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A VOCABULARY FOR QCA

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A good method needs a good vocabulary. A good vocabulary has precise words and phrases that express what the method does and allows researchers to clearly articulate their findings in a way that is consistent with that method. Although QCA is a set-theoretic method with a well-developed vocabulary, its users often borrow from the vocabulary of statistical methods, i.e., use correlational or variable-based language. This problem is not limited to newcomers to the method. Ragin's own software (fs/QCA) (Ragin and Davey 2017) uses the term 'variable' rather than 'condition.' Likewise, the important handbook by Schneider and Wagemann (2012) speaks of testing for necessity rather than performing an analysis of necessity. And the authors of this piece will readily admit that we have too often been sloppy with our own nomenclature.

But wording does matter, as Ragin has emphasized since originally publishing *The Comparative Method* (2014 [1987]). Because QCA is not a correlational method, using correlational language can confuse both researchers performing QCA and those reading their work. Because correlational methods heavily dominate the social sciences, it is understandable why QCA researchers so often reach for correlational language. But correlational methods make many very strong assumptions about the nature of social reality that case-based methods such as QCA do not share. First, correlational methods disassemble social reality into atomistic variables on the assumption that causal relationships exist independent of context. Instead, case-based methods consider social reality to be fundamentally contingent. Consequently, case-based methods have cases, i.e., holistic social entities, as their unit of analysis. Second, correlational methods consider independent variables, i.e., single factor causes, and aim to analytically isolate the contribution of each factor to the outcome. This is the so-called net-effects approach. Case-based methods instead understand causality as configurational. Individual factors (conditions) are not causes; they are insufficient but necessary parts of configurations explaining the outcome. This is why QCA uses Boolean algebra, which allows for the identification of configurations, rather than linear algebra, which allows for isolation of net effects. Third, correlational methods are effects-of-causes methods which seek to understand the effect that independent variables have on an outcome. Case-based methods are instead causes-of-effects methods that begin by identifying an outcome of interest and then seek to uncover its causes. Finally, because correlational methods perform a decontextualized empirical analysis, the robustness of empirical patterns is critically important. Instead, case-based methods draw on in-depth knowledge of cases and context. The plausibility of an explanation is more important than the robustness of the empirical pattern from which it is developed. Ragin (2008, 2014 [1987]) has repeatedly argued that QCA's Boolean expressions merely describe social reality and are not themselves causal statements. Instead, QCA results must be interpreted as causal statements based on dialoguing between empirical, contextual and conceptual knowledge. See Ragin (2014 [1987]), Goertz and Mahoney (2012b) and Mahoney and Goertz (2006) for a full discussion of correlational (variable-based) versus case-based methods.

QCA confronts many of the same methodological challenges as correlational methods, such as guarding against spurious results and how to generalize findings. However, the practices that QCA uses to solve these problems are often very different from those of correlational methods. Therefore, using a correlational vocabulary to refer to these practices in QCA is at a minimum inaccurate and often misleading.

Drawing upon both the extant literature and established conventions, this note provides a reference vocabulary for QCA. It consistently uses set-theoretical language in order to clarify and emphasize QCA's distinctive features. Structured around ten basic methodological tenets, our hope is to delineate the common QCA lexicon for both new and experienced users of QCA. A summary table at the end of the note highlights the most significant differences between the languages of QCA and correlational (statistical, variable-based) methods.

1. Solution versus model

The outcome of the truth table minimization is alternatively referred to as the model or the solution. However, solution is the preferred terminology because "model" has a very strong connotation in correlational methods. Etymologically, there is nothing wrong with the word model in QCA because the solution is exactly that; a stylized account of social reality. Any model (or solution) is always partial and perspectival. Moreover, the word "solution" has a ring of finality that it neither intends nor delivers. Yet, QCA's Boolean-algebraic solution is something very different than a statistical model. Most obviously, statistical models are additive, unifinal and symmetrical whereas QCA's solutions are configurational, equifinal and asymmetrical. Correlational (statistical) studies produce one model but QCA produces multiple solutions – most obviously the complex, intermediate and parsimonious solutions. Each solution consists of multiple configurations that explain the outcome for a different reason. Moreover, QCA produces a different solution for the absence of the outcome. Because of the obvious differences between the outputs of correlational methods versus QCA, it stands to reason to give these outputs different labels to avoid confusion.

