

# QCA

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# Standard analysis

1. Conceptual research – the research question, population of interest, outcome of interest, conditions to analyze
2. Data matrix – calibration of the measurements
3. Transformation of data matrix into truth table
4. Testing for necessity
  1. Assessment of the outcome – consistency and coverage
5. Testing for sufficiency
  1. Assessment of the outcome – consistency and coverage
6. Repeating the process for non-outcome.

# Truth table

- Truth table reflects data from the data matrix
- One row of truth table represents combination of conditions that can appear
- $2^k$  (k = number of conditions)
- Not all of the conditions then appear in the reality = incomplete truth table – logical remainders
- If there is 1 in the outcome column that row expresses statement of sufficiency (under this combination of conditions the outcome of interest happens)
- You take the truth table row and if it shows the outcome, then it is added to the logical minimization by Quine-McCluskey
- Fuzzy sets – fuzzy sets (as crisp ones) establish qualitative difference between membership and nonmembership in the set – property space – still belong into only one truth table row, because they will always have the value below 0.5 or above 0.5 for that condition

**Table 4.1** Data matrix with ten cases, three conditions, and outcome

Row	Cases	Conditions			Outcome
		A	B	C	Y
1	ARG	1	1	1	0
2	PER	1	0	0	0
3	BOL	1	1	0	0
4	CHI	0	1	0	1
5	ECU	1	0	0	0
6	BRZ	0	1	1	1
7	URU	1	0	1	1
8	PAR	0	0	1	1
9	COL	0	0	0	1
10	VEN	1	1	1	0

Y = set of countries with stable democracies  
A = set of countries with violent upheavals in the past  
B = set of countries with ethnically homogeneous population  
C = set of countries with pluralistic party system



Data matrix  
into the truth  
table

**Table 4.2** Hypothetical truth table with three conditions

Row	Conditions			Outcome		Cases
	A	B	C	Y	~Y	
1	0	0	0	1	0	COL
2	0	0	1	1	0	PAR
3	0	1	0	1	0	CHI
4	0	1	1	1	0	BRZ
5	1	0	0	0	1	PER, EC
6	1	0	1	1	0	URU
7	1	1	0	0	1	BOL
8	1	1	1	0	1	AR, VEN

See Table 3.2

~Y = set of countries with non-stable democracies

Cases	Conditions			Truth Table Row $A \sim BC$	Outcome
	A	B	C		
HU	0.8	0.6	0.2		0.4
RO	0.9	0.3	0.2		0.3
CZ	0.6	0.3	0.6		0.7
BG	0.8	0.9	0.1		0.3
SK	0.2	0.3	0.9		0.6

Fuzzy set truth  
table

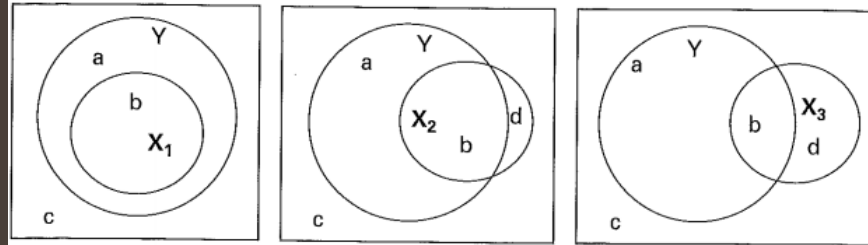
# Dealing with contradictory rows and logical remainders

- Logical remainders – those combinations that do not realize in the data
  - Either use no assumptions on logical remainders – bar them from logical minimization → conservative solution
  - Assign assumptions on logical remainders – the program itself decides what to do with the remainders (uses those that lead to more effective logical minimization) → parsimonious solution
  - Directional expectations → intermediate solution
- Contradictory row - If the same combination of conditions shows both outcome and non-outcome
- Before logical minimization:
  - adding a condition
  - respecify the population of interest
  - respecify the definition, conceptualization, or measurement of the outcome or conditions

