Supplementary online appendix

Table 1: Tools to assist and complement inference with QCA

	Issue	*Approaches*	*Tool*	*Limitations*
External validity	**Establishing empirical scope**	Condition-oriented large-N, especially deductive/ theory-evaluating	Probabilistic criteria	Case-orientation Representativeness of sample
		Case-oriented, especially inductive/ explorative	Scope conditions	Generalizability of results
	Sensitivity to one or more flawed cases	Condition-oriented large-N	Frequency threshold robustness test	Coverage Limited diversity
		Case-oriented	Case knowledge, scope conditions	Confirmation bias
		All, especially condition-oriented	Testing robustness to adding/dropping cases	Data availability
	Scope of counterfactual argument	Substantive interpretability	Conservative or intermediate solution	Redundancy-free models External validity
		Redundancy-free models	Parsimonious solution	Substantive interpretability
		All	Indicate extent of limited diversity If applicable, indicate directional expectations and simplifying assumptions	

	Issue	*Approaches*	*Tool*	*Limitations*
Measurement & internal validity	**Measurement error**	Case-oriented	In-depth knowledge of concepts and cases Set-theoretic multi-method research	External validity Data availability
	Systematic inaccuracy in coding	All, especially condition-oriented	Adjustment factor	
	Calibration errors	All, in absence of clear conceptual criteria	Calibration procedures robustness tests	Tests should involve only conceptually meaningful alternative calibrations
	Condition errors	Substantive interpretability	Comparative presentation & inspection of parsimonious & intermediate solution	Redundancy-free models
		All, especially condition-oriented/ambiguity on best model specifications	Adding/dropping conditions robustness test	Limited diversity Data availability
	Random errors	Condition-oriented large-N	Probabilistic criteria	Case-orientation; small-N Representativeness of sample
	Sensitivity to changes in minimally required raw consistency levels	All, especially condition-oriented / ambiguity on best model specifications	Raw consistency robustness test	Substantive interpretability
		Case-oriented	Case knowledge for determining threshold	Confirmation bias
	Case-based errors	Condition--oriented large-N	Frequency thresholds	Sample size Limited diversity

	Issue	*Approaches*	*Tool*	*Limitations*
	Limited diversity	All	Thresholds for case-conditions ratio under consideration of number of configurations	
		All, especially condition-oriented	Increase N	Case orientation Data availability Conceptual stretching
		All, especially case-oriented	Most similar systems design	External validity
		All	Reduce number of conditions	Under-specification of the theoretical model Coverage
		Substantive interpretability	Two-step QCA	Redundancy-free models Complexity & scope of results Only applies when conditions can be meaningfully considered as proximate vs. remote
	Validity of explanation	Substantive interpretability	Conservative or intermediate solution (SA, ESA, TESA)	Redundancy-free models External validity
		Redundancy-free models	Parsimonious solution	Substantive interpretability
		Substantive interpretability	Presentation of parsimonious & conservative/ intermediate solution	Does not resolve the epistemological problem
		Case-oriented	Case knowledge for causal explanation Set-theoretic multi-method research	External validity Data availability

	Issue	*Approaches*	*Tool*	*Limitations*
	Interpreting necessary conditions	Substantive interpretability	Empirical criteria: trivialness (coverage), relevance (RoN), theoretical and conceptual meaningfulness	Not valid according to redundancy-free models approach
		Redundancy-free models	No causal interpretation of single, a priori defined necessary conditions	Unclear research-practical relevance
		Case-oriented	Causal process tracing with set-theoretic multi-method research	Data availability
	Skewed data	All, especially condition-oriented large-N	Skewedness statistics / diagnosis	
		All	Sampling, measurement, calibration and concept building techniques	External validity Data availability Conceptual stretching Theory-driven sample, model and concept specification
		Substantive interpretability	Simultaneous subset relations diagnosis (PRI, RoN, XY-plots, Boolean intersections)	Meaningless under redundancy-free models approach
		Substantive interpretability	ESA to avoid simultaneous subset relations	Redundancy-free models
Reasoning	**Clarifying the external scope of the argument**	All	See "clarifying external validity"	Generalizability of conclusions/implications
	Hypothesis building / modification	Inductive/explorative Condition-oriented	Deriving new theories or extension, refinement of existing theories	Iterative elements of QCA approach Internal validity
		Inductive/explorative Case-oriented	Deriving new theories or extension, refinement of existing theories Case-oriented theory building	External validity

	Issue	*Approaches*	*Tool*	*Limitations*
	Hypothesis assessment	Deductive/theory-evaluating Case-oriented	Case-oriented theory testing	Iterativeness of QCA approach Inductiveness of technique External validity
		Deductive/theory-evaluating	Formal theory evaluation	
	Formulating expectations in line with the QCA approach	Deductive/theory-evaluating	Set-theoretic hypotheses on causal complexity, contingent causality, relevance of factors	Effects of causes, net effects
	Analysis of necessity	Deductive/theory-evaluating Substantive interpretability	Deductive test of previously defined single or unions of conditions	Inductive/explorative Redundancy-free models: necessary conditions must also be sufficient and non-redundant
		Inductive/explorative	Explorative super-/subset analysis	Trivialness, relevance Substantive interpretability: unions should represent meaningful higher-order construct

Notes: Confirmation bias prevails when empirical information is selected and interpreted such that it corresponds to the expectations (see e.g., Krogslund et al. 2015).

Conceptual stretching occurs when the meaning of concepts is loosened up so that they apply to additional cases.

This is the supplementary online appendix to: Thomann, E. and M. Maggetti, 2017. Designing Research with Qualitative Comparative Analysis (QCA): Approaches, Challenges, Tools. *Sociological Methods & Research*.