In sum, given the strong correlational connotations of "model" and given that QCA's output looks very different than the output of a correlational study, "solution" is a much more obvious word to describe the outcomes of the truth table minimization. Moreover, this word is native to QCA. The findings of a QCA study are identified as the solution, which in turn contains multiple configurations.

2. Condition versus variable

In case-based methods, conditions, and not variables, describe cases – for the obvious reason that cases do not vary. A variable describes the distribution of a characteristic in a population. In doing so, it abstracts from cases. Variables describe variation on the level of a population and this allows to calculate correlations (co-variation) between variables. Instead, cases either have a characteristic (fully or in degree) or they do not. Moreover, conditions account for context – they are characteristics of cases. "Variable" belongs to the vocabulary of correlational methods while "condition" belongs to the vocabulary of QCA and other case-based methods.

Nor is there something like an independent or dependent variable in case-based methods. Cases are holistic, they come as packages (Ragin 2000: 70). Packages that include the outcome also. Sufficiency and necessity imply that an outcome co-occurs with a condition (necessity) or configuration (sufficiency). It is not a correlational argument where variation in X "predicts" variation in Y, where an independent variable "does something" to the dependent variable, independently of the role of other variables. Since cases are packages, this kind of independence does not exist in case-based methods like QCA. QCA does not disassemble social reality into decontextualized variables.

This raises another issue. In as far as "causal condition" is a set-theoretical translation of "independent variable", it is a very problematic one. Conditions describe cases, they are not causes or causal. If the label cause can be attached to anything in QCA, it is the configuration because that is what explains the outcome. Ragin (2014 [1987]) very strongly argues that causality in QCA is about interpretation; about a dialogue between empirical, contextual and conceptual knowledge. Boolean expressions (configurations) are logical statements, they are not causal claims. Saying that a condition is an INUS-condition does not make it a cause or causal. It merely suggests that its presence is a necessary part of a configuration that explains the outcome, i.e., of the "cause". Making directional expectations about conditions does not make them causes or causal either. It merely says that one expects the presence rather than the absence of the condition to be an INUS-condition. While "causal condition" has become established usage in QCA, it is important to abandon it because it suggests something that conditions in QCA are not. Instead, "explanatory condition" is the correct terminology for QCA.

In sum, set-theoretically, the label causal condition is not just inaccurate but misleading. It is better to speak of explanatory conditions because researchers use these conditions to explain the outcome. QCA has two principal conditions: explanatory conditions and outcome conditions (or outcomes).

3. Case population versus sample

Correlational methods work with samples from given populations to allow empirical generalization of their findings. However, in QCA, samples are not an obvious way to obtain research populations because of the method's case sensitivity. Moreover, QCA is a comparative case study method, which means that cases must be comparable. Otherwise one risks comparing apples and oranges. Particularly random samples may defeat the homogeneity that is required for making meaningful cross-case comparisons. An obvious way of constructing a research population that consist of comparable cases is to select them on the basis of key scope conditions (Goertz 2017). Scope conditions are conditions that are causally relevant but that are not part of the QCA-study itself; i.e., they are not explanatory conditions in the truth table. Scope conditions may be calibrated crisp and one would select only 1-cases (or 0-cases, depending on one's research interests) to homogenize one's case population on that scope condition. That is, sampling obtains a research population top-down, by sampling from a given population. For case-based methods, it is more obvious to construct a case-population bottom-up, by selecting cases based on scope conditions to obtain a population of comparable cases. Instead, the representativeness of a sample (i.e., the degree to which the sample replicates the diversity of the population) allows making generalizations in correlational methods. (This is also why the size of N matters for generalizations in statistical methods but much less for QCA.) Scope conditions define the population (beyond the case population) to which findings may be generalized. Identifying relevant scope conditions is an important aspect of “casing”; of answering the question ‘what is a case’ in the context of one’s research (Ragin 1992).

In sum, given populations in social reality tend to be characterized by a good deal of heterogeneity and samples aim to capture that heterogeneity. However, QCA relies on homogenous case populations to make meaningful cross-case comparisons. Consequently, QCA researchers need to purposely select cases in such a way that all cases in their case population are qualitatively the same on key scope conditions (Mahoney and Goertz 2006).

