited by Beach, Derek and Rasmus Brun Pedersen. Ann Arbor, MI: University of Michigan Press, 89-154.

Beach, Derek, and Ingo Rohlfing. 2018. "Integrating Cross-case Analyses and Process Tracing in Set-Theoretic Research: Strategies and Parameters of Debate." *Sociological Methods & Research* 47 (1): 3-36.

Beebee, Helen, Christopher Hitchcock, and Peter Menzies, ed. 2009. *The Oxford Handbook of Causation.* Oxford: Oxford University Press.

Bennett, Andrew. 2008. "Process Tracing: A Bayesian Perspective." In *The Oxford Handbook of Political Methodology*, edited by Box-Steffensmeier, Janet M., Henry E. Brady and David Collier. Oxford: Oxford University Press, 702–21.

———. 2013. "The Mother of All Isms: Causal Mechanisms and Structured Pluralism in International Relations Theory." *European Journal of International Relations* 19 (3): 459-81.

Bennett, Andrew, and Jeffrey T. Checkel, ed. 2015. *Process Tracing: From Metaphor to Analytic Tool.* Cambridge: Cambridge University Press.

Berg-Schlosser, Dirk, Gisèle De Meur, Benoît Rihoux, and Charles C. Ragin. 2009. "Qualitative Comparative Analysis (QCA) as an Approach." In *Configurational Comparative Methods*, edited by Rihoux, Benoît and Charles C. Ragin. Thousand Oaks: Sage, 1–18.

Bevir, Mark, and Jason Blakely. 2018. *Interpretive Social Science: An Anti-Naturalist Approach*. Oxford: Oxford University Press.

Bhaskar, Roy. 2008. *A Realist Theory of Science*. 3rd. London: Verso.

Blatter, Joachim, and Markus Haverland. 2012. *Designing Case Studies: Explanatory Approaches in Small-N Research*. Basingstoke: Palgrave Macmillan.

Brady, Henry E. 2008. "Causation and Explanation in Social Science." In *The Oxford Handbook of Political Methodology*, edited by Box-Steffensmeier, Janet M., Henry E. Brady and David Collier. Oxford: Oxford University Press, 217–70.

Brown, Michael E., Steven E. Miller, and Sean M. Lynn-Jones, ed. 1996. *Debating the Democratic Peace.* Cambridge, Mass: MIT Press.

Byrne, David. 2009. "Complex Realist and Configurational Approaches to Cases: A Radical Synthesis." In *The Sage Handbook of Case-Based Methods*, edited by Byrne, David and Charles C. Ragin. Los Angeles: Sage, 101-11.

Byrne, David, and Charles C. Ragin, ed. 2009. *The Sage Handbook of Case-Based Methods.* Los Angeles: Sage.

Cartwright, Nancy. 1979. "Causal Effects and Effective Strategies." *Noûs* 13 (4): 419-37.

Collier, David. 2011. "Understanding Process Tracing." *Political Science & Politics* 44 (4): 823-30.

Collier, David, Henry E. Brady, and Jason Seawright. 2010. "Sources of Leverage in Causal Inference: Toward an Alternative View of Methodology." In *Rethinking Social Inquiry*, edited by Brady, Henry E. and David Collier. Lanham: Rowman & Littlefield, 161–99.

Cunningham, Daniel W. 2016. *Set Theory: A First Course*. New York: Cambridge University Press.

De Meur, Gisèle, Benoît Rihoux, and Sakura Yamasaki. 2009. "Addressing the Critiques of QCA." In *Configurational Comparative Methods*, edited by Rihoux, Benoît and Charles C. Ragin. Thousand Oaks: Sage, 147–65.

Duşa, Adrian. 2019. "Critical Tension: Sufficiency and Parsimony in QCA." *Sociological Methods & Research* (DOI: 10.1177/0049124119882456): 1-25.

Elster, John. 2015. *Explaining Social Behavior: More Nuts and Bolts for the Social Sciences*. New York, NY: Cambridge University Press.

