Theoretical and Statistical Models for the Analysis of Two-Stage Decisions with an Application to Criminal Decision Making

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Related publications:

- Eifler, S., & Leitgöb, H. (2018). Die Nutzenkomponente in zweistufigen Erklärungen kriminellen Handelns. Der Perception-Choice-Prozess und seine statistische Modellierung. *Monatsschrift für Kriminologie & Strafrechtsreform,* 101, 322-351.
- Eifler, S., & Leitgöb, H. (2020). Ein zweistufiges Modell zur Erklärung sozialen Handelns – Methodologische Grundlagen, statistische Modellierung und Anwendung auf kriminelles Handeln. In A. Mays, A. Dingelstedt, V. Hambauer, S. Schlosser, F. Berens, J. Leibold, & J. K. Höhne (Hrsg.) *Grundlagen – Methoden – Anwendungen in den Sozialwissenschaften* (S. 133-155). Wiesbaden: VS Verlag.

Theoretical and Statistical Models for the Analysis of Two-Stage Decisions

1. Action Theory in the Explanation of Crime

    1.1 SEU-Theory and Criminal Action
    1.2 Utility-Components in SEU-Models for Criminal Action
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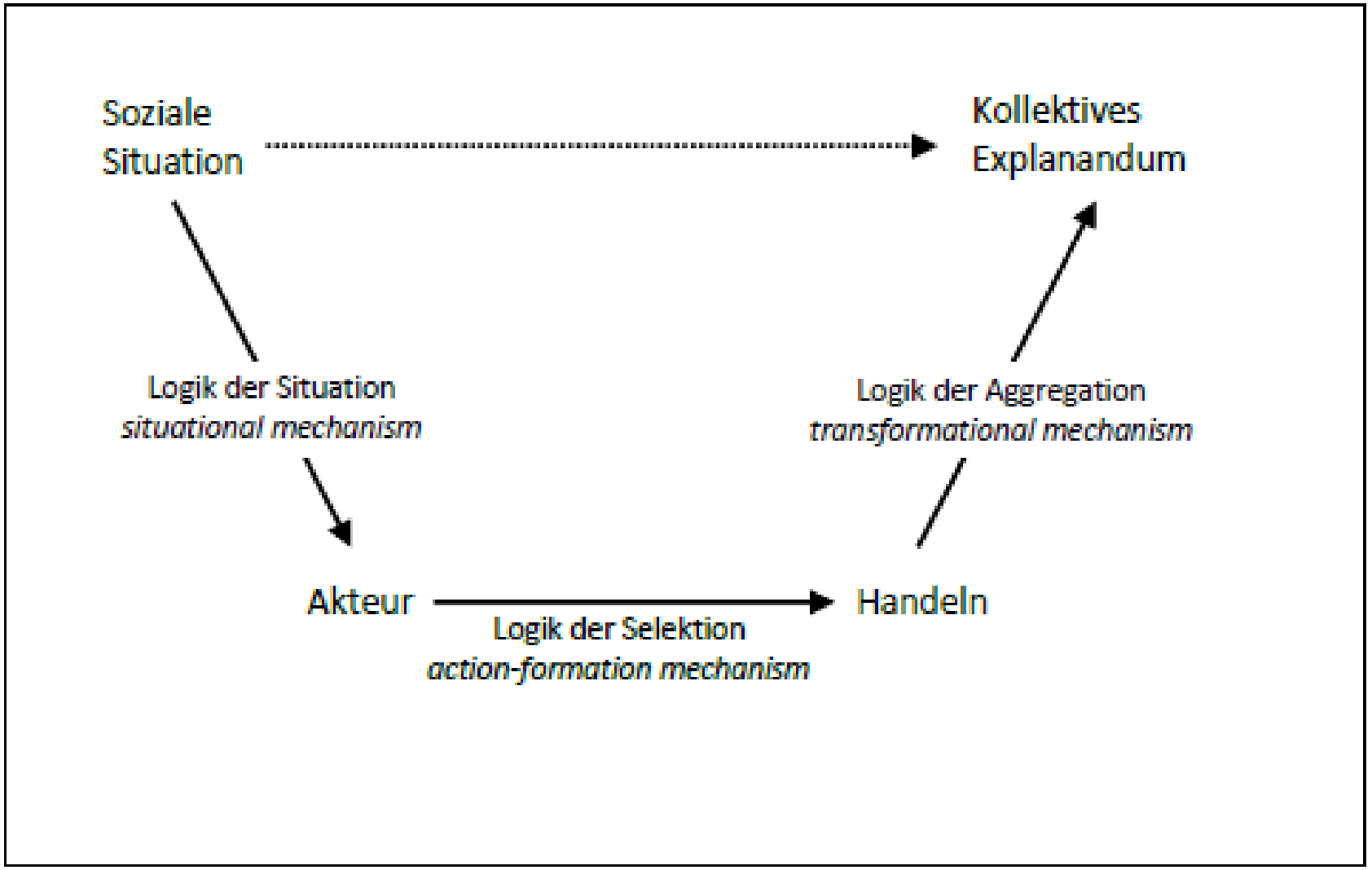
Methodological Preliminaries