4. Confounding condition versus control variable

Correlational studies tend to “neutralize” the heterogeneity of their samples with control variables. Confounding conditions perform a similar role in QCA. Confounding conditions may be causally relevant but they are neither explanatory nor scope conditions in a particular QCA-study. Typically, confounding conditions say something about the configuration explaining the outcome as well as about the outcome itself. QCA-researchers will know which cases have membership in the individual configurations in their solution. Calibrating a confounding condition crisp, one can establish whether the cases in a configuration are members or not-members of the confounding condition. If the distribution of members and non-members is more or less balanced, the presence or absence of the confounding condition is logically redundant. However, if this distribution is skewed, the (presence or absence of the) confounding condition is causally relevant. If not-P is a confounding condition for configuration Q, most cases in configuration Q will also be not-P cases. This is causally relevant information that the truth table does not provide. See Rutten (2022) for a metric for the skewedness of case membership in a confounding condition.

Scope and confounding conditions thus present different ways of dealing with heterogeneity. Scope conditions homogenize case populations prior to conducting the analysis of necessity and the truth table analysis. Confounding conditions check for heterogeneity after the analysis and thus “control” for potentially causally relevant conditions that do not feature in the truth table.

In sum, QCA-studies may feature four kinds of conditions: explanatory, outcome, scope and confounding conditions. Confounding conditions check for the heterogeneity of cases that have membership in a configuration. Heterogeneity (having both members and not-members of the confounding condition) suggests that the confounding condition is logically redundant.

5. Calibration versus scaling

Most basically, calibration is the procedure that gets a researcher from data to calibrated cases. Data are collected from social reality – where QCA is largely agnostic as to what kind of data they may be and how they are collected. Calibration qualifies cases as members (in degree) of a condition (a set) or as not-members, based on the case's data measurements. Importantly, calibration is about interpretation; it is not a mechanical conversion of data (Ragin 2000). (Even though the direct method of calibration limits interpretation to merely setting the three so-called critical values.) In other words, calibration entails making a judgement about the nature of cases. QCA calibrates conditions (sets); it asks, e.g., what it means to be a rich country and then identifies a data value beyond which countries are rich according to the definition of the set (condition). QCA then assigns (a degree of) set-membership to countries (cases) on the basis of what is known (i.e., the data) about each case. Calibration thus establishes a semantical threshold above which cases are qualitatively different (e.g., rich countries) from cases below it (not-rich countries). Note that fuzzy sets have multiple semantical thresholds; one for each category for discrete fuzzy sets and the three 'critical values' in the direct method of calibration.

Calibration is often based on scales used to collect data, however, scaling is something very different than calibration. Correlational methods must scale variables to be able to correlate them. Scales must accurately capture the variation in social reality, however, not all variation is relevant or meaningful. There are empirical differences in the wealth of countries like Luxembourg, Singapore and Switzerland but they are all very wealthy countries. Moreover, one may know that one object is warmer than another but still not know whether it is hot or cold (Ragin 2008: 72). That is, scales have no meaning while the purpose of calibration is to assign cases to meaningful categories. Since distributions (e.g., means, averages and percentiles) have no meaning, they should not be used as a basis for calibration. Averages, means and percentiles do not distinguish between different kinds of cases. They are not semantical thresholds.

In sum, calibration is to make a qualitative statement (assessment) about the nature of cases. It calibrates cases into semantically meaningful categories that transcend the (data) scales used to measure them.

6. A case of X versus a member of the set of X

A case may be a case of X and it may be a member of the set of X (a member of X in degree, if it is the fuzzy set of X). However, if a case is a member of the fuzzy set of X, it does not also have to be a case of X. In crisp sets, being a case of X necessarily implies that the case is also a member of the set of X. This is the (crisp) set-theoretical logic. We recognize a case as a case of X if the case has enough of the characteristic of X to qualify as a case of X. For example, all human beings have a degree of narcissism. This is because the apes that pottered along on the savanna thinking that all other apes were perfectly benign beings and would consider their interests also; well, those apes never became our ancestors. However, even though all human beings have a degree of narcissism, we only recognize someone as a narcissist above a threshold of narcissism. Only after one's level of narcissism starts to negatively affect one's relationships with other people do we recognize (qualify) someone as a narcissist. This is the semantical threshold or crossover point that calibrates human beings as narcissists or not-narcissists and, therefore, as members (1) of the crisp set of narcissist human beings or not-members (0) of the crisp set of narcissist human beings. In fuzzy sets, it is slightly more complicated. Cases above the crossover point (>0.5) are still cases of X and cases below the crossover point (<0.5) are not cases of X. However, a human being who is not a narcissist, i.e., not a case of a narcissist human being, still has a degree of narcissism. Therefore, this human being is still a member of the fuzzy set of narcissist human beings – albeit with a set-membership <0.5.