Falleti, Tulia G., and Julia F. Lynch. 2009. "Context and Causal Mechanisms in Political Analysis." *Comparative Political Studies* 42 (9): 1143–66.

Fearon, James D. 1991. "Counterfactuals and Hypothesis Testing in Political Science." *World Politics* 43 (2): 169–95.

George, Alexander L., and Andrew Bennett. 2005. *Case Studies and Theory Development in the Social Sciences*. Cambridge: MIT Press.

Gerring, John. 2005. "Causation: A Unified Framework for the Social Sciences." *Journal of Theoretical Politics* 17 (2): 163–98.

———. 2007. "Review Article: The Mechanismic Worldview: Thinking Inside the Box." *British Journal of Political Science* 37: 1–19.

———. 2010. "Causal Mechanisms: Yes, But …" *Comparative Political Studies* 43 (11): 1499-526.

———. 2012. "Mere Description." *British Journal of Political Science* 42: 721-46.

Gerrits, Lasse, and Sofia Pagliarin. 2020. "Social and Causal Complexity in Qualitative Comparative Analysis (QCA): Strategies to Account for Emergence." *International Journal of Social Research Methodology* doi: 10.1080/13645579.2020.1799636: 1-13.

Gerrits, Lasse, and Stefan Verweij. 2014. "Critical Realism as a Meta-Framework for Understanding the Relationships between Complexity and Qualitative Comparative Analysis." *Journal of Critical Realism* 12 (2): 166-82.

Glennan, Stuart. 2009. "Mechanisms." In *The Oxford Handbook of Causation*, edited by Beebee, Helen, Christopher Hitchcock and Peter Menzies. Oxford: Oxford University Press, 315-25.

Goertz, Gary. 2005. "Necessary Condition Hypotheses as Deterministic or Probabilistic: Does it Matter?" *Qualitative Methods* 3 (1): 22–26.

———. 2017. *Multimethod Research, Causal Mechanisms, and Case Studies*. Princeton, NJ: Princeton University Press.

Goertz, Gary, and Jack S. Levy, ed. 2007. *Explaining War and Peace: Case Studies and Necessary Condition Counterfactuals.* Abingdon: Routledge.

Goertz, Gary, and James Mahoney. 2012. *A Tale of Two Cultures: Qualitative and Quantitative Research in the Social Sciences*. Princeton, NJ: Princeton University Press.

Goertz, Gary, and Harvey Starr, ed. 2003. *Necessary Conditions: Theory, Methodology, and Applications.* Lanham: Rowman & Littlefield.

Guzzini, Stefano. 2017. "Power and Cause." *Journal of International Relations and Development* 20 (4): 737-59.

Haesebrouck, Tim. 2019. "An Alternative Update of the Two-Step QCA Procedure." *Quality & Quantity* 53 (6): 2765-80.

Haesebrouck, Tim, and Eva Thomann. forthcoming. "Introduction: Causation, Correctness, and Solution Types in Configurational Comparative Methods." *Quality & Quantity*.

Haig, Brian D. 2018. *The Philosophy of Quantitative Methods*. New York: Oxford University Press.

Harvey, David L. 2009. "Complexity and Case." In *The Sage Handbook of Case-Based Methods*, edited by Byrne, David and Charles C. Ragin. Los Angeles: Sage, 15-38.

Harvey, Frank P. 2012. *Explaining the Iraq War: Counterfactual Theory, Logic, and Evidence*. New York: Cambridge University Press.

Hedström, Peter. 2008. "Studying Mechanisms to Strengthen Causal Inference in Quantitative Research." In *The Oxford Handbook of Political Methodology*, edited by Box-Steffensmeier, Janet M., Henry E. Brady and David Collier. Oxford: Oxford University Press, 319–35.

Hedström, Peter, and Richard Swedberg, ed. 1998. *Social Mechanisms: An Analytical Approach to Social Theory.* Cambridge: Cambridge University Press.

Hempel, Carl G., and Paul Oppenheim. 1948. "Studies in the Logic of Explanation." *Philosophy of Science* 15 (2): 135-75.

