Causal Complexity

Another important benefit of set theoretic analysis is that it is much more compatible with the analysis of causal complexity than conventional techniques. Example: a researcher studies production sites in a strike-prone industry and considers four possible causes of strikes:

technology = the introduction of new technology
wages = stagnant wages in times of high inflation
overtime = reduction in overtime hours
sourcing = outsourcing portions of production

Possible findings include:

(1) technology → strikes
(2) technology·wages → strikes
(3) technology + wages → strikes
(4) technology·wages + overtime·sourcing → strikes

In (1) technology is necessary and sufficient; in (2) technology is necessary but not sufficient; in (3) technology is sufficient but not necessary; in (4) technology is neither necessary nor sufficient. The fourth is the characteristic form of causal complexity: no cause is either necessary or sufficient.

INUS Causation

In situations of *causal complexity*, no single cause may be either necessary or sufficient, as in the logic equation:

TECHNOLOGY*WAGES + OVERTIME*SOURCING → STRIKES

In *The Comparative Method*, this situation is called "multiple conjunctural causation."

In *The Cement of the Universe*, Mackie labels these causal conditions INUS causes because each one is:

Insufficient (not sufficient by itself) but
Necessary components of causal combinations that are
Unnecessary (because of multiple paths) but
Sufficient for the outcome

The Problem with Examining INUS Causes One at a Time

	X absent	X present
Outcome present	There are cases here because there are several recipes for the outcome, including some that do not involve X	There are cases here because X is an INUS condition--an ingredient in at least one of the recipes for the outcome
Outcome absent	There are cases here because some cases lack the outcome and also lack membership in the recipes that do not include X	There are cases here because X sometimes occurs without the other ingredients that it must be combined with in order to generate the outcome

Don’t forget: Almost all conventional statistical procedures are based on matrices of bivariate correlations. If INUS causes are involved, these correlations are almost completely useless.

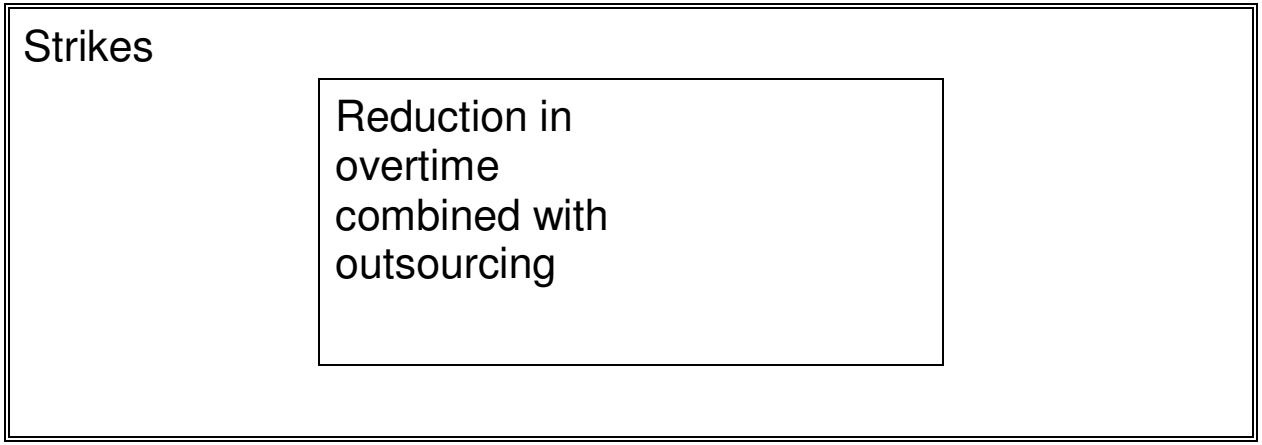
Assessing Causal Complexity

I. Logical equation: technology·wages + overtime·sourcing → strikes

II. Formulated as a partial crosstabulation:

	Second causal combination absent	Second causal combination present
Strike present (1)	Cell 1: 20 cases	Cell 2: 23 cases
Strike absent (0)	Cell 3: 18 cases	Cell 4: 0 cases

III. Expressed as a Venn diagram:



The key to assessing the sufficiency of a combination of conditions, even if it is one among many recipes, is to select on instances of the combination and assess whether these instances agree on the outcome.

SIMPLE EXAMPLE OF QCA USING HYPOTHETICAL DATA

A. Truth Table:

C	*L*	*H*	*G*	*U*	*N of Cases*
0	0	0	0	0	4
0	0	0	1	0	3
0	0	1	0	0	6
0	0	1	1	1	2
0	1	0	0	1	3
0	1	0	1	1	4
0	1	1	0	0	3
0	1	1	1	1	5
1	0	0	0	0	7
1	0	0	1	0	8
1	0	1	0	0	1
1	0	1	1	1	7
1	1	0	0	1	3
1	1	0	1	1	2
1	1	1	0	0	7
1	1	1	1	1	6

C = Corporatist wage negotiations
L = At least five years of rule by Left or Center-Left parties
H = Ethnic-cultural homogeneity
G = At least ten years of sustained economic growth
U = Adoption of universal pension system

B. Table simplified through row-wise comparisons (positive outcomes only)

```
-10-   (or L•h: Left rule combined with ethnic diversity)
-1-1   (or L•G: Left rule combined with economic growth)
--11   (or H•G: ethnic homogeneity combined with economic growth)
```

Dashes indicate that a condition has been eliminated (found to be irrelevant)

C. Finding redundant terms:

		Terms to be Covered (Rows with Outcome = 1)							
		0100	1100	0101	1101	0011	1011	0111	1111
Simplified Terms (from B)	-10-	x	x	x	x				
	-1-1			x	x			x	x
	--11					x	x	x	x

D. Final results (logically minimal):

$$U = L \cdot h + H \cdot G$$

Lower-case letters indicate condition must be absent.
Upper-case letters indicate that condition must be present.
Multiplication (•) indicates combined conditions (logical *and*).
Addition (+) indicates alternate combinations (logical *or*).