



MICRO-MACRO MODELS IN SOCIOLOGY: ANTECEDENTS OF COLEMAN'S DIAGRAM

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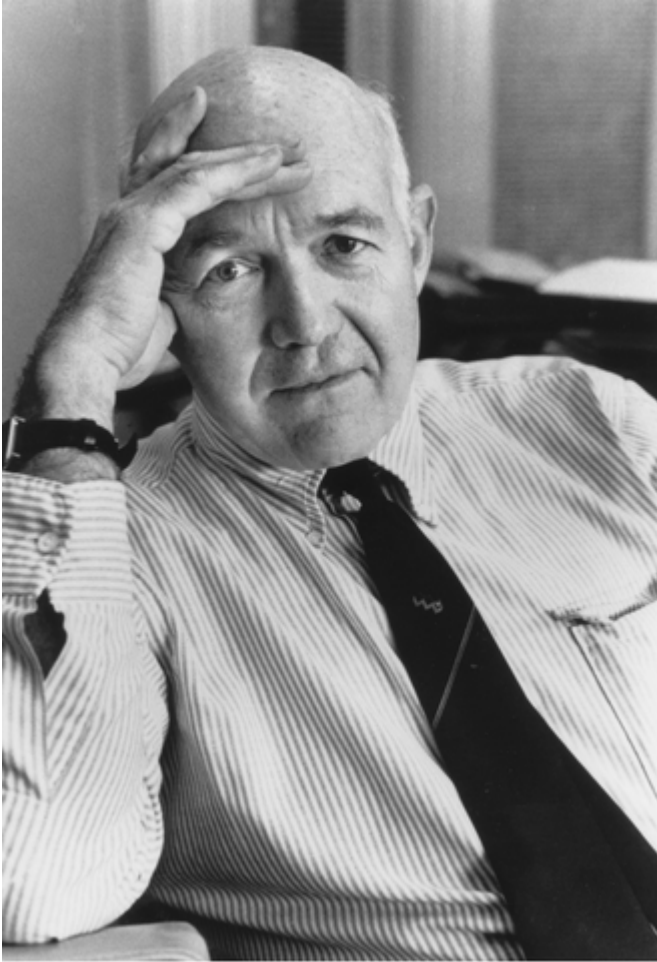
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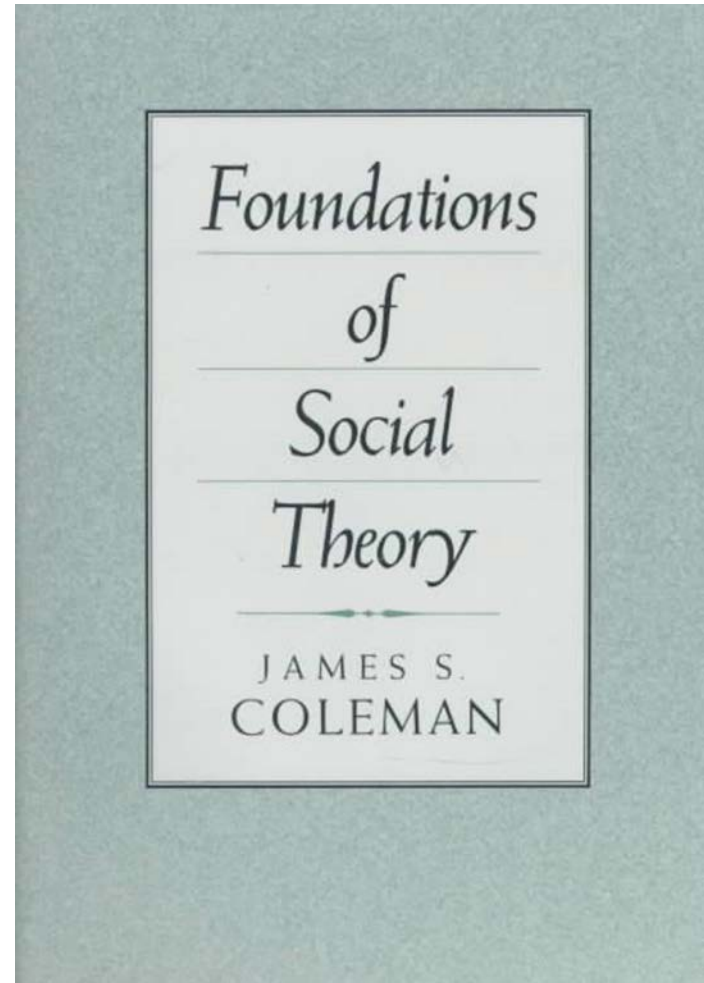
**Rational Choice Sociology: Theory and Empirical Applications
Venice, November 21-24, 2016**

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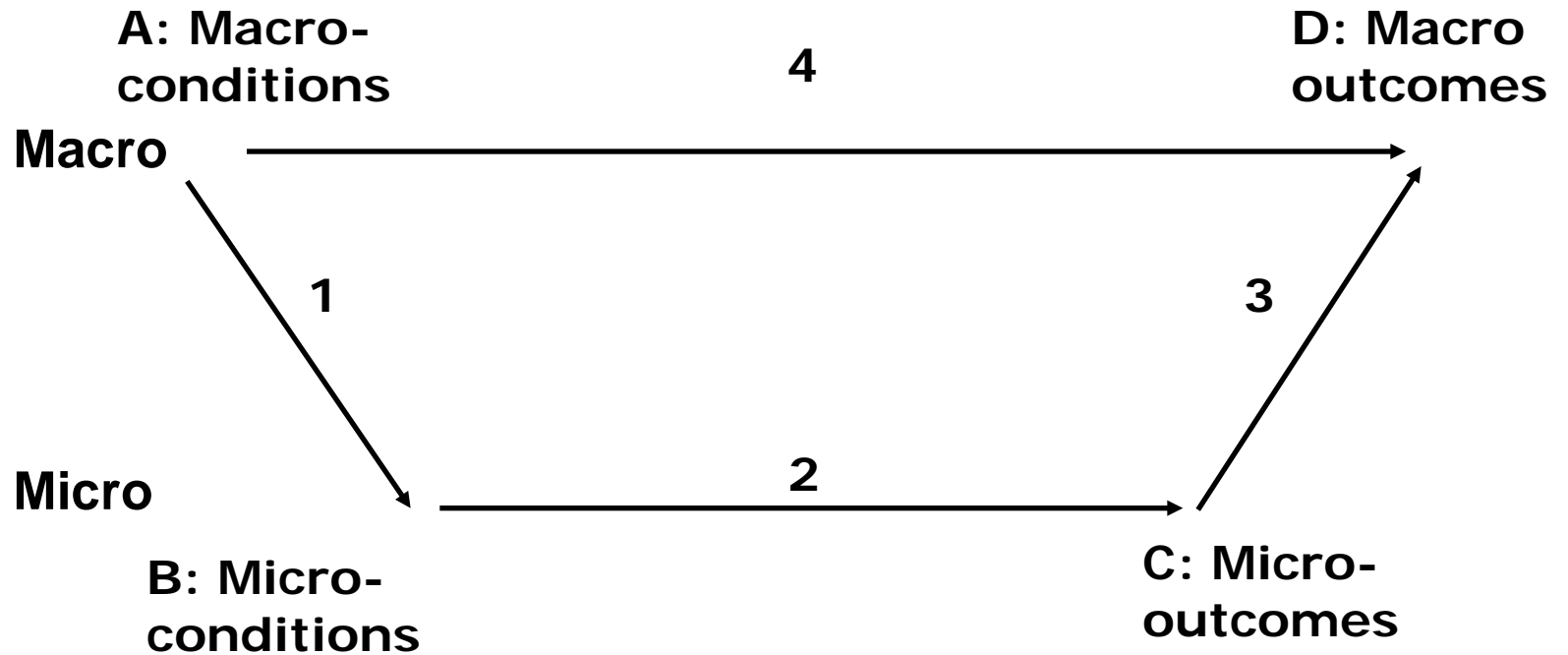
James S. Coleman