Holland, Paul W. 1986. "Statistics and Causal Inference." *Journal of the American Statistical Association* 81 (396): 945-60.

Hume, David. 2010 [1772]. *An Enquiry concerning Human Understanding*. Oxford: Oxford University Press.

Ide, Tobias. 2015. "Why Do Conflicts over Scarce Renewable Resources Turn Violent? A Qualitative Comparative Analysis." *Global Environmental Change* 33: 61-70.

Illari, Phyllis, and Federica Russo. 2014. *Causality: Philosophical Theory Meets Scientific Practice*. Oxford: Oxford University Press.

Imai, Kosuke. 2017. *Quantitative Social Science: An Introduction*. Princeton, NJ: Princeton University Press.

Jackson, Patrick Thaddeus. 2011. *The Conduct of Inquiry in International Relations: Philosophy of Science and Its Implications for the Study of World Politics*. London: Routledge.

Jackson, Patrick Thaddeus, and Daniel H. Nexon. 2013. "International Theory in a Post-Paradigmatic Era: From Substantive Wagers to Scientific Ontologies." *European Journal of International Relations* 19 (3): 543-65.

Jacobs, Alan M. 2016. "Introduction: Mechanisms and Process Tracing." *Qualitative & Multi-Method Research* 14 (1/2): 13-15.

Jervis, Robert. 1996. "Counterfactuals, Causation, and Complexity." In *Counterfactual Thought Experiments in World Politics: Logical, Methodological, and Psychological Perspectives*, edited by Tetlock, Philip E. and Aaron Belkin. Princeton, NJ: Princeton University Press, 309-16.

Kahwati, Leila C., and Heather L. Kane. 2020. *Qualitative Comparative Analysis in Mixed Methods Research and Evaluation*. Los Angeles Sage.

Kim, Yushim, and Stefan Verweij. 2016. "Two Effective Causal Paths that Explain the Adoption of US State Environmental Justice Policy." *Policy Sciences* 49: 505-23.

King, Gary, Robert O. Keohane, and Sidney Verba. 1994. *Designing Social Inquiry: Scientific Inference in Qualitative Research*. Princeton: Princeton University Press.

Kirchherr, Julian, Katrina J. Charles, and Matthew J. Walton. 2016. "Multi-causal Pathways of Public Opposition to Dam Projects in Asia: A Fuzzy Set Qualitative Comparative Analysis (fsQCA)." *Global Environmental Change* 41: 33-45.

Koivu, Kendra L., and Erin Kimball Damman. 2015. "Qualitative Variations: The Sources of Divergent Qualitative Methodological Approaches." *Quality & Quantity* 49: 2617-32.

Kurki, Milja. 2007. "Critical Realism and Causal Analysis in International Relations." *Millennium - Journal of International Studies* 35 (2): 361-78.

———. 2008. *Causation in International Relations: Reclaiming Causal Analysis*. Cambridge: Cambridge University Press.

Lebow, Richard Ned. 2000. "What's So Different About A Counterfactual?" *World Politics* 52 (4): 550-85.

———. 2014. *Constructing Cause in International Relations*. New York: Cambridge University Press.

Levy, Jack S. 2008. "Counterfactuals and Case Studies." In *The Oxford Handbook of Political Methodology*, edited by Box-Steffensmeier, Janet M., Henry E. Brady and David Collier. Oxford: Oxford University Press, 627-44.

Lewis, David. 1973. *Counterfactuals*. Cambridge, MA: Harvard University Press.

Lieberson, Stanley. 1985. *Making It Count: The Improvement of Social Research and Theory*. Berkeley: University of California Press.

Lieshout, Robert H. 2007. “A Note on Causality and Causal Mechanisms.” *Qualitative & Multi-Method Research* 5 (2): 18-21.

Lijphart, Arend. 1971. “Comparative Politics and the Comparative Method.” *American Political Science Review* 65 (3): 682-93.

Machamer, Peter, Lindley Darden, and Carl F. Craver. 2000. “Thinking About Mechanisms.” *Philosophy of Science* 67: 1-25.