Whether a set is crisp or fuzzy depends on the definition of the set (the concept). It is wrong to change from crisp to fuzzy sets (or vice versa) after having settled on a definition of the set. Crisp sets are best used for categorical concepts. Fine-grained or continuous fuzzy sets are not necessarily better than course-grained ones. The number of categories (set-membership values) of a fuzzy set should depend on the set's definition, on what is semantically meaningful.

Keep in mind that there must be enough cases above and below the crossover point. QCA is a difference-making method. It investigates whether (not) being a case of X makes a difference for the (non-)occurrence of the outcome. Calibrating (almost) all cases on one side of the crossover point on a particular condition turns that condition into a constant. It is no longer a potential difference-maker in the analysis.

Finally, keep in mind that 0.5-cases are analytically irrelevant, as they are neither X nor not-X, and, therefore, drop out of the truth table analysis. Assigning cases 0.5-membership thus comes close to throwing away data. Moreover, one may wonder whether it is even possible for a case to be neither X nor not-X. Can one have not enough income to make ends meet, but have too much income not-to make ends meet?

In sum, cases above the crossover point are always both cases of X and members of the set of X, in both crisp sets and fuzzy sets. Cases below the crossover point are never cases of X and they are never members of the crisp set of X. However, they may have a degree of membership (<0.5) in the fuzzy set of X. Whether a set is crisp or fuzzy depends on the definition of the set (condition). In most sets, 0.5-cases may be logically impossible.

7. Concepts, conditions and sets

Social scientists define concepts to investigate social reality. After being properly defined, concepts can be measured (Goertz and Mahoney 2012a). That is, concepts are analytical constructs; they are the key building blocks for social scientists. Concepts feature in QCA-studies as conditions; i.e., analytically, there is no difference between a condition and a concept. In turn, conditions are sets. Condition X describes the set of X in that all cases that have the characteristics of X are members of the set of X (in the above sense).

Social science concepts are multi-dimensional, they are themselves complex things. Case-based methods deal with this complexity in a different way than variable-based (correlational) methods. Correlational methods work with latent variables. Multiple indicators each measure the same latent variable. Consequently, indicators must correlate and if they do not correlate they do not measure the same latent variable. The indicator approach makes the strong assumption that all indicators are interchangeable. One can eliminate an indicator to get a higher Cronbach's Alpha and still measure the same latent variable. It also implies that meaning and measurement overlap in correlational methods. (See the above discussion on scaling and calibration.)

In case-based methods, meaning and measurement of concepts are different things. Concept definition is about answering the question: What is X (what does it mean to be X)? Concept measurement answers the question: How do we know and X when we see one? That first question defines different aspects or dimensions of a concept. The second question develops measurements for all dimensions and how they can be "translated" into meaningful categories (calibration).

Conditions in a QCA-study may have multiple dimensions, i.e., they may be composed of sub-conditions. But they are not indicators. Instead, sub-conditions are necessary elements of the condition. Sub-conditions are aggregated into conditions using logical ANDs and ORs (Goertz 2020).

In sum, concepts, conditions and sets are fundamentally the same thing. Conditions may be complex; they may be composed of sub-conditions that are aggregated into conditions using logical ANDs and ORs.

8. Limited diversity and empty truth table rows

The truth table is a tool to represent or identify the limited diversity in social reality in the form of empty rows (or logical remainders). However, not every empty row is an example of limited diversity. Limited diversity is what happens in social reality. Not every logically possible combination of explanatory conditions can have empirical representation in social reality. There are no empathic narcissists and there are no residential areas where people have low incomes, live in poor houses, have unhealthy lifestyles and are higher educated. However, some truth table rows remain empty simply because a researcher did not select enough cases. Those empty rows are a function of a limited case population, they do not represent limited diversity in social reality. Researchers can reduce the number of empty truth table rows on the basis of counterfactual arguments. Substantive knowledge of cases, context and theory may allow putting a 1 or 0 in the outcome column of an empty row (Schneider and Wagemann 2012).