Macro-Micro Model of Sociological Explanation

(adapted from: Coleman 1986, 1990; Esser 1993; Hedström/Swedberg 1996, 1998)

Methodological Preliminaries

Analytical sociology

„In sociology […], the elementary ‘causal agents’ are always individual actors, and intelligible social mechanisms should […] always include explicit references to the causes and consequences of their actions” (Hedström/Swedberg 1996, S. 290).

Mechanisms in the explanation of action

„mechanisms (as) hypothetical causal models that make sense of *individual* behavior (and) have the form, ‚given certain conditions *K,* an agent will do *x* because of (mechanism) *M* with probability *p*’“ (Gambetta 1998, S. 102).

Action-formation mechanisms

„[…] how a specific combination of individual desires, beliefs, and action opportunities generate a specific action” (Hedström/Swedberg 1998, S. 23).

Action Theory in the Explanation of Crime

1.1 SEU-Theory and Criminal Action

- Classical criminology
- Deterrence as a central explanatory variable for criminal action
- Influences of punishment

  (incapacitation, specific deterrence, general deterrence)
- Macro-level: analysis of the influences of arrest rates and criminal conviction rates on crime rates

  Micro-level: analysis of the subjective expected utility of criminal action (benefits, punishment)
- Perceptual deterrence research (Dahlbäck 1998, 2003)

Action Theory in the Explanation of Crime

1.1 SEU-Theory and Criminal Action

$$SEU(K)_i = \sum_{j=1}^{J} p_{ij} U_{ij} = \sum_{j_B=1}^{J_B} p_{ij_B} B_{ij_B} - \sum_{j_C=1}^{J_C} p_{ij_C} C_{ij_C}$$

with $SEU(K)_i$ as individual's i SEU-value for criminal action K, $\sum_{j=1}^{J} p_{ij} U_{ij}$ as the subjective expected utility, $\sum_{j_B=1}^{J_B} p_{ij_B} B_{ij_B}$ as the total benefits and $\sum_{j_C=1}^{J_C} p_{ij_C} C_{ij_C}$ as the total costs.

Furthermore, $J_B + J_C = J$.

Theoretical basis is a *wide* concept of utility (Opp 1999):

Besides the law-relevant costs of criminal action, internal and informal sanctioning costs are also considered as relevant for criminal decision making (Grasmick & Green 1980; Eifler 2009).

Action Theory in the Explanation of Crime

1.2 The Utility Component and Its Relevance for Criminal Action

$$SEU(K)_i = \sum_{j=1}^{J} p_{ij} U_{ij} = \sum_{j_B=1}^{J_B} p_{ij_B} B_{ij_B} - \sum_{j_C=1}^{J_C} p_{ij_C} C_{ij_C}$$

The role of various utility components in the context of criminal decision making has also been investigated:

- social recognition, feelings of excitement, adventure, thrill (e.g. Leitgöb et al. 2014; Matsueda et al. 2006; Nagin & Paternoster 1993; Wittenberg 2009)
- economic utility as integral part of EU-theory (Becker 1986)

In the context of SEU-theory, however, the relevance of material benefits of criminal action has so far received little attention.