Mackie, John L. 1965. “Causes and Conditions.” *American Philosophical Quarterly* 2 (4): 245–64.

———. 1980. *The Cement of the Universe: A Study of Causation*. New York: Oxford University Press.

Mahoney, James. 2003. “Strategies of Causal Assessment in Comparative Historical Analysis.” In *Comparative Historical Analysis in the Social Sciences*, edited by Mahoney, James and Dietrich Rueschemeyer. New York: Cambridge University Press, 337-72.

———. 2008. “Toward a Unified Theory of Causality.” *Comparative Political Studies* 41 (4/5): 412–36.

———. 2010. “After KKV: The New Methodology of Qualitative Research.” *World Politics* 62 (1): 120–47.

Mahoney, James, Erin Kimball, and Kendra L. Koivu. 2009. “The Logic of Historical Explanation in the Social Sciences.” *Comparative Political Studies* 42 (1): 114-46.

Massie, Justin. 2016. “Why Democratic Allies Defect Prematurely: Canadian and Dutch Unilateral Pullouts from the War in Afghanistan.” *Democracy and Security* 12 (2): 85-113.

Mello, Patrick A. 2014. *Democratic Participation in Armed Conflict: Military Involvement in Kosovo, Afghanistan, and Iraq*. Basingstoke: Palgrave Macmillan.

———. 2020. “Paths towards Coalition Defection: Democracies and Withdrawal from the Iraq War.” *European Journal of International Security* 5 (1): 45-76.

Mill, John Stuart. 2006. “Collected Works of John Stuart Mill: Volume VII.” Indianapolis: Liberty Fund.

Moore, Will H., and David A. Siegel. 2013. *A Mathematics Course for Political and Social Research*. Princeton: Princeton University Press.

Morgan, Stephen L., and Christopher Winship. 2007. *Counterfactuals and Causal Inference: Methods and Principles for Social Research*. New York: Cambridge University Press.

Moses, Jonathon W., and Torbjørn L. Knutsen. 2019. *Ways of Knowing: Competing Methodologies in Social and Political Research*. 3. Basingstoke: Red Globe Press.

Mross, Karina. 2019. *Democracy Support and Peaceful Democratization after Civil War: A Disaggregate Analysis*. Ph.D. thesis. University of St. Gallen.

Mumford, Stephen, and Rani Lill Anjum. 2013. *Causation: A Very Short Introduction*. New York: Oxford University Press.

Oana, Ioana-Elena, Carsten Q. Schneider, and Eva Thomann. 2021. *Qualitative Comparative Analysis Using R: A Beginner's Guide*. New York: Cambridge University Press.

Olsen, Wendy. 2014. "The Usefulness of QCA under Realist Assumptions." *Sociological Methodology* 44 (1): 101-07.

———, ed. 2010. *Realist Methodology.* Los Angeles: Sage.

Olson, James M., Neal J. Roese, and Ronald J. Deibert. 1996. "Psychological Biases in Counterfactual Thought Experiments." In *Counterfactual Thought Experiments in World Politics: Logical, Methodological, and Psychological Perspectives*, edited by Tetlock, Philip E. and Aaron Belkin. Princeton, NJ: Princeton University Press, 296-300.

Oppermann, Kai, and Klaus Brummer. 2020. "Who Gets What in Foreign Affairs? Explaining the Allocation of Foreign Ministries in Coalition Governments." *Government and Opposition* 55 (2): 241-59.

Pagliarin, Sofia, Anna M. Hersperger, and Benoît Rihoux. 2019. "Implementation Pathways of Large-Scale Urban Development Projects (lsUDPs) in Western Europe: A Qualitative Comparative Analysis (QCA)." *European Planning Studies* (DOI: 10.1080/09654313.2019.1681942): 1-22.

Paul, L. A. 2009. "Counterfactual Theories." In *The Oxford Handbook of Causation*, edited by Beebee, Helen, Christopher Hitchcock and Peter Menzies. Oxford: Oxford University Press, 158-84.

Paul, L. A., and Ned Hall. 2013. *Causation: A User's Guide*. New York: Oxford University Press.