# Sufficiency and its consistency

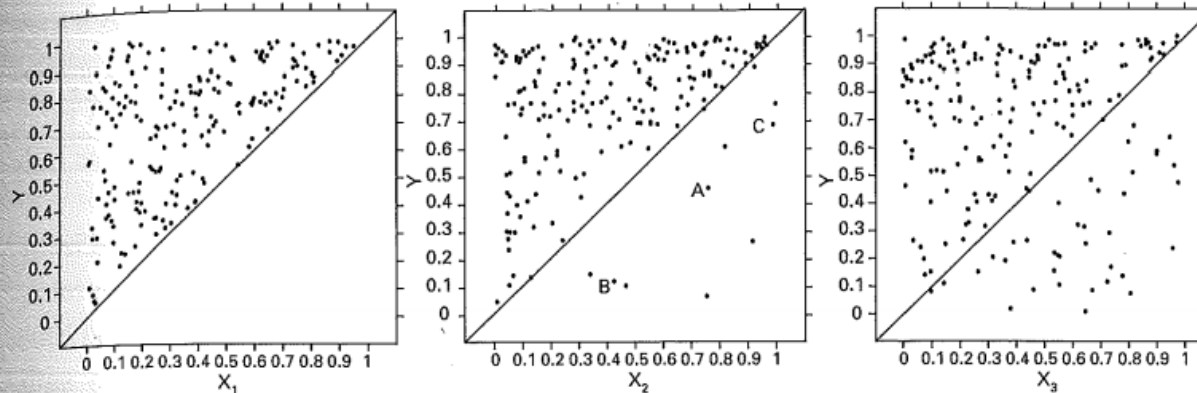
**Table 5.1** Two-by-two tables – consistent and inconsistent sufficient conditions

	0	1		0	1		0	1
Outcome Y	80	100		80	90		80	8
1	a	b		a	b		a	b
0	15	0		15	10		15	92
	c	d		c	d		c	d
	0	1		0	1		0	1
	$X_1$			$X_2$			$X_3$	



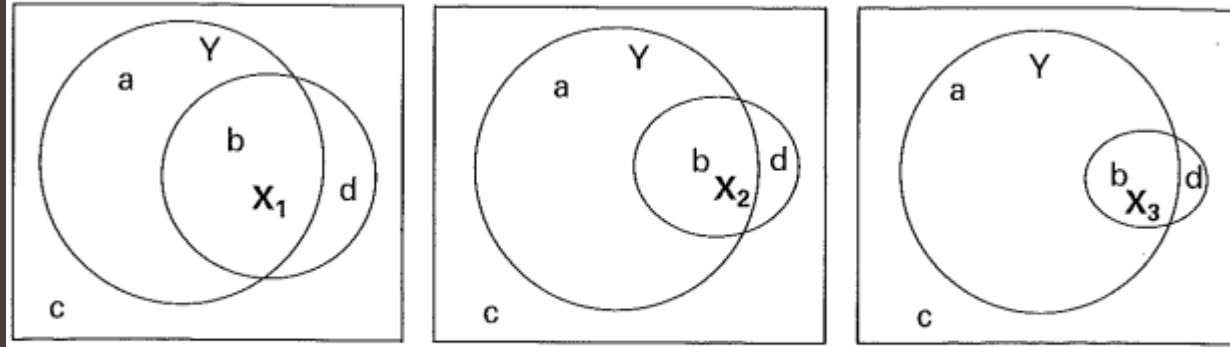
Venn diagrams – consistent and inconsistent sufficient conditions

*Consistency of X as a sufficient condition for Y = number of cases where X=1 and Y= 1/ number of cases where X=1*



**Figure 5.2** XY plot – consistent and inconsistent sufficient conditions

# Sufficiency and its coverage



Venn diagrams – different levels of coverage sufficiency

Table 5.2 Two-by-two tables – different levels of coverage sufficiency

Outcome Y	1	10	200	90	120	186	24
		a	b	a	b	a	b
	0	20	8	20	5	20	1
		c	d	c	d	c	d
		0	1	0	1	0	1
		$X_1$		$X_2$		$X_3$	



# Sufficiency and its coverage

- However, it is common in crisp-set analyses to assess the proportion of cases following each path—that is, the number of cases following a specific path to the outcome divided by the total number of instances of the outcome. This simple proportion is a direct measure of set-theoretic coverage and is a straightforward indicator of the empirical importance of a causal combination.