James S. Coleman



Coleman's diagram



1: Bridge assumptions

2. Theory of action

3. Transformation rules

4. Macro-regularities

Micro-macro explanations

- **Sociological explananda: macro-outcomes (Node D) and macro-level regularities (Arrow 4)**
- **Macro-level: collective phenomena, i.e., properties of social systems (e.g., dyad, triad, family, city, business firm, school, society)**
- **Micro-level: properties of individuals (e.g., preferences, information, behavior)**
- **Sociological explanations: macro-explananda are derived from assumptions on**
 - **regularities of individual behavior (Arrow 2); theory of action such as RC, GT, “softer versions” of such theories**
 - **bridge assumptions (Arrow 1) on how macro-conditions affect the “independent variables” on the micro-level**
 - **transformation rules (Arrow 3) on how actors’ behavior generates macro-outcomes**

Example: Coleman's reconstruction of Weber's thesis

E.g., Coleman, *Foundations of Social Theory*, p. 8

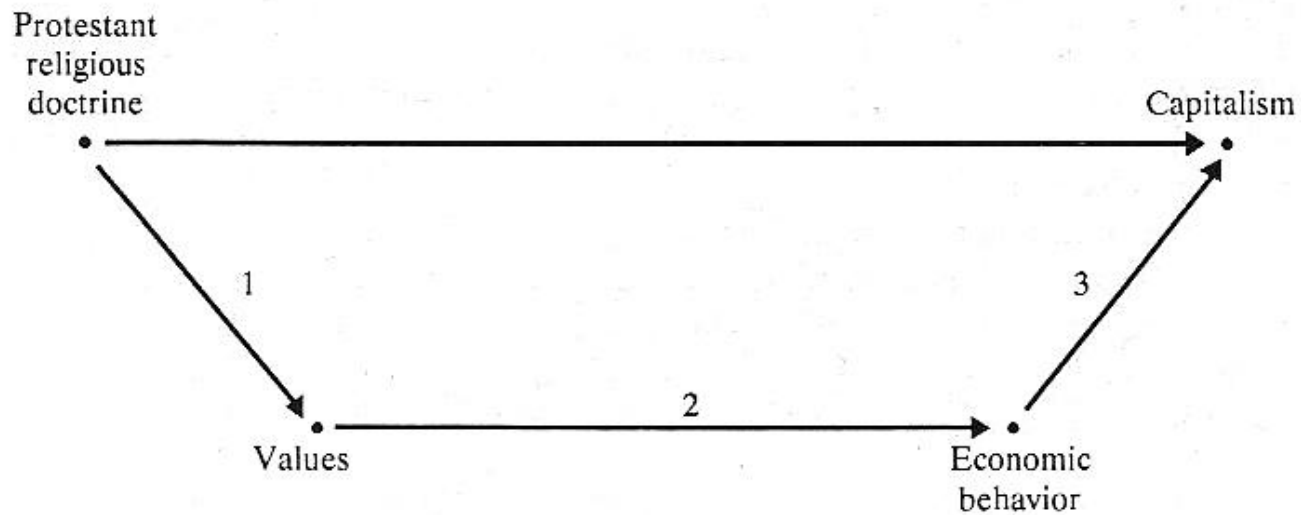


Figure 1.2 Macro- and micro-level propositions: effects of religious doctrine on economic organization.

Foundations of Social Theory
and Coleman's diagram:
Impact

Foundations of Social Theory

- Core contribution to Rational Choice approach in sociology
- Core feature: Coleman's micro-macro diagram
- Impact as indicated by citations (Google Scholar, November 19, 2016)

- *Foundations of Social Theory*: > 28.800

Compare with:

- Gary Becker, *The Economic Approach to Human Behavior*: > 6.700
- Peter Hedström, *Dissecting the Social. On the Principles of Analytical Sociology*: > 1.100

Textbooks

Esser, *Soziologie: allgemeine Grundlagen*

Hartmut Esser

Soziologie

Allgemeine Grundlagen

Campus Verlag
Frankfurt/New York

- **Logik der Situation (a),
Selektion (b), Aggregation (c)**

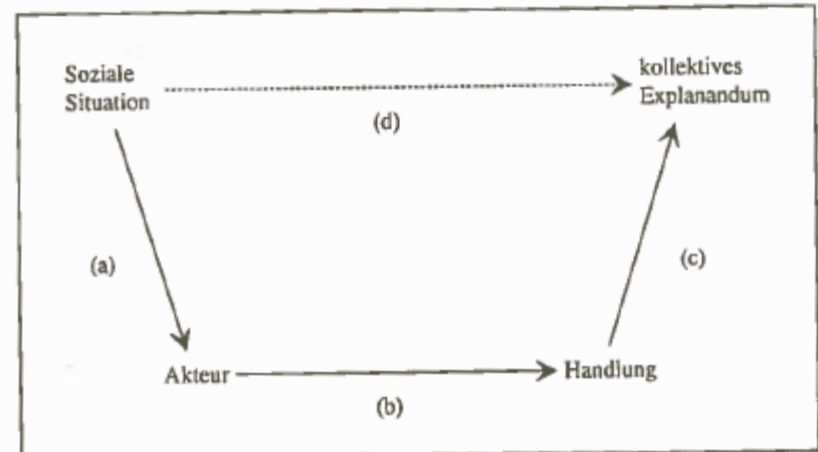


Abb. 6.1: Das Grundmodell der soziologischen Erklärung

Coleman's scheme and analytical sociology

Dissecting the Social

On the Principles of Analytical Sociology

Peter Hedström

University of Oxford

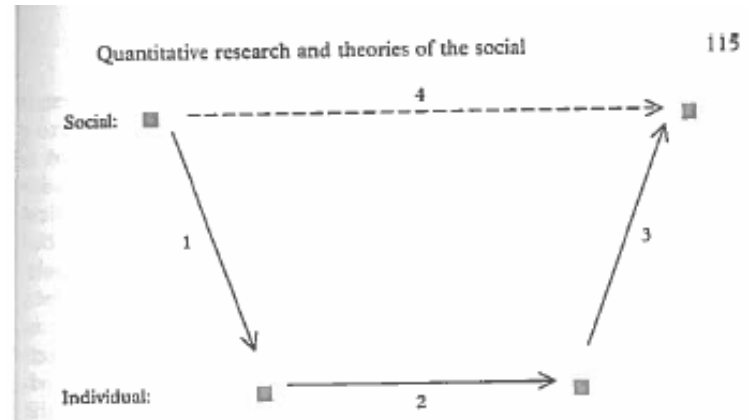


Figure 6.1. Coleman's micro-macro graph.

assumed to be operating, except, of course, that the mechanism in some way or other must be action-related. Unlike rational-choice theory, agent-based modelling is not a specific theory of action or interaction. It is a methodology for deriving the social outcomes that groups of interacting actors are likely to bring about whatever the action logics or interaction structures may be.

