Workshop

An Introduction to Necessary Condition Analysis (NCA)

Core Concepts and Latest Developments

Dr. Stefan Breet

Assistant Professor of Strategy and Entrepreneurship,
Radboud University Nijmegen

Member of the NCA Development Team

Tilburg University
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Part 1: Basics of NCA – Logic and Methodological Application (1 Hour)

1.1 Introduction to Necessary Condition Analysis (NCA)

1.2 Theoretical Logic of NCA

1.3 Methodological Application of NCA

Part 2: Discussion

Wrap-up

NECESSARY CONDITION ANALYSIS

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NECESSARY CONDITION ANALYSIS

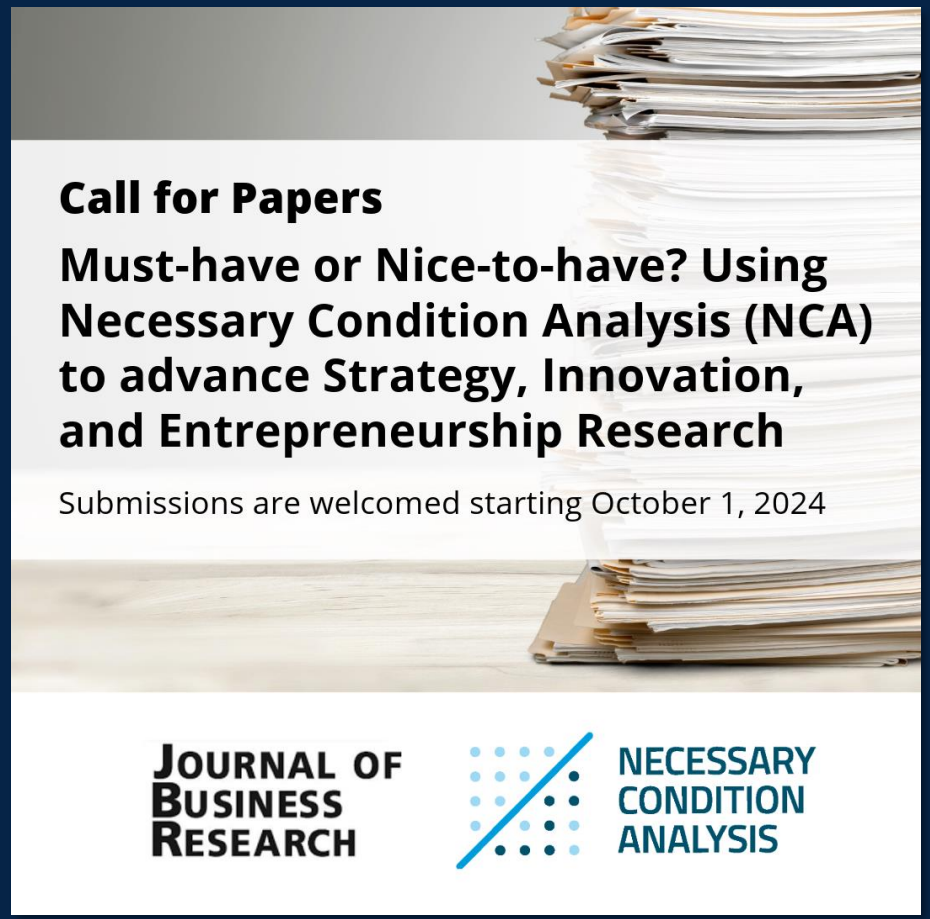
This Workshop in Context

- The **NCA Community consists** of **Experts**, **Researchers**, and **Teachers** who develop, apply, and teach Necessary Condition Analysis (NCA).
- The NCA Community organizes several **online** and **offline events**.
- We give a Professional Development Workshop at the **Academy of Management Annual Meeting** since 2018.
- We give workshops at other conferences too, such as the Strategic Management Society Annual Meeting.
- You are welcome to **join the NCA community** at www.erim.nl/nca.

NECESSARY CONDITION ANALYSIS

Coming up: JBR Special Issue on NCA

- Studies within **the strategic management**, **innovation**, and **entrepreneurship** literatures that consider **necessary conditions**, **bottlenecks**, or **constraints** for important **organizational outcomes**.



Today's Goals

After following this workshop, you should be able to:

1. Understand the logic and methodological application of NCA;
2. Identify different types of necessary conditions;
3. Understand the difference between NCA and other methods, such as regression analysis and QCA;
4. Design the outline of an NCA study in your own field.

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NECESSARY CONDITION ANALYSIS

Example of a Necessary Condition Statement

Oxygen is a necessary but not sufficient condition for life on earth.

Tabular Representation of the Statement

Oxygen is a necessary but not sufficient condition for life on earth.

1. The **absence** of oxygen causes the **absence** of life.
2. The **presence** of oxygen is necessary for the **presence** of life.

Outcome		1 **FALSE**	2 **TRUE**
	Life Exists		
	Life Does Not Exist	TRUE	TRUE
		Oxygen is Not Available	Oxygen is Available
		Condition	

Examples in Management Research

Entrepreneurship

- A range of popular gestation (founding) activities are **not necessary** for firm emergence (Arenius et al., 2017).

Human Resource Management

- HRM autonomy is **necessary but not sufficient** for HRM integration (Blom et al., 2022),

Operations and Supply Chain Management

- High levels of trust are **necessary but not sufficient** for successful buyer-supplier relationships (Van der Valk et al., 2016).

