‘Let’s Formalize Behavior’: The Early Adoption of Rational Choice Theories at the Cowles Commission, 1944-1965

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Malte Doehne
(University of Zurich)

ASSA 2020
Starting Point

Theories of rational decision making

- Behavioral Decision Research
- Mathematical Psychology & Measurement Theory
- Welfare Economics & Social Choice Theory
- General Equilibrium Analysis
- Mathematical Economics & Game Theory
- Mathematical Finance
- Theories of Organization & Artificial Intelligence
- Linear Programming & Operations Research
- Mathematical Statistics, Decision Theory, Bayesianism
Starting Point

General objective of project

• Understand how rational choice theories (RCT) in general, and game theory in particular, was adopted in order to diffuse within and across scientific communities.
Scientific Innovation

Pioneers

Innovation
• New mathematical tools (i.e. axiomatic method, theory of convex sets, theory of relations, topology) that would be applied across social sciences.

Contribution
• Two concepts of rational decision-making:
  o Expected utility theory
  o Minimax theorem

Co-Citation Analysis

Research fields affected by RCT
1. Foundations of statistics, decision theory, classics
2. Non-cooperative game theory, bargaining theory, cybernetics
3. Cooperative game theory, coalition formation, market games
4. Behavioral decision research, mathematical psychology
5. Stochastic decision theory, foundations of decision theory
6. Incomplete information, conventions
7. Theories of conflict and cooperation
8. Mathematical finance
9. Risk and uncertainty, measurement theory
10. Behavioral decision theory
11. Linear programming, operations research
12. Statistical decision theory
13. Economic theory of value
14. Evolutionary biology
15. General equilibrium analysis

(Herfeld/Doehne 2018)
# Role Typology

<table>
<thead>
<tr>
<th>Role</th>
<th>Innovator</th>
<th>Elaborator</th>
<th>Translator</th>
<th>Specialist</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Function</strong></td>
<td>• Articulates innovation in way that motivates its elaboration.</td>
<td>• Adopts innovation and develops it further.</td>
<td>• Establishes bridge between elaborators and specialist.</td>
<td>• Uses translated innovation for doing “normal science”.</td>
</tr>
<tr>
<td><strong>Technical criterion</strong></td>
<td>• Identified model-exogenously. • Starting point for data generation.</td>
<td>• Part of the epistemic core without connection to clusters.</td>
<td>• Connects epistemic core with a cluster. • Has highest degree centrality in its cluster.</td>
<td>• Not part of epistemic core. • Connected to at least half as many contributions in its cluster as translator.</td>
</tr>
<tr>
<td><strong>Network representation</strong></td>
<td><img src="image1" alt="Network representation" /></td>
<td><img src="image2" alt="Network representation" /></td>
<td><img src="image3" alt="Network representation" /></td>
<td><img src="image4" alt="Network representation" /></td>
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</table>

(Herfeld/Doehne 2018)
Theories of rational decision making


K. Arrow’s *Social Choice and Individual Values* (1951)

J. Nash’s Non-Cooperative Game Theory (1951)


H. Markowitz’s *Portfolio Selection* (1952)

H. Simon’s *Behavioral Model of Rational Choice* (1955)

G. Debreu’s *Theory of Value* (1959)

C. Coombs’ *Decision Processes* (1954)
(with R. Thrall and R. Davis)

T. Koopmans’ *Activity Analysis of Production and Allocation* (1951)

Translators

H. Markowitz’s *Portfolio Selection* (1952)

H. Simon’s *Behavioral Model of Rational Choice* (1955)

T. Koopmans’ *Activity Analysis of Production and Allocation* (1951)


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- H. Simon’s *Behavioral Model of Rational Choice* (1955)
- T. Koopmans’ *Activity Analysis of Production and Allocation* (1951)

Cowles direct & indirect affiliates
Reception of the *Theory of Games*

Reviews of the *Theory of Games* between 1944 and 1950

2. N.N., *Psychological Abstracts*, 1945, psychology
15. Louis O. Kattsoff, *Social Forces*, 1945, social sciences
Reception of the *Theory of Games*