Coleman's (1986b) so-called micro-macro graph can be used for describing how quantitative research and agent-based modelling can complement one another (see figure 6.1). As emphasized in previous chapters, sociology is not a discipline concerned with explaining the actions or behaviours of single individuals. The focus is on larger-scale *social* phenomena characterizing groups of actors or collectivities. But the properties of these social phenomena and changes in them over time

John Goldthorpe, *Sociology as a Population Science* (2016)

Sociology as a Population Science

JOHN H. GOLDTHORPE
Nuffield College, Oxford

- “The initial aim was to investigate, and to establish, the probabilistic regularities that characterise a particular population, or its appropriately defined subpopulations.” (→ macro-regularities, Arrow 4)
- “[...] the further aim of a population science had to be that of determining the processes or ‘mechanisms’ which *in their operation at the individual level* actually produced these regularities.” (→ micro-macro model)

(Goldthorpe 2016: 8; emphasis in original)

Impact in other social sciences: example demography

Population Studies, 2015
Vol. 69, No. S1, S11–S20, <http://dx.doi.org/10.1080/00324728.2015.1009712>



Integrating macro- and micro-level approaches in the explanation of population change

Francesco C. Billari
University of Oxford

Demographers study population change across time and place, and traditionally they place a strong emphasis on a long-range view of population change. This paper builds on current reflections on how to structure the study of population change and proposes a two-stage perspective. The first stage, discovery, focuses on the production of novel evidence at the population level. The second stage, explanation, develops accounts of demographic change and tests how the action and interaction of individuals generate what is discovered in the first stage. This explanatory stage also provides the foundation for the prediction of demographic change. The transformation of micro-level actions and interactions into macro-level population outcomes is identified as a key challenge for the second stage. Specific instances of research are discussed.

Keywords demographic research; theory; life course; micro–macro; discovery; explanation

Introduction

Demographers study population change across time and place, and traditionally they place a strong emphasis on a long-range view of population change. In this paper, I address two questions about the strategy of studying this phenomenon. First, should the study of population change be anchored solidly at the macro level of populations as located in time and place? Second, should we consider the micro level of individual actions and interaction that bring about demographic change to be outside the core realm of demography? Building on current and

the production of demographic evidence is grounded in formal demographic measurement, which at times might require spatial or temporal statistical modelling, or both. ‘Discovering’ population trends and patterns is a macro-level challenge, albeit ultimately based on the collection of micro-level data.

Informed by evidence produced in the first stage, the second stage in demographic inquiry should be aimed at explaining population change and predicting its future development. For this second, *explanation*, stage, a micro-level ‘life-course’ theoretical and empirical framework is essential in order to explain what has been discovered. The use of the

events or the prevalence of demographically relevant behaviour among individuals or couples) is studied as a function of macro-level factors (Entwisle et al. 1984, 1986; Entwisle 2007). Action-formation mechanisms have implicitly been invoked in life-course analyses of demographic behaviour, in which micro-level outcomes are studied as a function of the past history of individuals (embedded in a macro context), and in event-history analysis (Hobcraft and Murphy 1986; Courgeau and Lelièvre 1992), generalized to outcomes that are more general than the timing of events as life-course analysis (Billari 2003).

Transformational (micro→macro) mechanisms in demography

Mortality

The formidable improvement in survival triggered by the demographic transition and its aftermath has contributed to a renewed interest in the determinants of age patterns of mortality and their changes over time. In this area, the study of mortality and longevity through the lens of ‘frailty’ is an important example

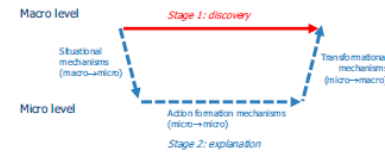


Figure 1 The two-stage view of demography (adapted from Hedström and Swedberg 1998 and the original diagram by Coleman 1986)

Rest of the presentation

Basically: “history of ideas”

1. History of the diagram in Coleman’s own work
2. Predecessors of Coleman’s diagram
 - McClelland 1961
 - Von Wright 1971
 - Structural individualism in European sociology
 - Hummell & Opp 1971; Hummell 1973
 - Lindenberg 1977
 - Boudon 1979 and Hernes 1976
 - Diekmann 1980
3. Some speculation: why Coleman never mentioned the predecessors and why they are largely forgotten

History of the micro-macro diagram in Coleman's own work

Development of the theoretical program of *Foundations...* in Coleman's own work

- Coleman's micro-macro model is closely related to his rational choice-program
- This program has two antecedents in Coleman's own work:
 1. Ideas in Coleman (1964) *Introduction to Mathematical Sociology*, specifically "synthetic theories": "they begin with postulates on the individual level and end with deductions on the group level" (1964: 41)
 2. His formal theory of social exchange and collective decisions, see, e.g., *Collective decisions* (1964) and *The Mathematics of Collective Decisions* (1973)

First publication of Coleman's diagram

MICRO FOUNDATIONS AND MACROSOCIAL BEHAVIOR

James S. Coleman

The first appearance is *not* in Coleman's programmatic 1986 *AJS*-paper 'Social theory, social research, and a theory of action,' but seemingly in 1984 in a hard to retrieve German journal *Angewandte Sozialforschung* (*Applied Social Research*)

A central problem in sociology is the problem of accounting for the functioning of some kind of social system. Yet in most sociological research, observations are not on the system as a whole, but on some part of it. In fact, the most natural unit of observation is the individual person; and in the development of quantitative methods of research, the dependence on individual-level data, most often in the form of interviews, sometimes in the form of administrative records of behavior, and sometimes in still other form, has increased greatly. This has led, within the discipline, to a widening gap between theory and research: Social theory continues to be about the functioning of social systems of behavior, while empirical research - particularly quantitative research, is largely concerned with explaining individual behavior.

This focus on individual behavior as the thing to be explained is not completely misplaced in sociology, nor is it new. For example, one of the sociological

papered over with the idea of "aggregation", and with a ubiquitous concept in macro-economic theory, the "representative agent".

What I want to do in this paper is to show some of the problems involved in making a proper micro-to-macro transition, to point to some instances of its having been done, and to indicate steps toward doing so in some areas where it has not been successfully done. In the process of doing these things, I will discuss Protestantism and the rise of capitalism, theories of revolution, economic markets, marriage markets, labor force problems and job markets, panics, and collective decisions.

To see something about what is involved in making a proper transition from micro to macro, I will turn first to an instance in which it was not done properly. The example is another classic in sociology, Max Weber's THE PROTESTANT ETHIC AND THE SPIRIT OF CAPITALISM:

...there is quite generally, in economics, there is micro-economic theory, and there is macro-economic theory; and one of the central deficiencies in economic theory is the weakness of the linkage between them, a weakness which is

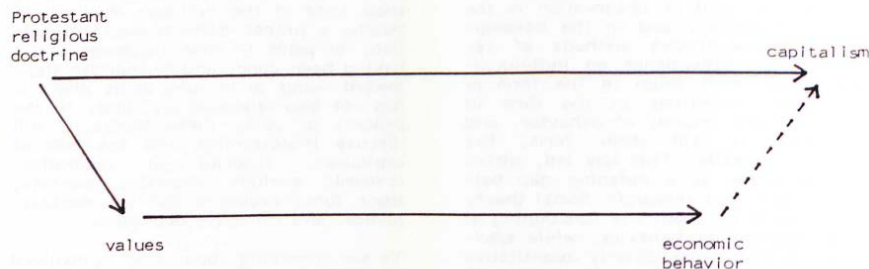
different.