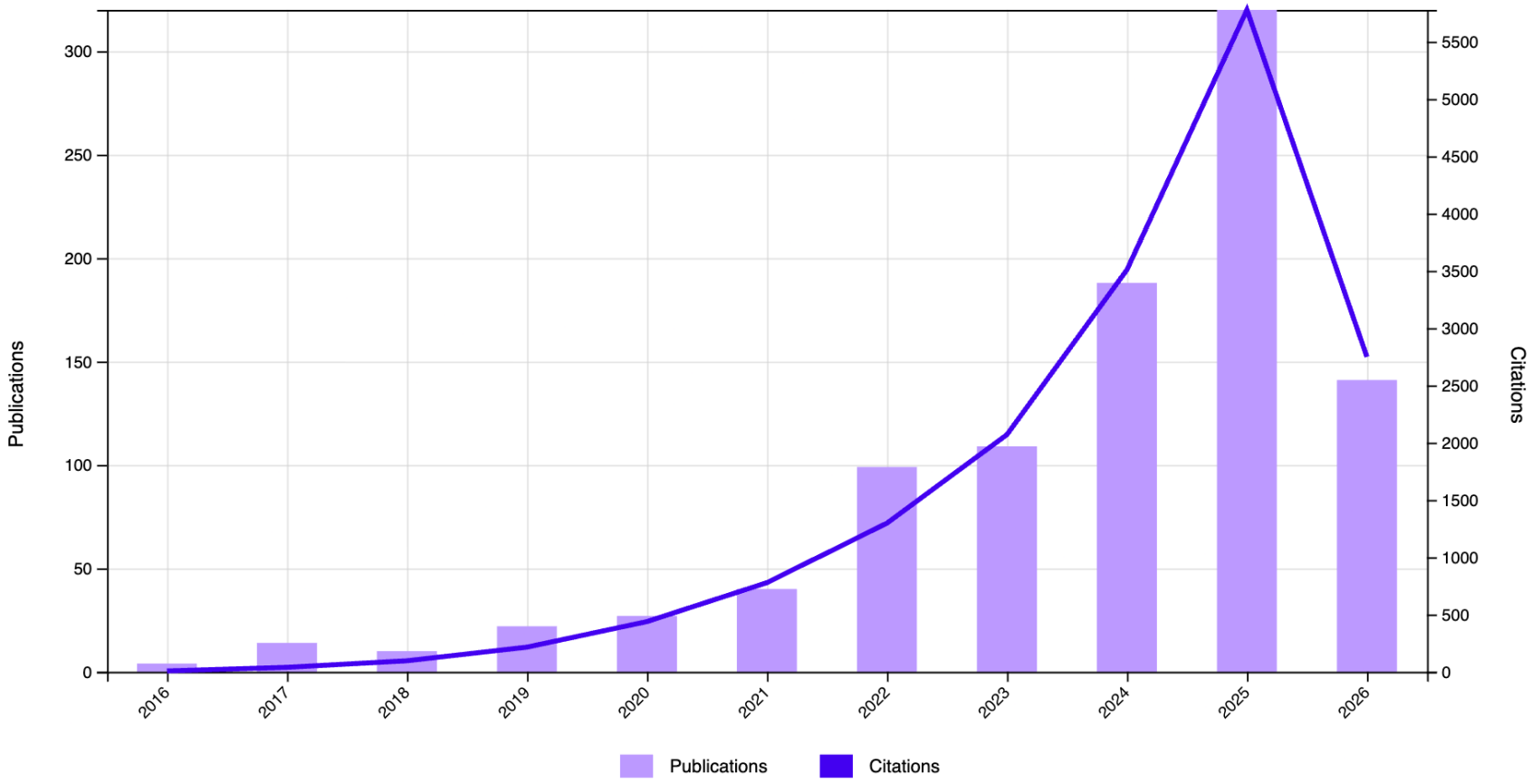
Key Definitions

- A **necessary condition** is a condition that must be present for a particular outcome or event to occur.
- If the necessary condition is not met, the outcome **cannot happen**.
- However, the **presence of a necessary condition** does **not guarantee that the outcome will occur** (i.e., it is **not sufficient**).
- **Necessary Condition Analysis (NCA)** is a research methodology used to identify and quantify necessary conditions in various contexts.

Benefits of NCA for Business & Management Research

- **Theoretical Implications**: NCA offers novel theoretical perspectives on established relationships.
- **Practical Implications**: NCA practitioners focus on the **"need-to-have" or "must-have"** conditions for success (next to or as opposed to the "nice-to-have" factors).
- **Complementary to other methods**: NCA be used alongside traditional analysis to provide a **more comprehensive understanding** of conditions needed for important outcomes.

The Popularity of NCA is Rising



Citations of Dul (2016) recorded in the Web of Science Database (974 citations)

NECESSARY CONDITION ANALYSIS

Most Publications are in Business & Management, but its application is broader than those fields

Citations of Dul (2016) recorded in the Web of Science Database (974 citations)