Pearl, Judea. 2009. *Causality: Models, Reasoning, and Inference*. 2nd. New York: Cambridge University Press.

Pearl, Judea, Madelyn Glymour, and Nicholas P. Jewell. 2016. *Causal Inference in Statistics: A Primer*. Chichester: Wiley.

Pearl, Judea, and Dana Mackenzie. 2018. *The Book of Why: The New Science of Cause and Effect*. New York: Basic Books.

Peters, B. Guy. 2020. "Can We Be Casual about Being Causal?" *Journal of Comparative Policy Analysis: Research and Practice* 10.1080/13876988.2020.1793327: 1-13.

Pilster, Ulrich, Tobias Böhmelt, and Atsushi Tago. 2013. "Political Leadership Changes and the Withdrawal from Military Coalition Operations, 1946-2001." *International Studies Perspectives* 16 (4): 463-83.

Przeworski, Adam, and Henry Teune. 1970. *The Logic of Comparative Social Inquiry*. New York: Wiley-Interscience.

Psillos, Stathis. 2009. "Regularity Theories." In *The Oxford Handbook of Causation*, edited by Beebee, Helen, Christopher Hitchcock and Peter Menzies. Oxford: Oxford University Press, 131-57.

Ragin, Charles C. 1987. *The Comparative Method: Moving Beyond Qualitative and Quantitative Strategies*. Berkeley, CA: University of California Press.

———. 2000. *Fuzzy-Set Social Science*. Chicago, IL: University of Chicago Press.

———. 2006. "Set Relations in Social Research: Evaluating Their Consistency and Coverage." *Political Analysis* 14 (3): 291–310.

———. 2008. *Redesigning Social Inquiry: Fuzzy Sets and Beyond*. Chicago, IL: University of Chicago Press.

———. 2009. "Reflections on Casing and Case-Oriented Research." In *The Sage Handbook of Case-Based Methods*, edited by Byrne, David and Charles C. Ragin. Los Angeles: Sage, 522-34.

Ragin, Charles C., and John Sonnett. 2005. "Between Complexity and Parsimony: Limited Diversity, Counterfactual Cases, and Comparative Analysis." In *Vergleichen in der Politikwissenschaft*, edited by Kropp, Sabine and Michael Minkenberg. Wiesbaden: Verlag für Sozialwissenschaften, 180–97.

Ray, James Lee. 2000. "Democracy: On the Level(s), Does Democracy Correlate with Peace?" In *What Do We Know about War?*, edited by Vasquez, John A. Lanham, MD: Rowman & Littlefield, 299–316.

Rihoux, Benoît, and Charles C. Ragin, ed. 2009. *Configurational Comparative Methods: Qualitative Comparative Analysis (QCA) and Related Techniques.* Thousand Oaks, CA: Sage.

Rohlfing, Ingo. 2012. *Case Studies and Causal Inference: An Integrative Framework*. Basingstoke: Palgrave Macmillan.

Rohlfing, Ingo, and Carsten Q. Schneider. 2018. "A Unifying Framework for Causal Analysis in Set-Theoretic Multimethod Research." *Sociological Methods & Research* 47 (1): 37-63.

Rohlfing, Ingo, and Christina Isabel Zuber. 2019. "Check Your Truth Conditions! Clarifying the Relationship between Theories of Causation and Social Science Methods for Causal Inference." *Sociological Methods & Research* (DOI: 10.1177%2F0049124119826156): 1-37.

Rosato, Sebastian. 2003. "The Flawed Logic of Democratic Peace Theory." *American Political Science Review* 97 (4): 585–602.

———. 2005. "Explaining the Democratic Peace." *American Political Science Review* 99 (3): 467–72.

Rosenberg, Andrew S., Austin J. Knuppe, and Bear F. Braumoeller. 2017. "Unifying the Study of Asymmetric Hypotheses." *Political Analysis* 25 (3): 381-401.

Russett, Bruce, and John R. Oneal. 2001. *Triangulating Peace: Democracy, Interdependence, and International Organizations*. New York: Norton.