2. Individuals with certain values (referred to in 1 above) adopt certain kinds of orientations to economic behavior.

Angewandte Sozialforschung, Jg. 12, 1/2 1984

25

FIGURE 1:



The diagram in Coleman's works

- Coleman, J.S. (1984) "Micro foundations and macrosocial behavior." *Angewandte Sozialforschung* 12(1/2): 25–37
 - Background: the paper is a preliminary version of Coleman 1987 that appeared in an edited volume based on papers presented at a 1984 conference at Schloss Rauschholzhausen, Giessen, Germany. In the 1980's, Coleman quite regularly visited the University of Erlangen-Nürnberg, Germany, and presented work in progress. His host was Henrik Kreutz. *Angewandte Sozialforschung* was edited by Henrik Kreutz. Most likely, Coleman presented his paper in Nürnberg directly before or after the Schloss Rauschholzhausen conference
- --- (1986) "Social theory, social research, and a theory of action." *American Journal of Sociology* 91(6): 1309–1335
- --- (1986) "Micro foundations and macrosocial theory." Pp. 345–363 in *Approaches to Social Theory*, edited by Siegwart Lindenbergh, James S. Coleman, and Stefan Nowak. New York: Russell Sage
- --- (1987) "Microfoundations and macrosocial behavior." Pp. 153–73 in *The Micro-Macro Link*, edited by Jeffrey C. Alexander, Bernhard Giesen, Richard Münch, and Neil J. Smelser. Berkeley, CA: University of California Press
- --- (1990) *Foundations of Social Theory*. Cambridge, MA: Belknap Press of Harvard University Press, Chapter 1

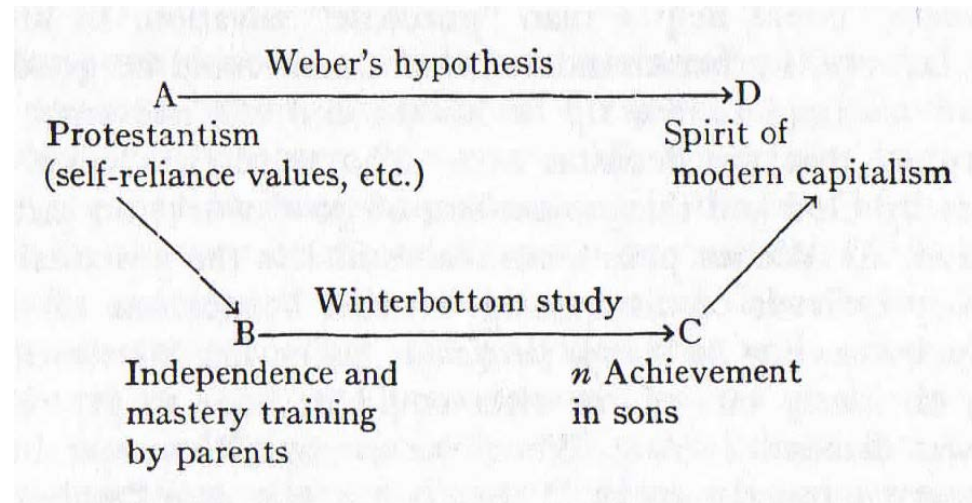
Predecessors of Coleman's diagram

McClelland on Weber

On p. 47 in his *The Achieving Society* (1961!), the psychologist McClelland used a diagram exactly like Coleman's for a summary reconstruction of Weber's argument on protestantism and the emergence of capitalism

THE ACHIEVING SOCIETY

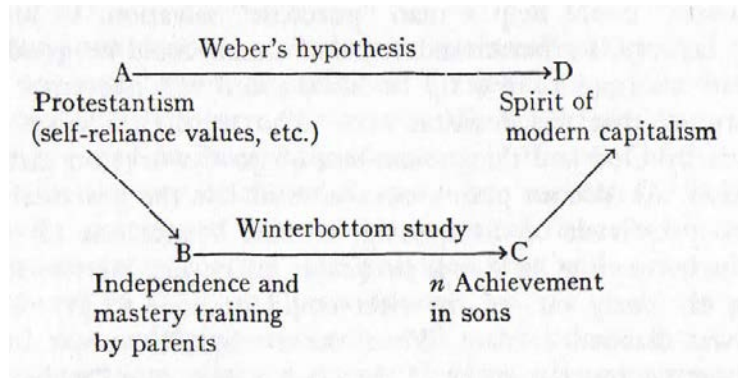
David C. McClelland



THE FREE PRESS
A Division of Macmillan Publishing Co., Inc.
NEW YORK

McClelland 1961 and Coleman 1984 etc.

McClelland (1961) *The Achieving Society*, New York: Free Press, p. 47



Coleman 1990: 8 (see also 1984, 1986, 1987)

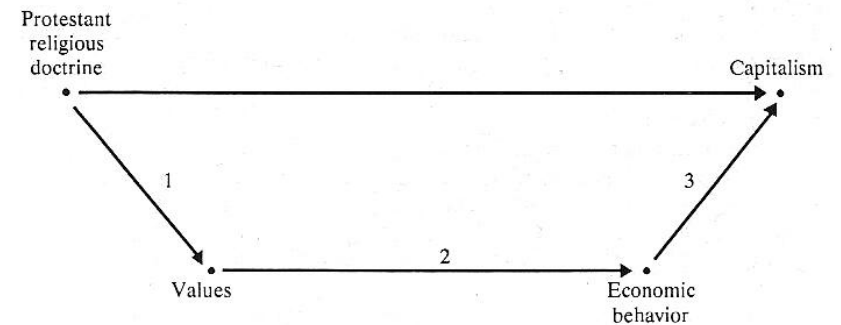
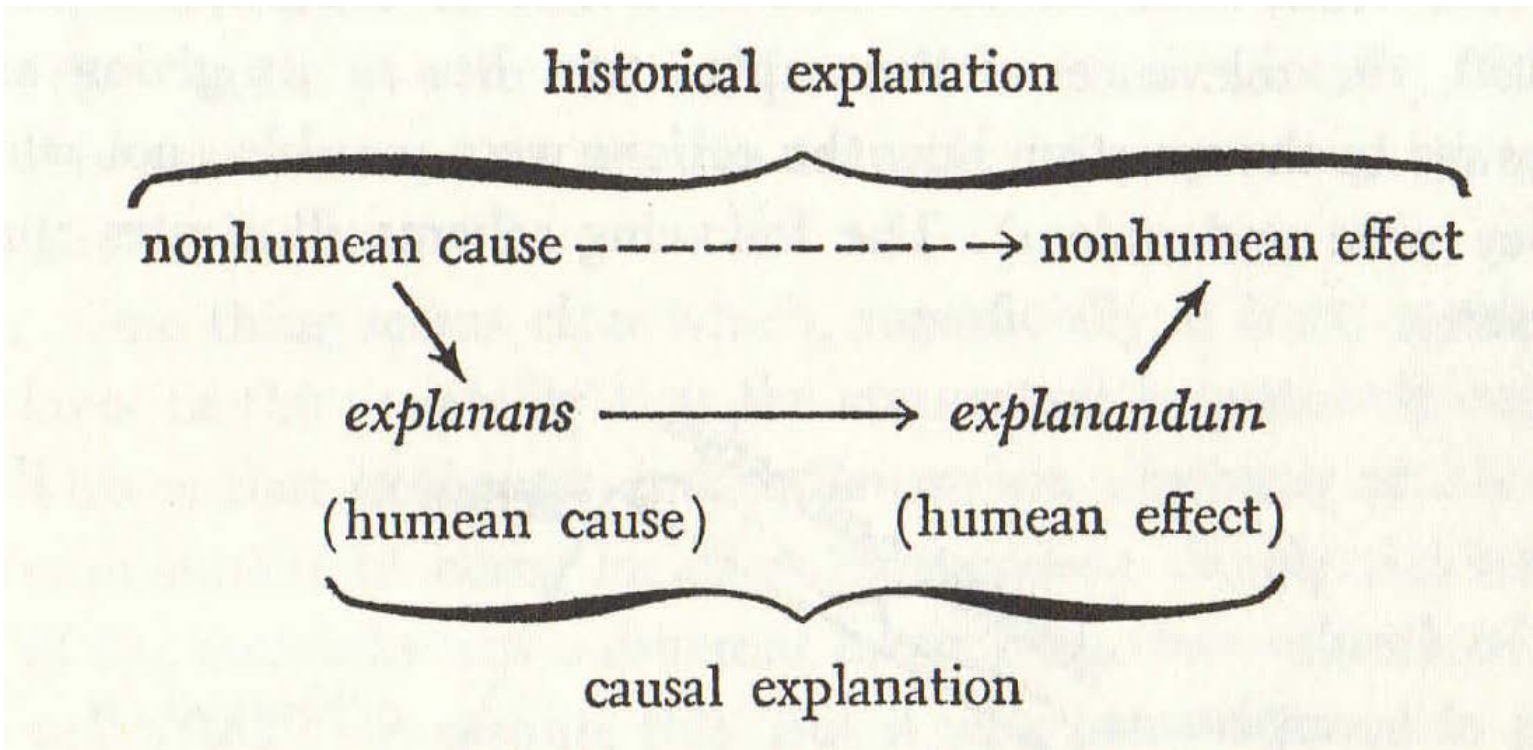