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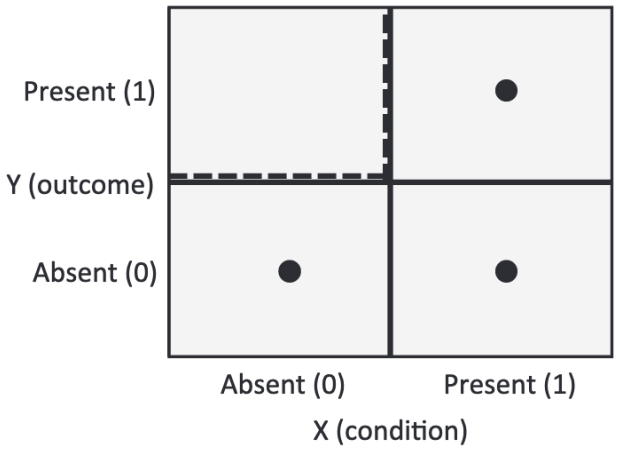
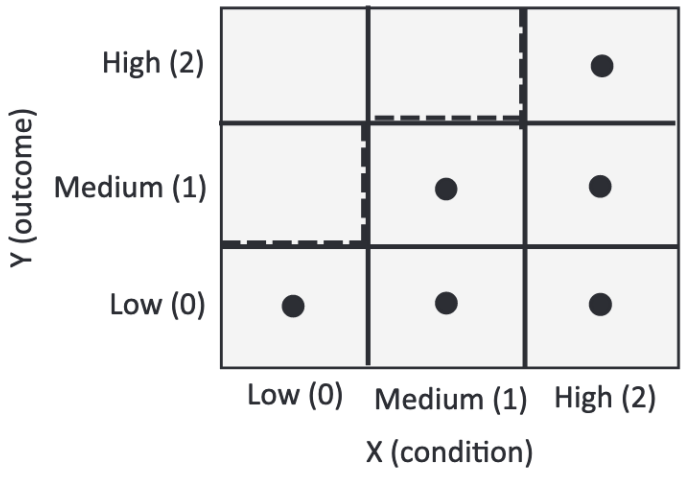
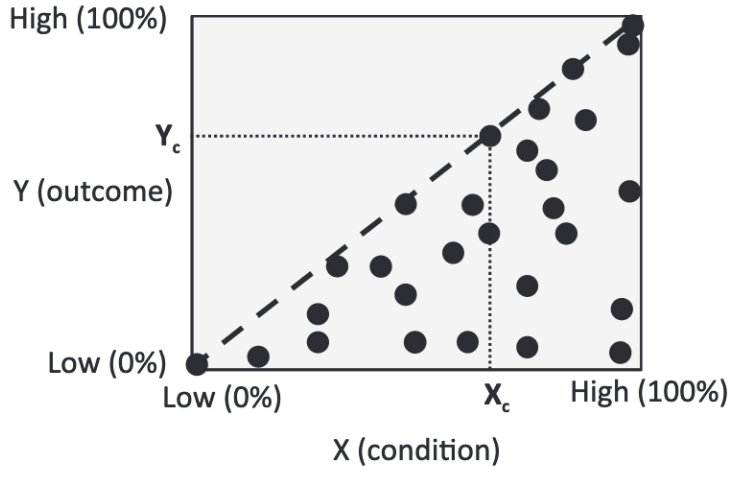
Three Basic Types of Necessary Condition Statements