Rutten, Roel. 2019. *Critical Realism and Complex Causality: On the Assumptions You Buy In To When You Are Making Causal Claims*. Oisterwijk: Wolf Publishers.

———. 2020. "Applying and Assessing Large-N QCA: Causality and Robustness from a Critical-Realist Perspective." *Sociological Methods & Research* (forthcoming): 1-21.

Schneider, Carsten Q. 2018. "Realists and Idealists in QCA." *Political Analysis*: 1-9.

Schneider, Carsten Q., and Ingo Rohlfing. 2013. "Combining QCA and Process Tracing in Set-Theoretic Multi-Method Research." *Sociological Methods & Research* 42 (4): 559-97.

Schneider, Carsten Q., and Claudius Wagemann. 2012. *Set-Theoretic Methods for the Social Sciences: A Guide to Qualitative Comparative Analysis*. New York, NY: Cambridge University Press.

Sekhon, Jasjeet S. 2008. "The Neyman-Rubin Model of Causal Inference and Estimation via Matching Methods." In *The Oxford Handbook of Political Methodology*, edited by Box-Steffensmeier, Janet M., Henry E. Brady and David Collier. Oxford: Oxford University Press, 271–99.

Selvin, Steve. 2019. *The Joy of Statistics: A Treasury of Elementary Statistical Tools and their Application*. New York: Oxford University Press.

Sil, Rudra, and Peter J. Katzenstein. 2010. *Beyond Paradigms: Analytic Eclecticism in the Study of World Politics*. Basingstoke: Palgrave Macmillan.

Slantchev, Branislav L., Anna Alexandrova, and Erik Gartzke. 2005. "Probabilistic Causality, Selection Bias, and the Logic of the Democratic Peace." *American Political Science Review* 99 (3): 459–62.

Stevens, Alex. 2020. "Critical Realism and the 'Ontological Politics of Drug Policy'." *International Journal of Drug Policy* forthcoming: 1-24.

Tetlock, Philip E., and Aaron Belkin, ed. 1996. *Counterfactual Thought Experiments in World Politics: Logical, Methodological, and Psychological Perspectives.* Princeton, NJ: Princeton University Press.

Thomann, Eva, and Martino Maggetti. 2020. "Designing Research With Qualitative Comparative Analysis (QCA): Approaches, Challenges, and Tools." *Sociological Methods & Research* 49 (2): 356-86.

Toshkov, Dimiter. 2016. *Research Design in Political Science*. Basingstoke: Palgrave Macmillan.

Vis, Barbara. 2011. "Under Which Conditions Does Spending on Active Labor Market Policies Increase? An fsQCA Analysis of 53 Governments between 1985 and 2003." *European Political Science Review* 3 (2): 229–52.

Wagemann, Claudius, and Carsten Q. Schneider. 2010. "Qualitative Comparative Analysis (QCA) and Fuzzy-Sets: Agenda for a Research Approach and a Data Analysis Technique." *Comparative Sociology* 9 (3): 397–418.

Weber, Max. 1922. *Gesammelte Aufsätze zur Wissenschaftslehre*. Tübingen: Mohr.

Whitesitt, J. Eldon. 2010. *Boolean Algebra and its Applications*. Mineola, NY: Dover.

Wight, Colin. 2007. "A Manifesto for Scientific Realism in IR: Assuming the Can-Opener Won't Work!" *Millennium – Journal of International Studies* 35 (2): 379-98.

Williamson, Jon. 2009. "Probabilistic Theories." In *The Oxford Handbook of Causation*, edited by Beebee, Helen, Christopher Hitchcock and Peter Menzies. Oxford: Oxford University Press, 185-212.

Woodward, James L. 2009. "Agency and Interventionist Theories." In *The Oxford Handbook of Causation*, edited by Beebee, Helen, Christopher Hitchcock and Peter Menzies. Oxford: Oxford University Press, 234-62.

Wurster, Stefan, and Christian Hagemann. 2018. "Two Ways to Success: Expansion of Renewable Energies in Comparison Between Germany's Federal States." *Energy Policy* 119: 610-19.