Figure 1.2 Macro- and micro-level propositions: effects of religious doctrine on economic organization.

Wright 1971

In 1971, the philosopher Georg Henrik von Wright used a Coleman-like diagram in *Explanation and Understanding* (London: Routledge, p. 137):



Structural individualism I

- In the 1970s, 'structural individualism' (sometimes: 'explanatory sociology') developed in European sociology (Germany, Netherlands, France)
 - Hans Albert: methodological foundations
 - Viktor Vanberg, Alfred Bohnen: roots of the program in social theory and sociology
 - Hans Hummell, Karl-Dieter Opp, Rolf Ziegler, Siegwart Lindenberg Reinhard Wippler, Raymond Boudon, Hartmut Esser: theoretical studies, formal features of micro-macro modeling, empirical research
- Note: most of the literature in German, Dutch, French (it was a period when publishing in English was less common in continental Europe; but that doesn't mean that this literature doesn't exist...)

Structural individualism II:

Core of the program

- **Sociology as a problem- and theory-guided discipline, aiming at the explanation of social (macro) phenomena and macro-regularities**
- **Focus on model-building, rigorous theoretical arguments**
- **Focus on testable implications; integration of theory and empirical research**
- **Methodological individualism → focus on micro-macro modeling**
- **Focus on the methodological unity of the social sciences; keen eye on and import of insights from similar approaches in other social science disciplines such as economics and political science**
- **In quite some respects: analytical sociology *avant la lettre* (although with much less attention on handsome and clever 'marketing' of such an approach)**

Predecessors of Coleman's diagram in structural individualism

- Hummell & Opp 1971
- Lindenberg 1976, 1977
- Boudon 1979 and Hernes 1976
- Diekmann 1980

Overview and discussion: Raub & Voss (1981)
Individuelles Handeln und gesellschaftliche Folgen. Das individualistische Programm in den Sozialwissenschaften [Individual Action and Societal Level Implications], Darmstadt: Luchterhand, chaps. 2–4

Hummell & Opp 1971: Reducing sociological to psychological theories

- Brief summary (1968):

Inquiry, 11, 205–26

SOCIOLOGY WITHOUT SOCIOLOGY

THE REDUCTION OF SOCIOLOGY TO PSYCHOLOGY: A PROGRAM, A TEST, AND THE THEORETICAL RELEVANCE

Hans J. Hummell and Karl-Dieter Opp

University of Cologne, University of Erlangen-Nürnberg

The discussion of the thesis that sociology is reducible to psychology generally suffers from two short-comings: first, it is usually not stated what is to be understood by the generally imprecise terms 'sociology', 'psychology' and 'reduction'. But this is a prerequisite for discussing the reductionism thesis at all. Secondly, it is usually only asserted apodictically or at best illustrated by some examples that a reduction is possible, without any systematic test of the thesis. In this paper the authors try to avoid these short-comings. After having defined what they understand by 'sociology', 'psychology' and 'reduction' they reduce — in the sense defined — some central sociological terms like 'system', 'structure', etc. They then reduce some sociological to psychological statements and show the 'psychological' character of ecological, functional and contextual hypotheses. Finally, they deal with some consequences of the reductionism thesis for the advancement of theoretical sociology. The systematic test—which is reported much more extensively in another work not yet published—resulted in every case in a confirmation of the reductionism-thesis.¹

I. THE PROBLEM OF AN AUTONOMOUS SOCIOLOGY

In their writings leading sociologists and psychologists have often asserted that psychology and sociology are concerned with entirely different phenomena and that sociological statements could not

H.J.Hummell / K.-D. Opp

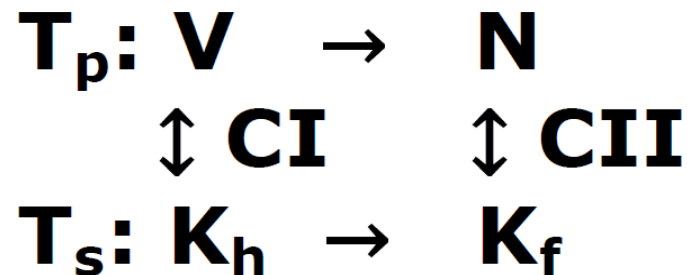
Die Reduzierbarkeit von Soziologie auf Psychologie

Vieweg

7 Wissenschaftstheorie
Wissenschaft und Philosophie

Hummell & Opp 1971: Reducing sociological to psychological theories

- Core idea: psychological hypotheses, together with coordination rules that link concepts from psychological hypotheses with concepts from sociological hypotheses, allow for the derivation of sociological hypotheses
- Upside down-version of Coleman's diagram:



Lindenberg's micro-macro model (1976, 1977)

Siegwart Lindenberg

Individuelle Effekte, kollektive Phänomene und das Problem der Transformation

1. Einleitung

Das Problem der Transformation hat mit der Verbindung individueller Effekte und kollektiver Phänomene zu tun. Es ist ein relativ neues Problem in der Soziologie. Aus diesem Grund kann es nicht bereits in einer Einleitung deutlich umrissen werden, sondern erst in einer im Text selbst vorzunehmenden schrittweisen Explikation. Die Einleitung kann also dazu benützt werden, den Leser kurz über die Struktur des vorliegenden Artikels zu informieren. Ich beginne mit einer kurzen Betrachtung darüber, wie das Transformationsproblem aus der soziologischen Tradition entspringt. Danach wird das Transformationsproblem selbst behutsam aufgebaut und mit möglichen Gegenargumenten und Mißverständnissen konfrontiert. Auf dieser Basis wird dann die zentrale heuristische Funktion von Transformationen gezeigt, was den Artikel zur Analyse einer fortgeschritteneren und komplexeren Art von Transformation führt. Schließlich wird noch kurz auf ein Schwesterproblem zur Transformation, nämlich das Korrespondenzproblem, eingegangen.

2. Die soziologische Tradition und ihr blinder Fleck

schematisch verdeutlichen. Das allgemeine Erklärungsschema¹² hat folgende Gestalt:



Dies allgemeine Schema wird bei der Erklärung kollektiver Effekte zweimal angewandt:



Figur 1. Das Erklärungsschema für kollektive Effekte.