Dichotomous



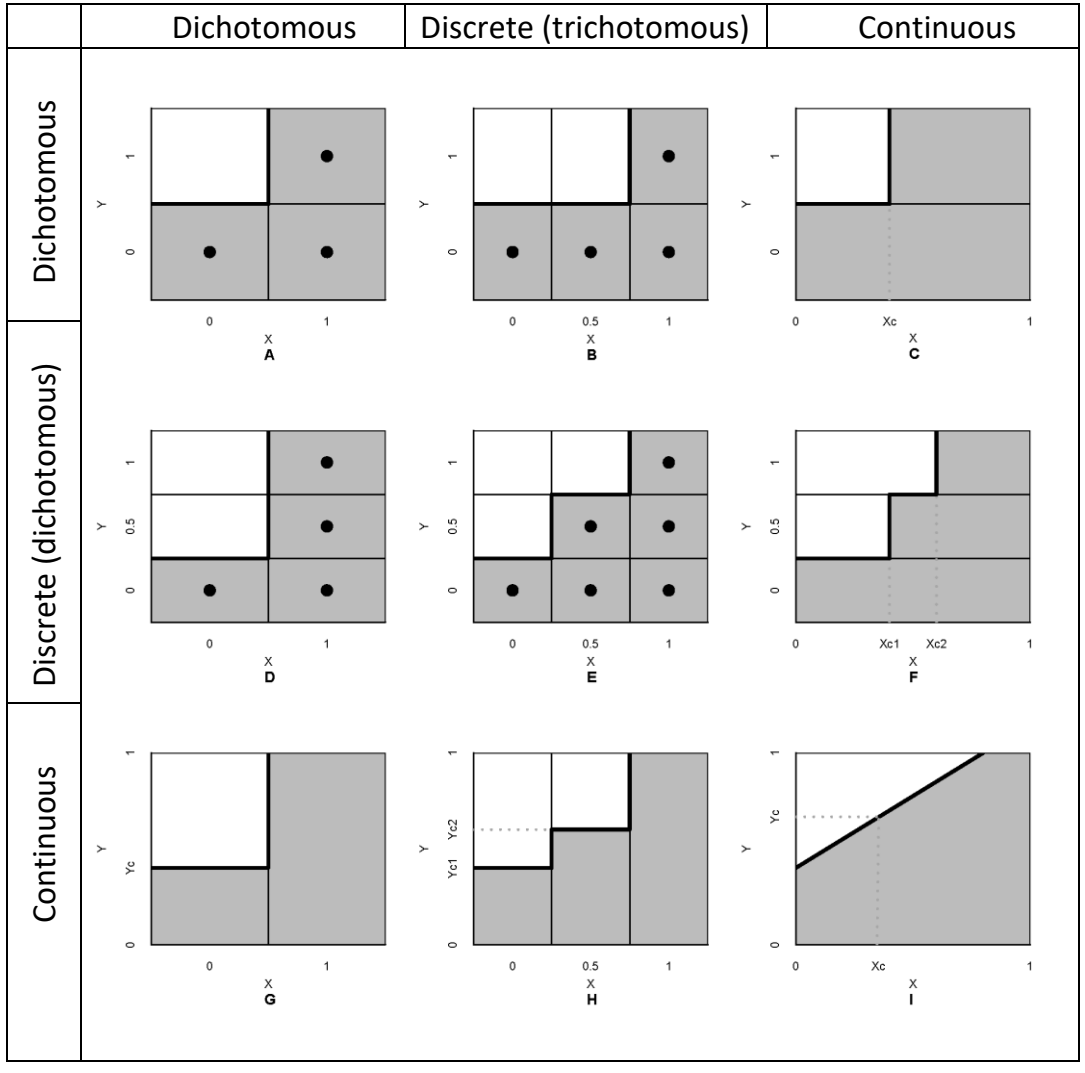
Discrete



Continuous

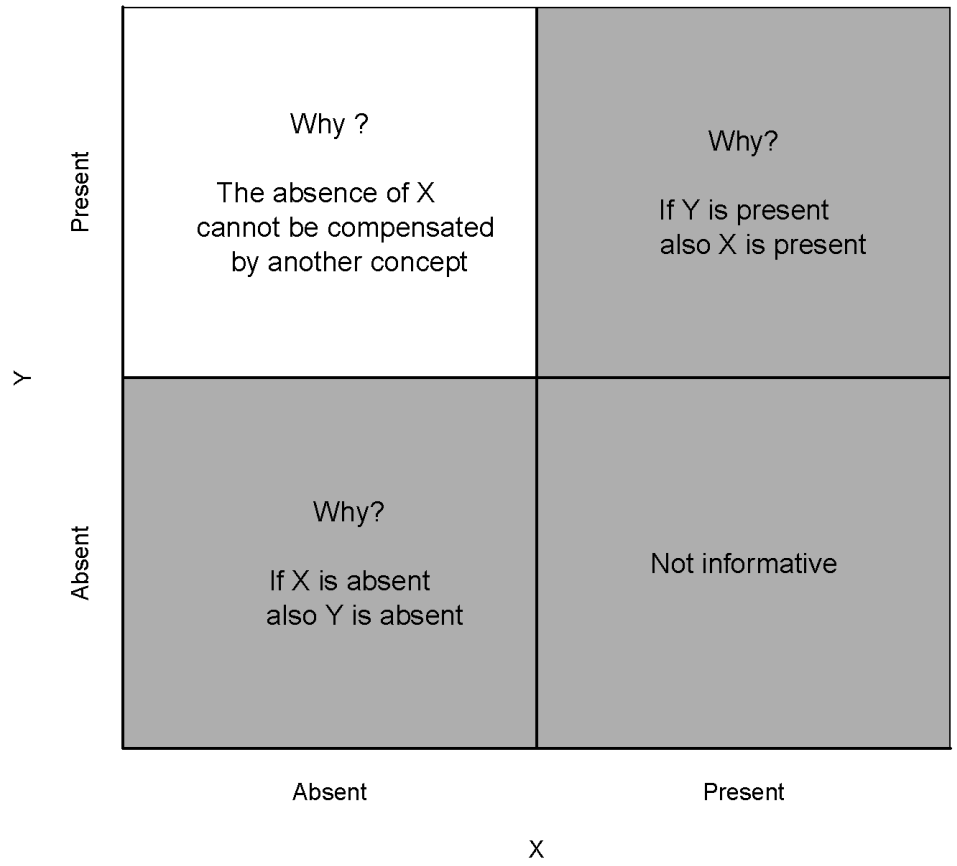
NECESSARY CONDITION ANALYSIS

The 3 Types can be Extended to 9 Combinations of the Condition and the Outcome



NECESSARY CONDITION ANALYSIS

Theoretical Justification of a Necessary Condition

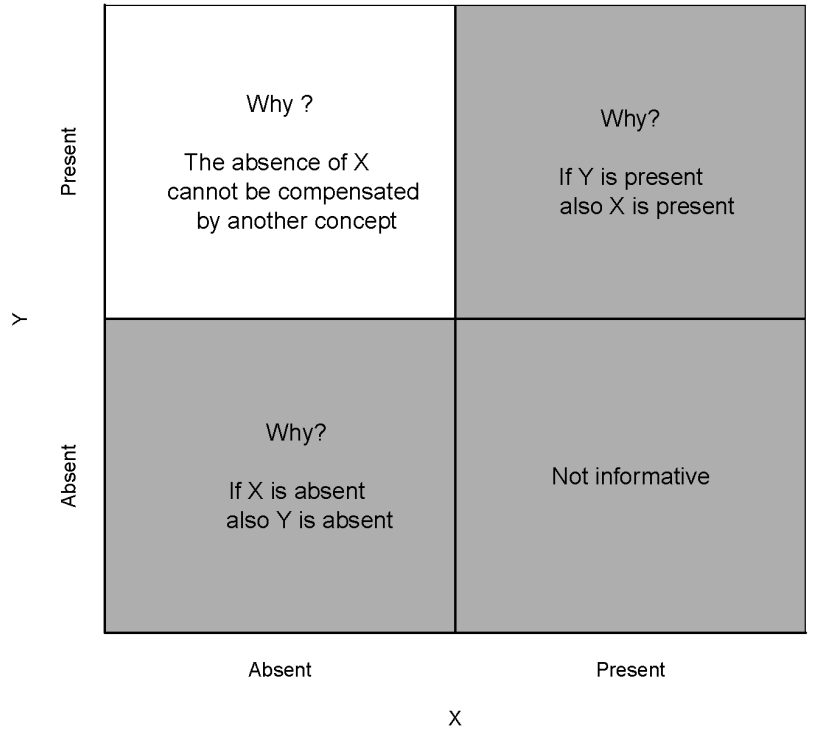


See https://bookdown.org/ncabook/advanced_nca2/theory.html#justification-of-necessity-hypotheses

NECESSARY CONDITION ANALYSIS

Example: Attending the AOM Annual Meeting 2026

- This year's AOM will be in *Philadelphia*, USA.
- One of your colleagues claims the following:
  "Flying to Philadelphia is a necessary but not sufficient condition to attend AOM 2025"
- Is this statement justified?



NECESSARY CONDITION ANALYSIS

Comparison of NCA with other Methods

- **NCA vs. Regression Analysis:** Regression models show how factors increase or decrease **the probability of an outcome**, looking at **average effects** across data.
- **NCA vs. Qualitative Comparative Analysis (QCA)**: QCA identifies combinations of conditions that can **jointly produce an outcome.**

Theory-Method Fit is Important!

Causal Perspective

Method	Probabilistic Sufficiency	Configurational Sufficiency	Necessity
Regression	**Fit**	Misfit	Misfit
QCA	Misfit	**Fit**	Misfit
NCA	Misfit	Misfit	**Fit**

 Slide adapted from Dul (2024).