In sum, limited diversity is what social reality is like. Empty rows is what one finds in the truth table. No amount of cases can reduce limited diversity, but increasing one's case population may reduce the number of empty truth table rows. A healthy balance between conditions and cases (Marx et al. 2013) ensures that empty rows reflect limited diversity rather than a limited case population.

9. Necessity and sufficiency analysis versus testing for necessary and sufficient conditions

Several QCA handbooks speak of testing for necessity and sufficiency (e.g., Schneider and Wagemann 2012). While again etymologically correct, testing has a very specific connotation in statistical methods. Namely that one develops a hypothesis first and then performs an empirical test in order to assess whether the data corroborate the hypothesis. Testing thus assumes a strict distinction between the theoretical moment (developing a hypothesis) and the analytical moment (subjecting the hypothesis to an empirical test). However, QCA is deliberately recursive. QCA requires researchers to go back-and-forth between cases, calibration and analysis; it deliberately blurs the line between the theoretical and analytical moments so as to learn from cases. Consequently, QCA does not and cannot test anything in the statistical (correlational) sense of the word. Instead, QCA performs analyses of necessity and sufficiency. More particularly, QCA performs superset and subset analyses that are then interpreted into statements of necessity and sufficiency.

In sum, testing has a very strong connotation in statistical methods and, in that context, it does something very different than what QCA does. To acknowledge this difference, it is clearer to speak of analysis of necessity and analysis sufficiency in QCA.

10. Statements of necessity and sufficiency versus statements of causal effects

Ultimately, (most) QCA-studies aim to make causal statements. Sometimes such statements are verbalized as causal effects of conditions or configurations, but that is not necessarily set-theoretical vocabulary. Correlational methods identify causal effects. The causal effect of X on Y is the amount of variation in Y that may be attributed to (is caused by) the variation in X. But that is not what QCA does. QCA makes statements of necessity and sufficiency; it can say that a condition is necessary for the outcome and that a configuration is sufficient for the outcome. Statements of necessity and sufficiency are based on superset and subset-relationships between cases. Moreover, in QCA, conditions are not causes but merely describe cases (see above). Superset and subset-relationships may be interpreted into statements of necessity and sufficiency but they are not themselves causal claims (see above). Of course one can think of a necessary condition or a sufficient configuration as having an effect on the outcome, however, that would be a very different kind of effect than the one implied in correlational methods. See the above discussion on effects-of-causes versus causes-of-effects and, in particular, see the discussion Furnari et al. (2021) on theorizing configurational causality.

In sum, to acknowledge that causality is and means something different in QCA than in correlational methods, it is clearer to label causal claims as statements of necessity and sufficiency.

Set-theoretical versus correlational vocabulary

SET-THEORETICAL VOCABULARY	**CORRELATIONAL VOCABULARY**
A **solution** is the result of QCA's truth table minimization. A solution may contain multiple **configurations,** each of which may contain multiple conditions connected by logical ANDs. Logical ORs connect configurations into a solution.	A **model** is the result of a statistical analysis
Conditions are case-level constructs that describe different aspects of a case. An **outcome condition** (more often, simply "outcome") is the condition whose presence (or absence) is to be explained. **Explanatory condition**s are used to explain the outcome.	**Variables** are constructs that abstract cases away in order to describe the distribution of population-level characteristics.
Case population: a population of purposely selected cases in such a way that the case population is homogenous on key scope conditions. Ideally, QCA works with (purposely selected) case populations and not with samples. **Scope condition**: a condition that is causally relevant but not an explanatory condition in a QCA-study. All cases in a QCA-study must be qualitatively the same on all scope conditions to allow meaningful comparison. Scope conditions are the constraints under which the solution explains the outcome.	A **sample** from a given population aims to capture the heterogeneity of the given population. Sampling may be random but may also be based on criteria, such as scope conditions.
A **confounding condition** characterizes both the outcome and the configurations (combination of explanatory conditions) in a QCA-study. Confounding conditions are logically redundant in a configuration when the cases that the configuration covers are	**Control variables** are introduced into correlational studies in order to "neutralize" heterogeneity in the population.