Lindenberg's model (1976, 1977)

"Two step-version" of H-O model of deductive explanations

Behavioral theory
(Arrow 2)

Transformation rules
(Arrow 3)

Bridge assumptions
(Arrow 1)

**Additional boundary
Conditions (Nodes A and B)**

Initial conditions

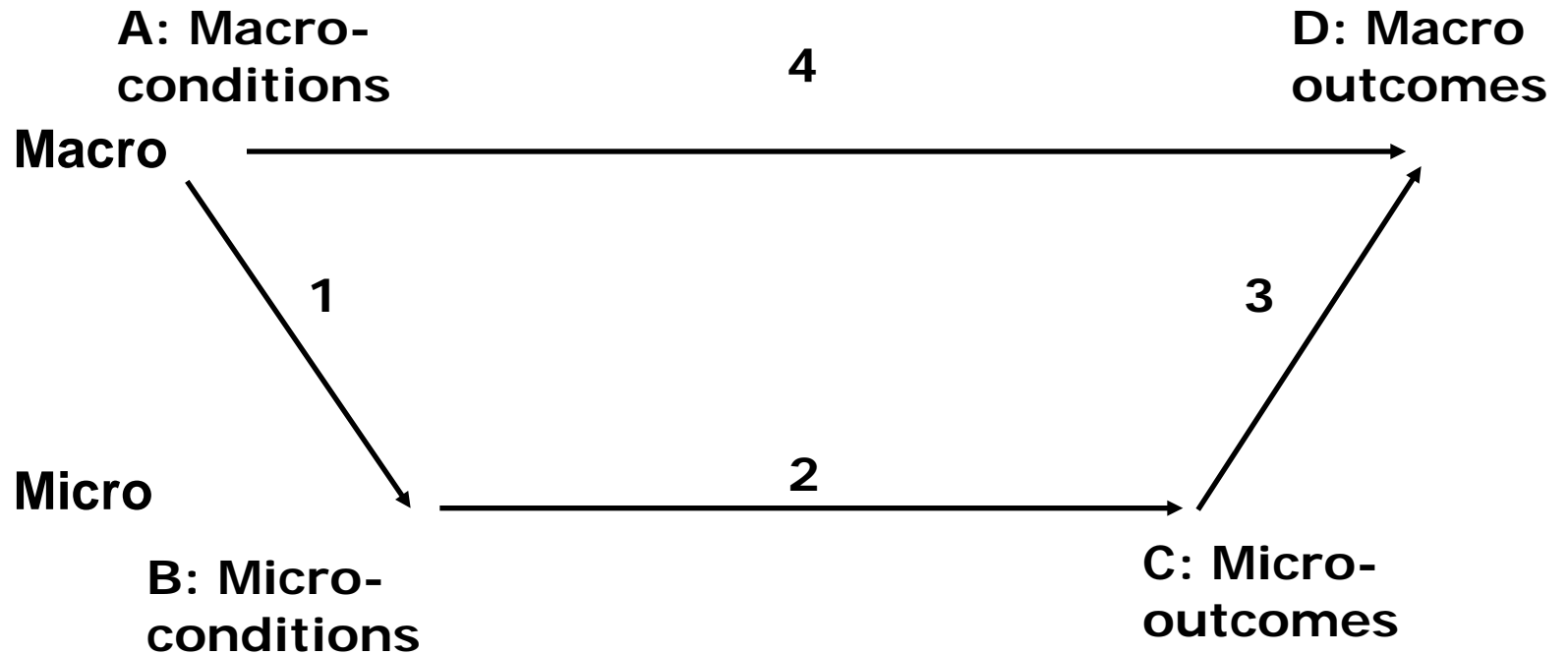
- **Macro-conditions (Node A)**
 - **Micro-conditions (Node B)**
-

Individual effects **—————>**
(Node C)

Individual effects
(Node C)

**Collective (macro)
phenomena and
processes (Node D)**

Coleman's diagram



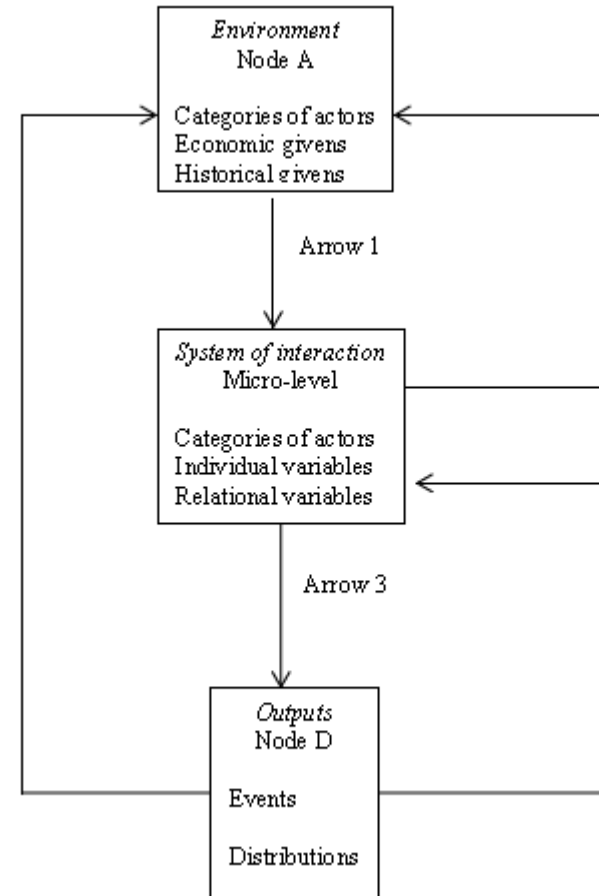
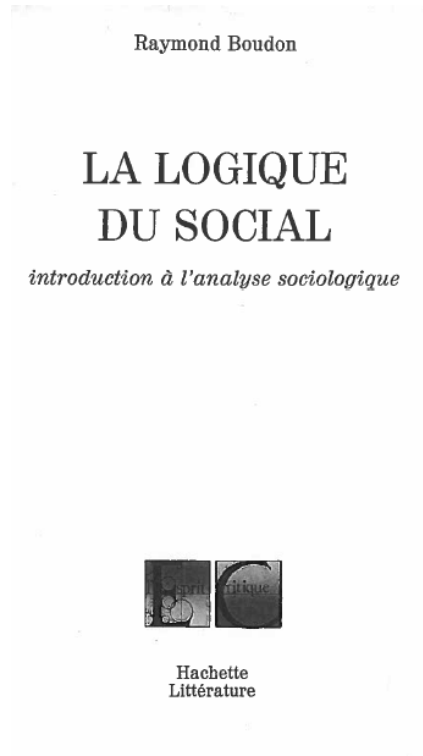
1: Bridge assumptions

2. Theory of action

3. Transformation rules

4. Macro-regularities

Boudon's (1979: 148) version for social processes



- English translation: *The Logic of Social Action*, London: Routledge 1981

Boudon's predecessor: Hernes (AJS 1976)

Structural Change in Social Processes¹

Gudmund Hernes
University of Bergen

Models of structural change should be able to explain constancy as well as change, must combine micro- and macrolevel analysis, and must encompass endogenous sources of change. It is necessary to distinguish among three levels of structure of a system: output structure, parameter structure, and process structure. With these concepts four basic types of change processes can be identified: simple reproduction, extended reproduction, transition, and transformation. These are discussed and illustrated, as well as some important special cases such as dialectical change, overintegration, and catastrophe.