Action Theory in the Explanation of Crime

1.3 Modelling Decisions for Criminal Action

- Modelling of the situational background of criminal action
- Introducing the perception of opportunities into the SEU-theory for the explanation of criminal action
- Elaboration of the action-formation mechanism

  -> Perception of an opportunity (a)

  -> Decision for individual action (b)
- Instrumental rational action as one form of action

Action Theory in the Explanation of Crime

Research Questions

Two-stage decisions for crime

-> Perception of the Situation (a)

Material benefits are relevant for the perception of an opportunity

-> Decision for Criminal Action (b)

Subjective expected utility of benefits is a relevant predictor of the likelihood of criminal decision making.

Empirical Research Methods

Vignette:

> You go to the nearest bakery in your neighborhood on Saturday morning around 11 am. All of a sudden you notice that a few metres in front of you a well-dressed man drops a bill from his coat pocket without him noticing it. You see that it is a banknote with a value of **10,- €/100,- €**. Apart from you, there are **passers-by and they are watching the incident / no other passers-by**.

Experimental Design:

2*2 between-subjects design

Factor A: Opportunity Benefits

Factor B: Opportunity Costs

Empirical Research Methods

Project „Living Together in Cities“

1. Mail survey (TDM, Dillman 2009)

2. Simple random sample (n=2383, aged 18-65)

3. Experimental design
   (randomization, parallelization age/gender)

4. Control variables
   (age, gender, education, experience,
   social desirability)

Empirical Research Methods

5. Independent Variables

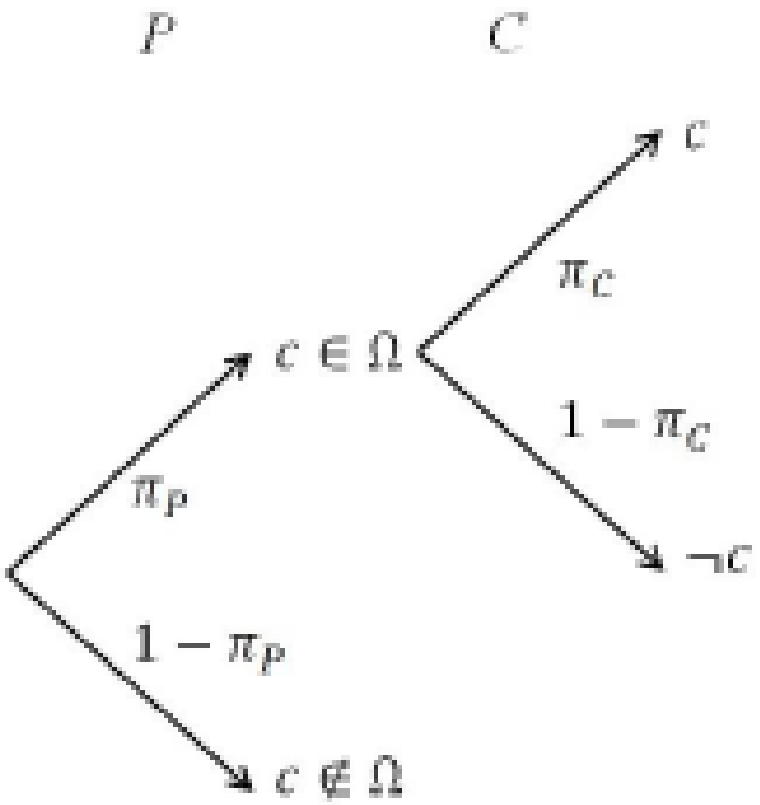
Experience (1 Item, dichotomous)
Morality (3 Items, mean score, alpha = .82)
Deterrence (SEU punishment)
Material benefits (SEU monetary value)
Income (per capita)

6. Dependent Variables

Perception of opportunity (0: no; 1: yes)

Self-reported intention for theft by finding (dichotomous, 0: < 50%; 1: ≥ 50%)

Empirical Research Methods



Decision Tree for the Situational Analysis of Criminal Action

Empirical Research Methods

Modeling the Decision Making Process

Discrete Choice Modeling (DCM; e.g. Hensher et al. 2005; Train 2009)

$$\Pr(P_i = 1|\mathbf{x}_i) = \pi_{P_i} = F(\mathbf{x}_i) \quad (1)$$

The term $\Pr(P_i = 1|\mathbf{x}_i)$ represents the probability (conditional on the covariates $\mathbf{x}_i$) that individual i perceives criminal action c as potential action opportunity in a particular situation, and thus, that c is actually entering the choice set Ω_i.