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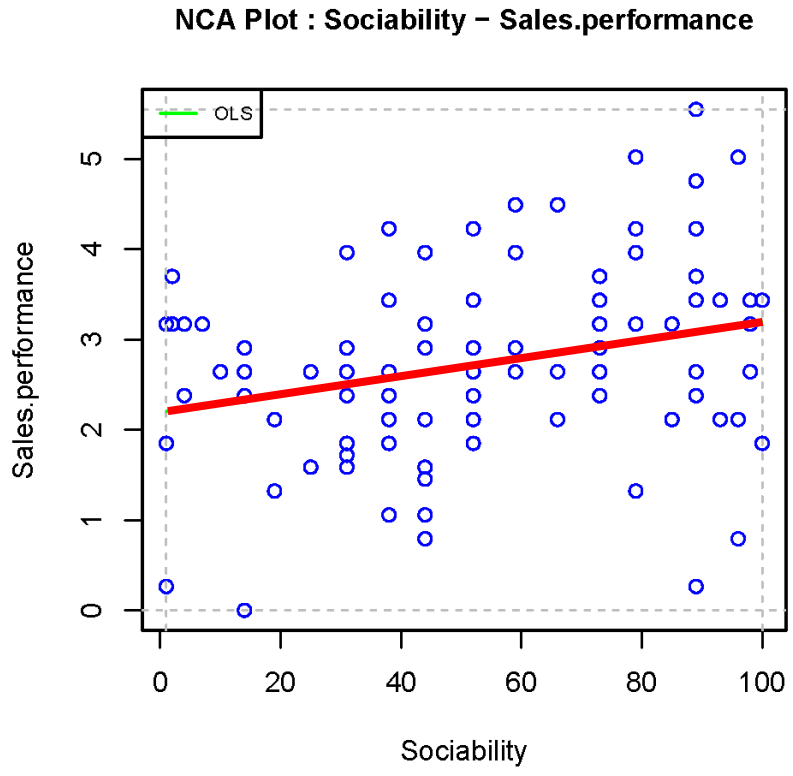
Traditional regression-based analyses measure the average effect.

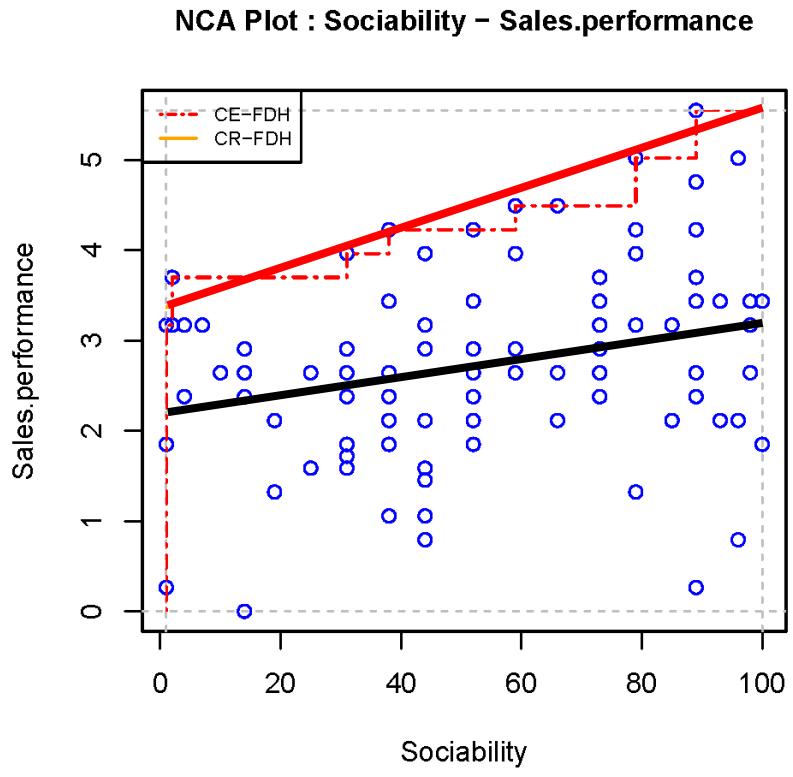
- By drawing a line **through the middle** of the data, a regression line minimizes the sum of the squared residuals.



Data from: Hogan Personality Inventory (HPI) (Hogan, & Hogan, 2007). Slides adapted from Dul (2024).

Necessary Condition Analysis measures the ceiling effect.

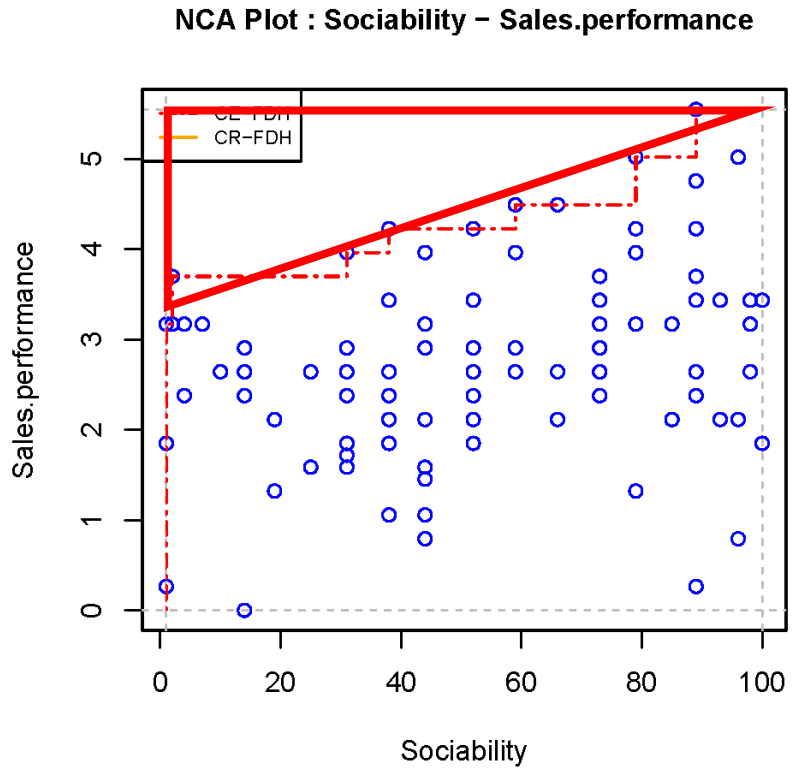
- By drawing a line **on top of the data**, NCA separates the area with observations from the area without observations



Data from: Hogan Personality Inventory (HPI) (Hogan, & Hogan, 2007). Slides adapted from Dul (2024).