The main concern of theories of structural change is how men react to conditions of their own making and in so doing change these conditions. However, only a relatively small proportion of the studies carried out by contemporary sociologists focus on the whole cycle. There are several reasons for this. To collect data as a process unfolds is often infeasible

ASSOCIATION IN TORONTO, 1974, and at the MATHEMATICAL SOCIAL SCIENCE BOARD CONFERENCE on organized complexity and structural change in St. Louis, 1975. I have benefited from discussions with Hayward Alker, Jon Elster, Adam Przeworski, and John Sprague. I am especially grateful for the detailed comments of an anonymous reviewer of the *AJS*. None of them are responsible for defects in the argument.

AJS Volume 82 Number 3 513

Boudon's predecessor: Hernes

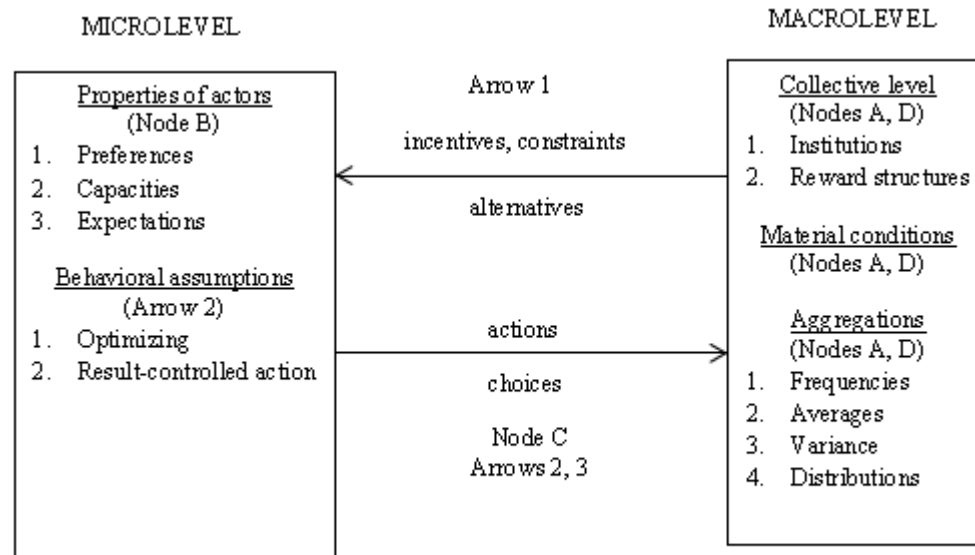


Figure 8. Hernes' (1976: 518) scheme for the relation between micro and macro level

Diekmann's (1980b: 73) reconstruction of Merton's theory of anomie

Andreas Diekmann

Dynamische Modelle sozialer Prozesse

Theoretische Ansätze zur
Erklärung krimineller Prozesse
und Möglichkeiten ihrer Formalisierung

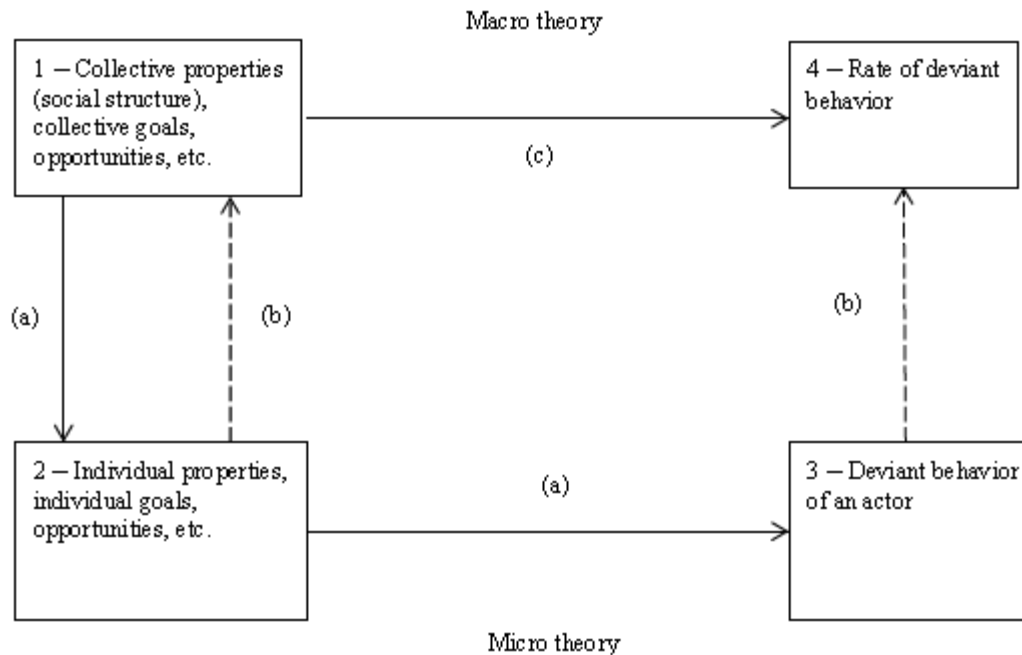


Forschungsergebnisse bei Oldenbourg

Oldenbourg



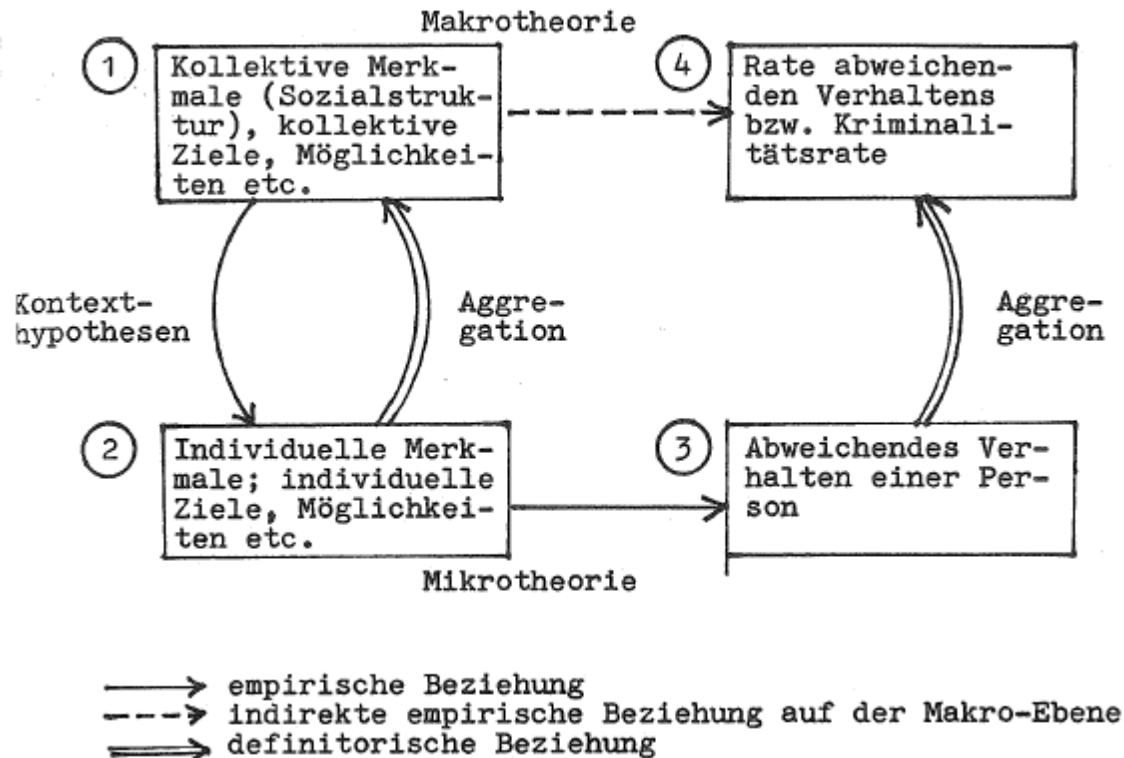
Diekmann's (1980b: 73) reconstruction of Merton's theory of anomie