Furthermore, P_i is based on

$$P_i = \begin{cases} 0 \text{ if } c \notin \Omega_i \\ 1 \text{ if } c \in \Omega_i \end{cases} \quad (2)$$

Empirical Research Methods

If $c \in \Omega_i$, the conditional probability for selecting criminal action c can then be written as

$$\Pr(C_i = c | P_i = 1, \boldsymbol{z}_i) = \pi_{C_i|P_i=1} = F(\boldsymbol{z}_i) \tag{3}$$

with $\boldsymbol{z}_i$ as a set of covariates

Assuming statistical independence between the conditional probabilities at stages 1 (perception) and 2 (choice), $\Pr(C_i = c) = \pi_{C_i}$, the total probability of criminal action c to occur is the product (Liao 1994; Maddala 1983):

$$\pi_{C_i} = \begin{cases} 0 & \text{if } P_i = 0 \\ \pi_{C_i|P_i=1} & \text{if } P_i = 1 \end{cases} \tag{4}$$

Empirical Research Methods

Defining Λ^{-1} (Λ is the CDF of the standard logistic distribution) as the link function and the Bernoulli distribution as the random component, the likelihood function for the full model can finally be formulated as

$$L(\boldsymbol{\beta}, \boldsymbol{\gamma}|D) = \prod_{i=1}^{n} \left[\Lambda\left(\eta_{P_i}\right)\right]^{P_i} \left[1 - \Lambda\left(\eta_{P_i}\right)\right]^{1-P_i} P_i \left\{\left[\Lambda\left(\eta_{C_i}\right)\right]^{C_i} \left[1 - \Lambda\left(\eta_{C_i}\right)\right]^{1-C_i}\right\} \quad (5a)$$