- ( ) \_\_\_\_\_

Necessity and  
its coverage  
and  
parameters of  
fit

# Conceptual work

- Research question: What factors motivate UN intervention.
  - causally complex phenomenon
  - outcome: the strength of international response (“STRONG”)
  - conditions:
    - Extent of the crisis
    - Spillover effects
    - Countervailing power
    - Institutional involvement
    - Media attention

# Data matrix

Table I. Fuzzy-set membership scores for 31 humanitarian crises 1991–2004

<i>Cases</i>	<i>Years</i>	<i>Explanatory conditions</i>					<i>Outcome</i>
		<i>(1) Extent</i>	<i>(2) Spillover effects</i>	<i>(3) Countervailing power</i>	<i>(4) Institutional involvement</i>	<i>(5) Media attention</i>	<i>Strength of UN response</i>
Afghanistan	1991–2004	1	1	0.08	0.64	0.16	1
Angola 1	1991–1994	1	0.66	0.44	0.32	0.12	0.64
Angola 2	1998–2002	1	1	0.35	0.8	0.06	0.64
Azerbaijan (Karabakh)	1992–1994	0.68	0.59	1	0.16	0.09	0.16
Bosnia	1992–1995	1	1	0.38	0.8	1	1
Burundi	1993–2004	0.86	0.64	0.09	0.8	0.05	0.8
Colombia	1991–2004	1	1	1	0.16	0.11	0.16
Congo-Brazzaville	1997–1999	0.49	0	0	0.16	0	0.16
DR Congo	1996–2004	1	1	0.16	0.8	0.27	0.8
Georgia (Abkhazia)	1992–1994	0.13	0.13	1	1	0.06	0.32
Guinea-Bissau	1998–1999	0.1	0	0	1	0	0.16
India (Kashmir)	1991–2004	0.24	1	1	0.16	0.07	0
Iraq (Northern Iraq)	1991–1993	0.64	1	1	1	1	1
Liberia 1	1991–1995	1	1	0	1	0	0.64
Liberia 2	2000–2003	0.6	0.49	0	0.64	0.09	0.8
Mozambique	1991–1992	1	1	0.12	0.16	0	0.48
Myanmar	1991–2004	0.86	1	1	0.16	0	0.16
Nepal	1996–2004	0.06	0	1	0.16	0	0.16
Peru	1991–1997	0.64	1	1	0.16	0.07	0.16
Russia (Chechnya) 1	1994–1996	0.41	0	1	0.16	0.7	0.16
Russia (Chechnya) 2	1999–2004	0.86	0	1	0.16	0.37	0.16
Rwanda	1993–1994	1	1	0.06	0.8	0.22	1
Sierra Leone	1991–2002	0.82	1	0	1	0	1
Somalia	1991–1995	1	0.92	0	0.8	0.08	1
Sri Lanka	1991–2002	0.92	0.28	1	0.16	0.06	0.16
Sudan	1991–2004	1	0.72	1	0.32	0.07	0.32
Sudan (Darfur)	2003–2004	1	0.25	1	0.16	0.05	0.16
Tajikistan	1992–1997	0.32	0.3	1	1	0	0.32
Turkey	1991–2004	1	1	1	0.16	0	0
Uganda (Northern Uganda)	1994–2004	1	1	0.11	0.16	0	0.16
Yugoslavia (Kosovo)	1998–1999	0.1	1	1	1	0.87	0.64

# Data matrix in RStudio

	EXTENT	SPILLOVER	COUNTPOWER	INVOLV	ATTENTION	STRONG
Afghanistan	1.00	1.00	0.08	0.64	0.16	1.00
Angola 1	1.00	0.66	0.44	0.32	0.12	0.64
Angola 2	1.00	1.00	0.35	0.80	0.06	0.64
Azerbaijan (Karabakh)	0.68	0.59	1.00	0.16	0.09	0.16
Bosnia	1.00	1.00	0.38	0.80	1.00	1.00
Burundi	0.86	0.64	0.09	0.80	0.05	0.80
Colombia	1.00	1.00	1.00	0.16	0.11	0.16
Congo-Brazzaville	0.49	0.00	0.00	0.16	0.00	0.16
DR Congo	1.00	1.00	0.16	0.80	0.27	0.80
Georgia (Abkhazia)	0.13	0.13	1.00	1.00	0.06	0.32
Guinea-Bissau	0.10	0.00	0.00	1.00	0.00	0.16
India (Kashmir)	0.24	1.00	1.00	0.16	0.07	0.00
Iraq (Northern Iraq)	0.64	1.00	1.00	1.00	1.00	1.00
Liberia	1.00	1.00	0.00	1.00	0.00	0.64
Liberia 2	0.60	0.49	0.00	0.64	0.09	0.80
Mozambique	1.00	1.00	0.12	0.16	0.00	0.48
Myanmar	0.86	1.00	1.00	0.16	0.00	0.16
Nepal	0.06	0.00	1.00	0.16	0.00	0.16
Peru	0.64	1.00	1.00	0.16	0.07	0.16
Russia (Chechnya) 1	0.41	0.00	1.00	0.16	0.70	0.16
Russia (Chechnya) 2	0.86	0.00	1.00	0.16	0.37	0.16
Rwanda	1.00	1.00	0.06	0.80	0.22	1.00
Sierra Leone	0.82	1.00	0.00	1.00	0.00	1.00
Somalia	1.00	0.92	0.00	0.80	0.08	1.00
Sri Lanka	0.92	0.28	1.00	0.16	0.06	0.16
Sudan	1.00	0.72	1.00	0.32	0.07	0.32
Sudan (Darfur)	1.00	0.25	1.00	0.16	0.05	0.16
Tajikistan	0.32	0.30	1.00	1.00	0.00	0.32
Turkey	1.00	1.00	1.00	0.16	0.00	0.00
Uganda (Northern Uganda)	1.00	1.00	0.11	0.16	0.00	0.16
Yugoslavia (Kosovo)	0.10	1.00	1.00	1.00	0.87	0.64