The Key Parameters of an NCA Analysis

- **Empty zone**: Ceiling zone (C).
- **Total zone**: Scope (S).
- **Effect size** ***d*** = C/S (0≤ d ≤1).
- **Ceiling accuracy**: percentage of observations on or below the ceiling line



 Data from: Hogan Personality Inventory (HPI) (Hogan, & Hogan, 2007). Slides adapted from Dul (2024).

When is a condition necessary?

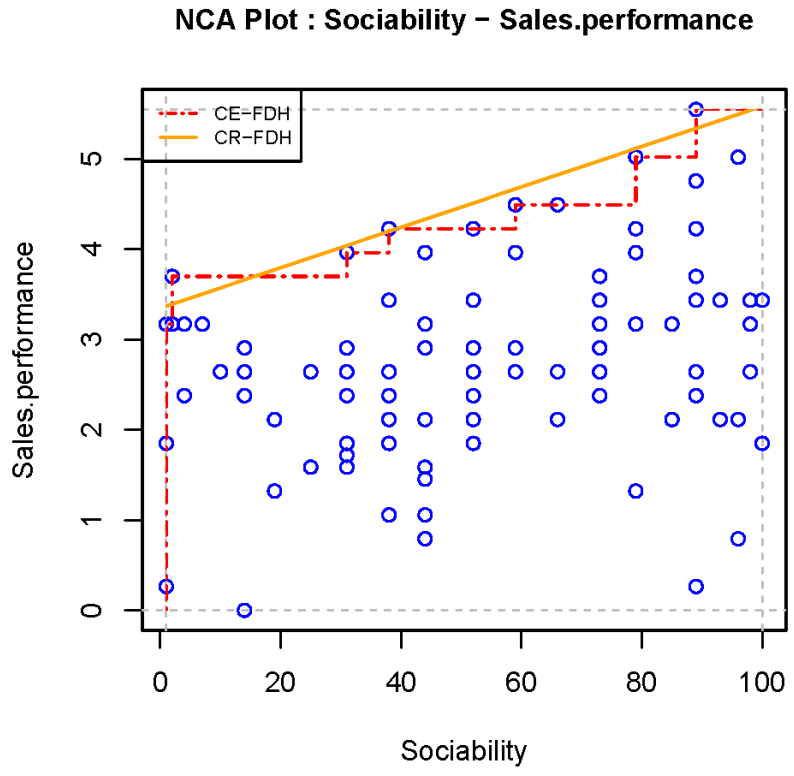
Necessary condition “in kind”:

1. There should be an empty space with **practical significance** (e.g., effect size $d \geq 0.1$).
2. The effect should be **statistically significant** (e.g., p value ≤ 0.05): no random effect of unrelated variables.
3. The effect should be supported with **theoretical arguments**.

Slide adapted from Dul (2024).

Example: The Conditions for High Sales Performance

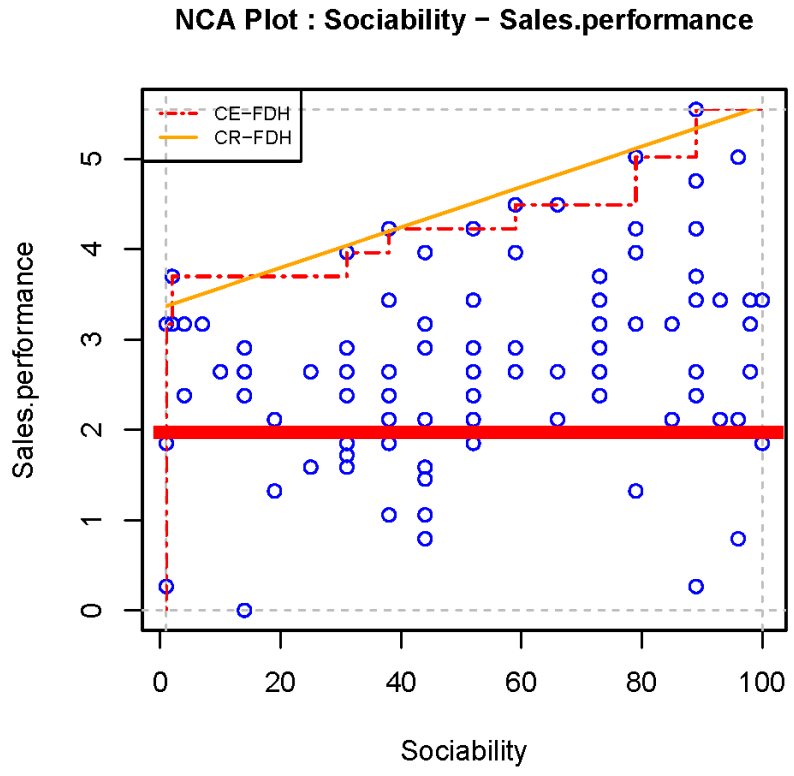
Sales Performance	Sociability
0	NN
1	NN
2	NN
3	NN
4	29
5	74
5.5	98



Data from: Hogan Personality Inventory (HPI) (Hogan, & Hogan, 2007). Slides adapted from Dul (2024).