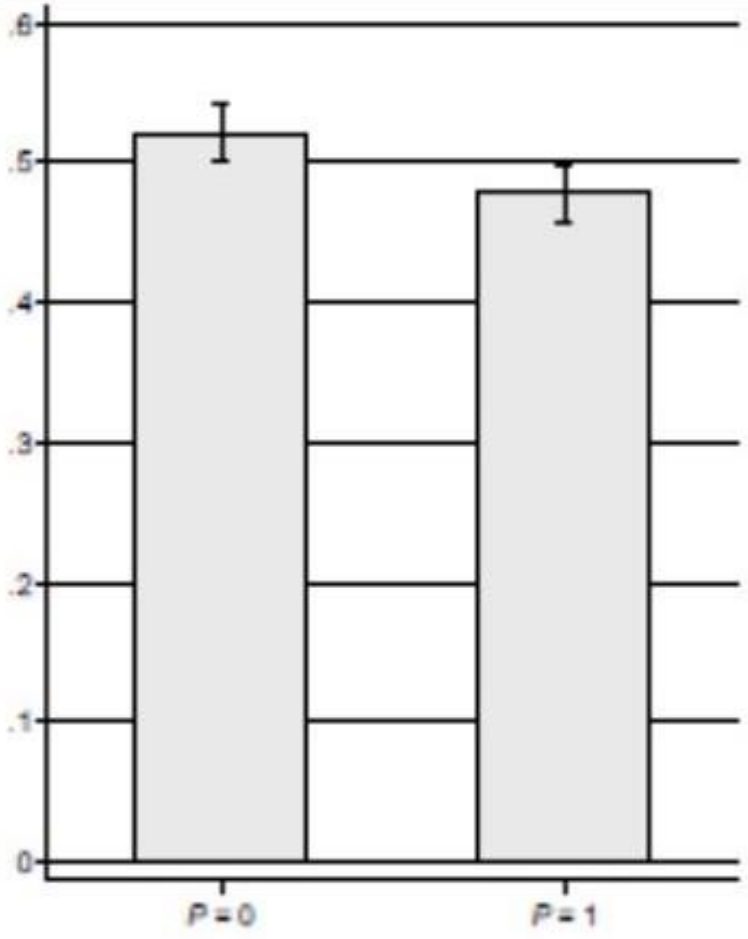
with

$$\eta_{P_i} = \mathbf{x}_i' \boldsymbol{\beta} \quad (5b)$$

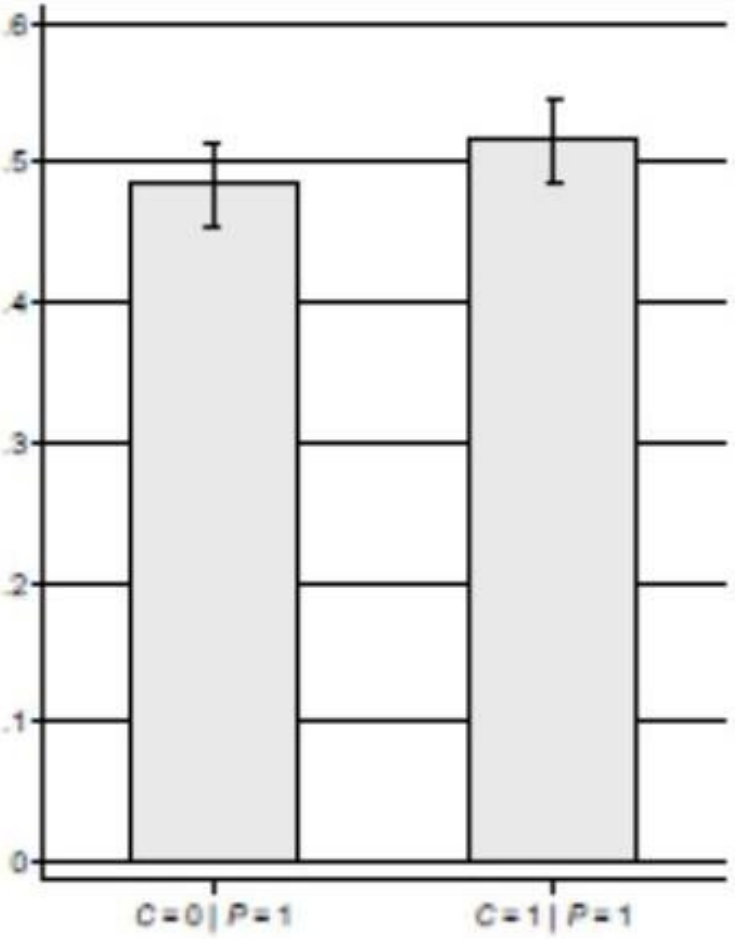
$$\eta_{C_i} = \mathbf{z}_i' \boldsymbol{\gamma} \quad (5c)$$

Results of Data Analyses

Perception of Opportunity



Choice of Theft by Finding



Distribution of Dependent Variables

Results of Data Analyses

	Stage 1: Perception of Opportunity		Stage 2: Choice of Theft by Finding	
	Coef.	**Std.Err.**	**Coef.**	**Std.Err**
Income	**-.0003**	**.0001**	-.0002	.0001
Opportunity Benefit	-.0563	.1008	**-.3349**	**.1373**
Opportunity Costs	**-.2038**	**.0966**	*-.0190*	*.1298*
SEU-monetary incentive	**.4724**	**.0535**	**.1584**	**.0617**
SEU-punishment	**-.1403**	**.0482**	*-.1213*	*.0709*
Not reported: control variables, experience, morality				

Results of sequential logit modeling (seqlogit, Buis 2007)

Discussion

The costs of crime on the level of the opportunity and the subjective expected utility of punishment are relevant predictors of the perception of the situation as an opportunity for theft by finding.

The rewards of crime on the level of the opportunity is not relevant on the first stage of the decision process, but per capita income is relevant for the perception of the situation as an opportunity in the expected direction.

The subjective expected utility of the monetary value is relevant on both stages of the decision process.

-> additional insights into decision processes by our two-stage modelling strategy compared to previous analyses or other modelling strategies.

Discussion

-> in progress:

Inclusion of subjective evaluation of household’s economic position

Inclusion of mediator- and moderator-variables in order to model the relationship between situational aspects and individual features more appropriately

Thank you for your attention!

In case of further questions, please contact us:

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