both members and not-members of the confounding condition.	
Calibration is the process that allows researchers to create semantically meaningful data. This process requires researchers to make a series of informed judgements in order to produce semantic thresholds that distinguish the degree to which an observation does or does not belong to a set. **Crossover point**: the empirical value (the threshold) that distinguishes between cases that are cases of X (above the crossover point) and those that are not-cases of X (below the crossover point). A case is **a case of X** if it "sits" above the crossover point. For crisp and fuzzy sets, a case is **a member of the set of X** if it sits above the crossover point. Cases that sit below the crossover point are not-members of the crisp set of X; however, they may be members (<0.5) of the fuzzy set of X.	**Scaling**: capturing all empirical variation in a population. Scales are epistemology only, they have no semantical meaning. **Data**: the data collected from social reality. In correlational studies, the variation in the data is meaningful as such. In QCA-studies, data is meaningless. Data must always be both valid and reliable. Calibration (creating meaning) is not possible from data that are not valid or reliable.
Concepts (sets) are composed of **subsets** that each have their own definition and meaning. Sub-conditions are necessary aspects of a concept but they only jointly define the concept. Therefore, sub-concepts are aggregated into concepts using logical ANDs and ORs. Each (sub-)concept may have one or more measurements that are also aggregated using logical ANDs and ORs. Sub-concepts are an ontological approach to concepts and measurement.	**Indicators** are measurements of **latent variables**. Indicators must correlate to suggest they measure the same underlying construct (latent variable). Indicators have no meaning, they are just measurements. They are aggregated using averages, means or indices. Indicators are an epistemological approach to concepts and measurement.
Limited diversity is an inherent feature of social reality: many logically-possible combinations of conditions do not empirically exist. It is important to recognize that the presence of **empty rows** in a truth table may reflect either limited diversity *or* missing data.	**Missing data** are possible measurements that are not recorded. Missing data may affect the validity of the data and the conclusions that may be drawn from them in various ways.
An **analysis of necessity** seeks to identify conditions that are (almost) always present when the outcome is present. In QCA, necessity is indicated when the explanatory condition is a consistent superset of the outcome. Researchers wishing to avoid attributing causation sometimes refer to necessary conditions as **antecedent conditions**. An **analysis of sufficiency** seeks to identify combinations of conditions that, when present, are (almost) always accompanied by the presence of the outcome. In QCA, sufficiency is identified through the process of constructing and minimizing truth tables. The process of identifying necessary and sufficient conditions is iterative; as a method, QCA deliberately blurs the distinction between theorizing and data analysis.	**Testing**: a procedure in statistical (correlational) methods that aims to find empirical corroboration for hypothesized causal relationships. Testing implies a strict distinction between hypothesis development and empirical analysis.
Making **causal statements of necessity and sufficiency** requires both empirical support (strong set-theoretic consistency) as well as a theoretical and/or substantive basis for making the causal claim.	A **causal effect** is the variation in the dependent variable that may be attributed to the variation in the independent variable.

Suggested further reading

QCA essentials
Ragin, Ch. (2014 [1987]). *The comparative method: Moving beyond qualitative and quantitative strategies*, Oakland, CA: University of California Press. Ragin, Ch. (2008). *Redesigning social inquiry: Fuzzy sets and beyond*, Chicago, IL: The University of Chicago Press. Ragin, Ch. (2000). *Fuzzy set social science*, Chicago, IL: The University of Chicago Press.
Quick reference
Rubinson, C., Gerrits, L., Rutten, R. and Greckhamer, Th. (2019). *Avoiding common errors in QCA: A short guide for new practitioners*. https://compasss.org/wp-content/uploads/2019/07/Common_Errors_in_QCA.pdf
QCA handbooks
Schneider, C. and Wagemann, C. (2012). *Set-theoretic methods for the social sciences: A guide to Qualitative Comparative Analysis*, Cambridge: Cambridge University Press. Mello, P. (2021). *Qualitative Comparative Analysis: An introduction and research guide*, Washington, DC: Georgetown University Press. Oana, I., Schneider, C. and Thomann, E. (2021). *Qualitative Comparative Analysis with R: A beginner's guide*. Cambridge: Cambridge University Press.
Set-theoretical versus correlational methods
Goertz, G. and Mahoney, M. (2012). *A tale of two cultures: Qualitative and quantitative research in the social sciences*, Princeton, NJ: Princeton University Press. Mahoney, J. and Goertz, G. (2006). A tale of two cultures: Contrasting qualitative and quantitative research, *Political Analysis*, 14(3): 227-249. Rutten, R. (2020). Comparing causal logics: A configurational analysis of proximity using simulated data, *Zeitschrift für Wirtschaftsgeographie*, 64(3): 134-148.
Designing research with QCA
Thomann, E. and Maggetti, M. (2020). Designing research with Qualitative Comparative Analysis (QCA): Approaches, challenges and tools, *Sociological Methods & Research*, 49(2): 356-386. Goertz, G. (2017). *Multi-method research, causal mechanisms and case studies: An integrated approach*, Princeton, NJ: Princeton University Press.
Concepts and measurements
Goertz, G. (2020). *Social science concepts and measurements*, Princeton, NJ: Princeton University Press. Goertz, G. and Mahoney, J. (2012). Concepts and measurements: Ontology and epistemology, *Social Science Information*, 51(2): 205-216.
Robustness
Skaaning, S. (2011). Assessing the robustness of crisp-set and fuzzy-set QCA results, *Sociological Methods & Research*, 40(2): 391-408. Rutten, R. (2022). Applying and assessing large-N QCA: Causality and robustness from a critical realist perspective, *Sociological Methods & Research*, 51(3): 1211-1243. Oana, I. and Schneider, C. (2021). A robustness test protocol for applied QCA: Theory and R software application, *Sociological Methods & Research*, published online, pp. 1-32.