Sociability is not necessary for achieving a sales performance of 2

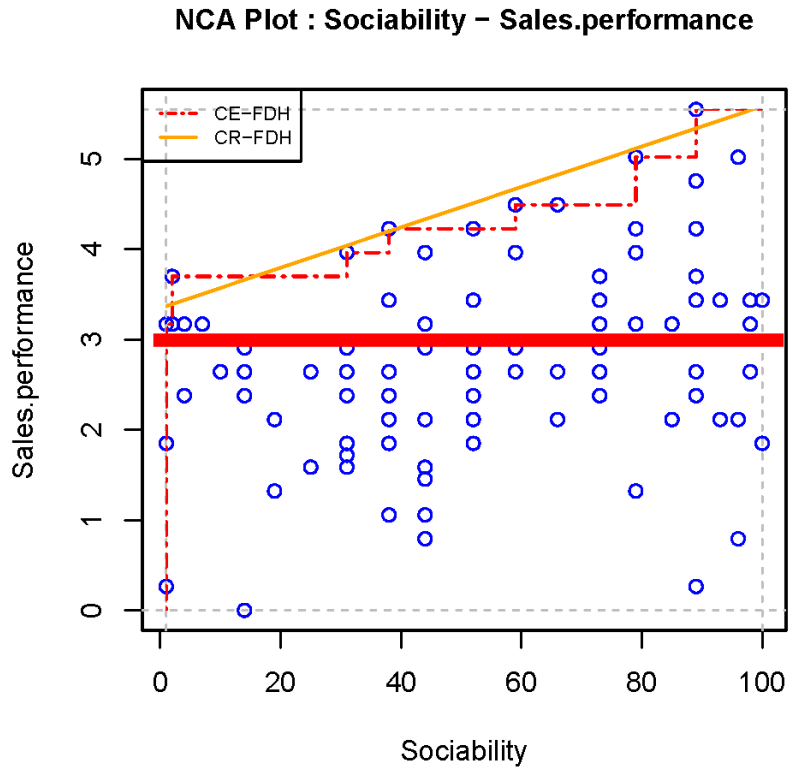
Sales Performance	Sociability
0	NN
1	NN
2	NN
3	NN
4	29
5	74
5.5	98



Data from: Hogan Personality Inventory (HPI) (Hogan, & Hogan, 2007). Slides adapted from Dul (2024).

Sociability is not necessary for achieving a sales performance of 3

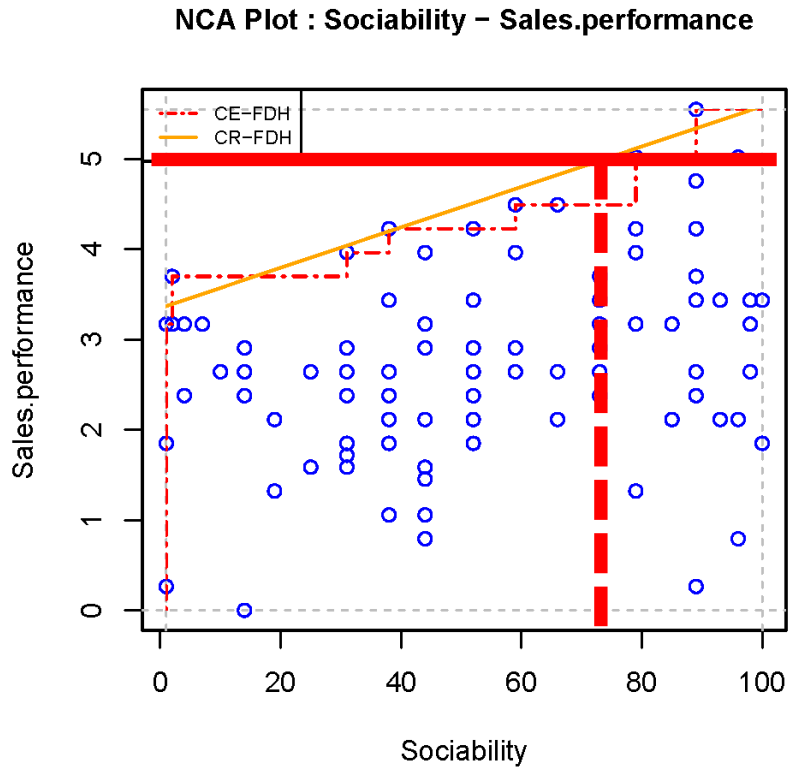
Sales Performance	Sociability
0	NN
1	NN
2	NN
3	NN
4	29
5	74
5.5	98



Data from: Hogan Personality Inventory (HPI) (Hogan, & Hogan, 2007). Slides adapted from Dul (2024).

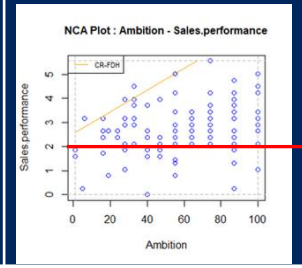
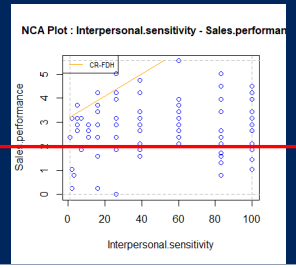
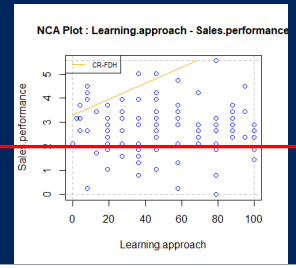
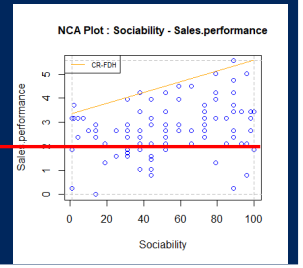
A sociability of 29% is necessary for achieving a sales performance of 4

Sales Performance	Sociability
0	NN
1	NN
2	NN
3	NN
4	29
5	74
5.5	98



Data from: Hogan Personality Inventory (HPI) (Hogan, & Hogan, 2007). Slides adapted from Dul (2024).