Showing 1 to 31 of 31 entries

OUT: outcome value  
 n: number of cases in configuration  
 incl: sufficiency inclusion score

	EXTENT	SPILLOVER	COUNTPOWER	INVOLV	ATTENTION	OUT	n	incl	PRI
19	1	0	0	1	0	1	1	1.000	1.000
28	1	1	0	1	1	1	1	1.000	1.000
2	0	0	0	0	1	?	0	1.000	-
4	0	0	0	1	1	?	0	1.000	-
8	0	0	1	1	1	?	0	1.000	-
9	0	1	0	0	0	?	0	1.000	1.000
10	0	1	0	0	1	?	0	1.000	-
11	0	1	0	1	0	?	0	1.000	1.000
12	0	1	0	1	1	?	0	1.000	-
18	1	0	0	0	1	?	0	1.000	1.000
20	1	0	0	1	1	?	0	1.000	1.000
23	1	0	1	1	0	?	0	1.000	-
24	1	0	1	1	1	?	0	1.000	-
26	1	1	0	0	1	?	0	1.000	1.000
32	1	1	1	1	1	1	1	0.969	0.943
27	1	1	0	1	0	1	8	0.949	0.929
30	1	1	1	0	1	?	0	0.944	0.829
31	1	1	1	1	0	?	0	0.906	0.304
15	0	1	1	1	0	?	0	0.881	0.000
16	0	1	1	1	1	0	1	0.816	0.681
14	0	1	1	0	1	?	0	0.794	0.000
17	1	0	0	0	0	?	0	0.776	0.421
25	1	1	0	0	0	0	3	0.737	0.519
1	0	0	0	0	0	0	1	0.653	0.314
22	1	0	1	0	1	?	0	0.623	0.000
7	0	0	1	1	0	0	2	0.611	0.000
6	0	0	1	0	1	0	1	0.538	0.000
3	0	0	0	1	0	0	1	0.537	0.213
5	0	0	1	0	0	0	1	0.446	0.000
21	1	0	1	0	0	0	3	0.439	0.000
29	1	1	1	0	0	0	6	0.393	0.053
13	0	1	1	0	0	0	1	0.360	0.000

# Truth table

cases

19 Liberia 2  
 28 Bosnia  
 2  
 4  
 8  
 9  
 10  
 11  
 12  
 18  
 20  
 23  
 24  
 26  
 32 Iraq (Northern Iraq)  
 27 Afghanistan,Angola 2,Burundi,DR Congo ,Liberia,Rwanda,Sierra Leone,Somalia  
 30  
 31  
 15  
 16 Yugoslavia (Kosovo)  
 14  
 17  
 25 Angola 1,Mozambique,Uganda (Northern Uganda)  
 1 Congo-Brazzaville  
 22  
 7 Georgia (Abkhazia),Tajikistan  
 6 Russia (Chechnya) 1  
 3 Guinea-Bissau  
 5 Nepal  
 21 Russia (Chechnya) 2,Sri Lanka,Sudan (Darfur)  
 29 Azerbaijan (Karabakh),Colombia,Myanmar,Peru,Sudan,Turkey  
 13 India (Kashmir)

# Bibliography

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