Theorizing and causality
Furnari. S., Crilly, D., Misangyi, V., Greckhamer, Th., Fiss, P. and Aguilera, R. (2021). Capturing complex causality: Heuristics for configurational theorizing, *Academy of Management Review*, 46(4): 778-799.
Rutten, R. (2021). Uncertainty, possibility and causal power in QCA, *Sociological Methods & Research*, published online, pp. 1-30.
Rohlfing, I. and Zuber, Ch. (2019). Check your truth conditions! Clarifying the relationship between theories of causation and social science methods for causal inference, *Sociological Methods & Research*, 50(4): 1623-1659.

References

Furnari. S., Crilly, D., Misangyi, V., Greckhamer, Th., Fiss, P. and Aguilera, R. (2021). Capturing complex causality: Heuristics for configurational theorizing, *Academy of Management Review*, 46(4): 778-799.

Goertz, G. (2017). *Multimethod research, causal mechanisms, and case studies: An integrated approach*, Princeton, NJ: Princeton University Press.

Goertz, G. (2020). *Social science concepts and measurements*, Princeton, NJ: Princeton University Press.

Goertz, G. and Mahoney, J. (2012a). Concepts and measurements: Ontology and epistemology, *Social Science Information*, 51(2): 205-216.

Goertz, G. and Mahoney, J. (2012b). *A tale of two cultures: Qualitative and quantitative research in the social sciences*, Princeton, NJ: Princeton University Press.

Mahoney, J. and Goertz, G. (2006). A tale of two cultures: Contrasting qualitative and quantitative research, *Political Analysis*, 14(3): 227-249.

Marx, A., Cambré, B. and Rihoux, B. (2013). Crisp-set Qualitative Comparative Analysis in Organizational Studies. In Fiss, P., Cambré, B. and Marx, A. (Eds). *Configurational Theory and Methods in Organizational Research*, Binley: Emerald, pp. 3-48.

Ragin, Ch. (1992). 'Casing' and the process of social inquiry. In Ragin, Ch. and Becker, H. (Eds), *What is a case? Exploring the foundations of social inquiry*, Cambridge: Cambridge University Press, pp. 217-226.

Ragin, Ch. (2000). *Fuzzy set social science*, Chicago, IL: The University of Chicago Press.

Ragin, Ch. (2008). *Redesigning social inquiry: Fuzzy sets and beyond*, Chicago, IL: University of Chicago Press.

Ragin, Ch. (2014 [1987]). *The comparative method: Moving beyond qualitative and quantitative strategies*, Oakland, CA: University of California Press.

Ragin, Ch. and Davey, S. (2017). *fs/QCA [Computer Programme],* Version 3.0. Irvine, CA: University of California.

Ragin, C. C. and S. Davey. 2017. *fs/QCA [Computer Programme], Version 3.0*, Irvine: University of California.

Rutten, R. (2022). Applying and assessing large-N QCA: Causality and robustness from a critical realist perspective, *Sociological Methods & Research*, 51(3): 1211-1243.

Schneider, C. and Wagemann, C. (2012). *Set-theoretic methods for the social sciences: A guide to Qualitative Comparative Analysis*, Cambridge: Cambridge University Press.