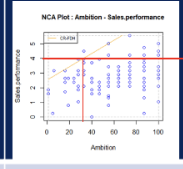
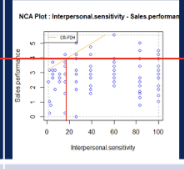
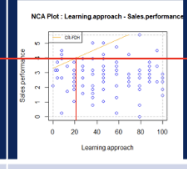
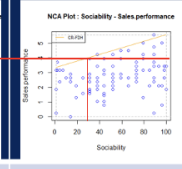
Multiple Necessary Condition Analysis

Sales Performance	Ambition	Interpersonal sensitivity	Learning approach	Sociability
				
0	NN	NN	NN	NN
1	NN	NN	NN	NN
2	**NN**	**NN**	**NN**	**NN**
3	10	NN	NN	NN
4	33	18	21	29
5	55	40	52	74
5.5	67	52	68	98

Data from: Hogan Personality Inventory (HPI) (Hogan, & Hogan, 2007). Slides adapted from Dul (2024).

Multiple Necessary Condition Analysis

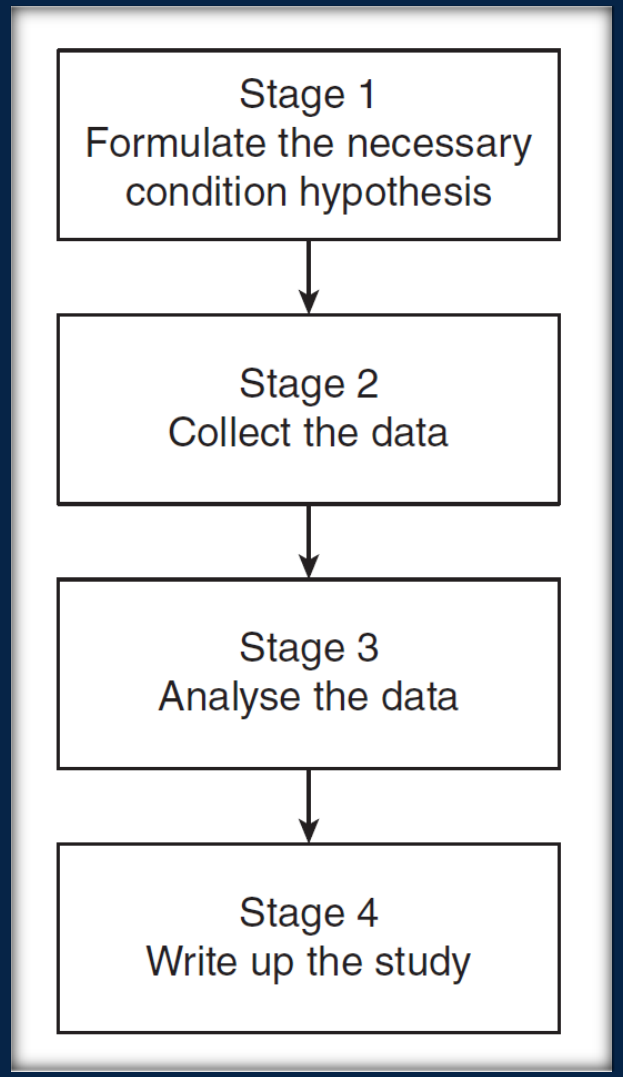
- Important conclusion: to become a top performer, **sociability is critical**!
- Even if you have ambition, a lot of interpersonal sensitivity and a strong learning approach, you will **never be a top performer** if you are **not highly sociable too**.

Sales Performance	Ambition	Interpersonal sensitivity	Learning approach	Sociability
				
0	NN	NN	NN	NN
1	NN	NN	NN	NN
2	NN	NN	NN	NN
3	10	NN	NN	NN
4	**33**	**18**	**21**	**29**
5	55	40	52	74
5.5	67	52	68	98

Data from: Hogan Personality Inventory (HPI) (Hogan, & Hogan, 2007). Slides adapted from Dul (2024).

Designing an NCA study

- The same as any other quantitative study.
- NCA Hypothesis: “X is necessary for Y”.
- Data Collection: High quality data for X and Y (no new or different requirements!).
- Data Analysis: NCA.
- Conclusion: Theoretical and Practical Implications.



Dul, J. (2020) *Conducting Necessary Condition Analysis*. Mastering Business Research Methods Series, London: Sage Publications.

Latest Developments

- NCA is in full development!
- Recent completed developments:
  - Statistical significance test.
  - Stata Package
- New developments in progress:
  - Outlier analysis
  - Robustness checks.
  - Sampling and case selection strategies.

Recap of Part 1

- A **necessary condition** is a condition that must be present for a particular outcome or event to occur. If the necessary condition is not met, the outcome **cannot happen**.
- **Necessary Condition Analysis (NCA)** is a research methodology used to identify and quantify necessary conditions in various contexts.
- NCA is useful for management researchers because of its **theoretical** and **practical** relevance.
- Necessary condition statements can have **different forms** (dichotomous, discrete, and continuous).
- NCA draws a **ceiling line** on top of the data to separate the area with observations from the area without observations.

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NECESSARY CONDITION ANALYSIS

Instructions

- Identify possible necessary conditions for the outcome you are studying in your own research.
- Formulate potential necessary condition hypotheses.
- Think about the theoretical logic underpinning the hypotheses.
- Discuss with your group how you would collect and structure data for the analysis.

Write down any questions you have, difficulties you encounter, and potential opportunities you see.

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Useful NCA Resources

- The NCA website: www.erim.nl/nca.
- Online book: Dul, J. (2021). *Advances in Necessary Condition Analysis*. https://bookdown.org/ncabook/advanced_nca2/
- Accessible introduction: Dul, J. (2019). *Conducting necessary condition analysis for business and management students*. Sage Publications.
- Online courses: Coursera; INSTATS.
- Software: `NCA` R package, `nca` Stata package.
- Guidelines: Dul, J., Hauff, S., & Bouncken, R. B. (2023). Necessary condition analysis (NCA): Review of research topics and guidelines for good practice. *Review of Managerial Science*, 17, 683–714.