(a): empirical relation; (b) aggregation (analytical relation); (c) indirect empirical relation

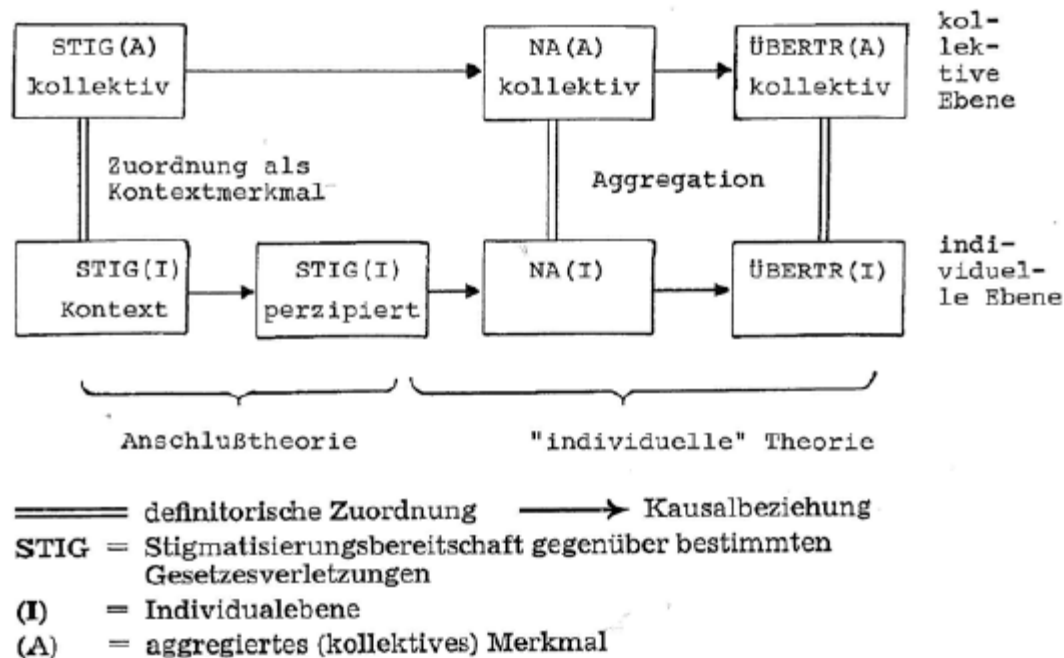
Diekmann's (1980b: 73) reconstruction of Merton's theory of anomie: the original

Abbildung 1 Die Struktur der Theorie: Integration von Mikro- und Makrotheorie.



Another variant in Diekmann 1975/1980a: *Die Befolgung von Gesetzen*

Abbildung 5: Kollektive und individuelle Variablen



Structural individualism: Heuristic guidelines for micro-macro modeling I

Other ideas in structural individualism that have been 'reinvented' quite some years later in Coleman and in analytical sociology:

- Macro-micro-macro transitions are often complex. Hence, formal model-building is often required so that assumptions become explicit and implications can be derived systematically
- Model building, in turn, requires simplifications, hence...
 - ... "method of decreasing abstraction": keep the assumptions concerning individuals and their cognitive make-up and abilities as simple as possible (observing the principle of "sufficient complexity"); however, when feasible, do employ more complex macro-assumptions such as alternatives to the assumption of "atomized interactions in perfect markets"
 - Focus on careful specification of bridge assumptions and transformation rules, i.e., on assumptions "linking" micro- and macro-level

Structural individualism: Heuristic guidelines for micro-macro modeling II

- Interdependence between actors drives macro-outcomes
- Macro-outcomes as unintended consequences (often due to interdependence)

Caveat:

- Coleman's diagram and its predecessors summarize many assumptions as well as different assumptions; *the decisive (and often difficult) step is the derivation of implications from those assumptions (including testable implications)*

Some speculation: Why Coleman never mentioned the predecessors and why they are (largely) forgotten

Did Coleman know about the predecessors?

- Coleman did not refer to McClelland's Weber-reconstruction. He for sure knew about *The Achieving Society*.
- Coleman was aware of structural individualism: frequent and regular contacts (lectures, conferences, workshops, etc.). He knew and respected the sociologists involved.
- In particular, Coleman was aware of at least Lindenberg's model: Coleman 1986 appeared in a volume that he co-edited with Lindenberg (Lindenberg, Coleman and Nowak 1986), based on a conference at the University of Chicago in 1983 (a discussion of Coleman's own conference contribution included in the volume includes an exchange between Lindenberg and Coleman, with Lindenberg explicitly mentioning the 'problem of transformation'). Coleman 1987 appeared in a volume based on a 1984 conference, likewise comprising a programmatic paper on Lindenberg's model.
- In 1980 and 1981, Lindenberg and Coleman had conversations on McClelland's diagram and Lindenberg's model.

Why did Coleman never mention the predecessors?

- Seemingly, Coleman's only suggestion that there have been predecessors is a casual remark, without any reference, in his programmatic 1986 *AJS*-paper (p. 1321): "This micro-macro problem is sometimes called by European sociologists the problem of transformation."
- Best guess (and a 'friendly' interpretation): he knew the difference between a heuristic diagram and a full-fledged model that includes an explicit set of assumptions together with theorems spelling out the assumptions' implications (not to forget the proofs of such theorems). He thus knew that his diagram, just like the diagram's predecessors, was a heuristic device and was as such not a full fledged micro-macro model. Why, thus, explicitly refer to predecessors?
- Also: Coleman himself may not have foreseen the later impact of his diagram.
- Still, at least with hindsight, a reference every now and then would have been appropriate. Also, putting Coleman's diagram in some perspective is worth the effort, if only because of the diagram's later prominence.

Coleman's predecessors, priority in scientific discovery, and 'Stigler's law of eponymy'

- **Stigler's law of eponymy: "No scientific discovery is named after its original discoverer" (Stigler 1999: 277; see also Merton 1973 who, also according to Stigler himself, may claim priority with respect to Stigler's law).**
- **In our case, this may be due to:**
 1. **The success of Coleman's scheme, deriving from its simplicity and intuitive appeal**
 2. **Coleman, while aware of at least some of the predecessors, declined to refer to them**
 3. **The original literature being often not in English, with few, if any, English translations**
 4. **Innovations in science are often 'in the air' and are pushed by various individuals, with the eponym for someone particularly prominent and part of the 'mainstream'**

Thanks for your attention!

Further reading:

- **Raub & Voss (2016) Micro-Macro Models in Sociology: Antecedents of Coleman's Diagram, *forthcoming***

Werner Raub/Thomas Voss

Individuelles Handeln und gesellschaftliche Folgen

Das individualistische Programm in den Sozialwissenschaften

Journal of Mathematical Sociology, 35:1–25, 2011
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Introduction

Micro-Macro Links and Microfoundations in Sociology

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Using Coleman's well-known scheme as an anchor, we review key features of explanations of social phenomena that employ micro-macro models. Some antecedents of micro-macro models and of Coleman's scheme as well as some paradigmatic examples of micro-macro links are sketched. We then discuss micro-level assumptions in micro-macro explanations and the robustness of macro-level implications to variations in micro-level assumptions. We conclude with an overview of some recent developments in micro-macro modeling and of the contributions to the special issue.