Reviews of the *Theory of Games* between 1944 and 1950

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<th>No.</th>
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<th>Title/Source</th>
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<td>1946</td>
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<td>17</td>
<td>J. Marschak</td>
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<td>1946</td>
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<td>C. Kaysen</td>
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</table>
The Cowles Commission

- At the University of Chicago from 1939 until 1955.
- At Yale University from 1955 onwards.
- Became stronghold of mathematical economics.
- Directors:
  - Jacob Marschak: 1943-48
  - James Tobin, 1955-61, 1964-65

Social Science Research Building at the University of Chicago
Source: Cowles Foundation
Theoretical Setup

Observation
• Directors did not make seminal contributions.
• In their social role, directors differed structurally from other scientists at Cowles (e.g., Arrow, Markowitz, Hurwitz, etc.)

Departure point
• Do scholars occupying distinct social roles at an institution influence the diffusion of scientific innovations in different ways?

Hypothesis
• The administrative leaders at Cowles played a crucial role in initiating the diffusion process by occupying the role of academic ‘opinion leaders,’ i.e., those individuals from whom others seek advice and information (e.g., Rogers 2003).
Theoretical Setup

- **Aim**: Systematically analyze how each individual’s social role at Cowles affected the early adoption of rational choice theories by engaging with TGEB.

- **Analytical framework**: Blockmodeling → method for reducing a social network to a set of (structurally equivalent) social roles.

- **Dataset**: Acknowledgements in reprints/papers written at the Cowles Commission between 1944 and 1965.

- **Novelty**: Studying acknowledgement networks
Dataset: Acknowledgements

- Cowles Commission/Foundations Papers (Reprints)
  - 1,424 reprints of publications (1943-2013)
  - 250 contributions from 1943-1964*

* Cowles Monograph Series not included
**Dataset: Acknowledgements**

- **Cowles Commission/Foundations Papers (Reprints)**
  - 1,424 reprints of publications (1943-2013)
  - 250 contributions from 1943-1964*
  - 38 of 250 publications cite TGEB (~15%)

* Cowles Monograph Series not included
Acknowledgements

• Differs from a citation and is not ‘reducible’ to scientific content.
• Potentially reflects formal and informal social structure at an institution.
• Acknowledgements signal (among other things):
  o general feedback
  o suggestions for further development of a work
  o inspiration and advice-giving
  o financial and other kinds of dependencies
  o any kind of support
• Regarding **scientific content**
  o can refer to all levels of the analysis, i.e., to general idea, theoretical approach, methods, proof procedures, etc.
  o acknowledged person can channel information flows, direct topical emphasis, push research agendas.
• Regarding **social structure**
  o acknowledgements are given to scholars that are central, whereby central can mean many things.
Initial Dataset (before processing)

• Collection of acknowledgements
  o 144 of 250 contributions published at Cowles between 1943-1964 acknowledge one or more individuals.
  o Raw data: 530 acknowledgement relations expressed in 144 papers that were (co-)authored by 78 individuals.

* The author is associate professor of economics at Yale University. He owes a great debt to Tjalling C. Koopmans who contributed the basis for the theorems established in the second part of this paper. David Cass, Peter A. Diamond, Paul A. Samuelson, and Robert M. Solow made useful comments on an earlier draft. The author alone is responsible for any errors in the final product.
Acknowledgements Network

- Collection of acknowledgements
  - Of these: 23 papers citing TGEB, by 17 authors (acknowledging 62 individuals).
  - Acknowledgements of papers citing TGEB originate in one subsection of the network.
  - Few nodes with high acknowledgements-outdegree account for much of the spread of TGEB at Cowles.
Centrality in Acknowledgement Network

- Names of individuals included with 5 or more papers.
- Directors have highest betweenness centrality.
- However, they did not feature in the co-citation network.

<table>
<thead>
<tr>
<th>person</th>
<th>betweenness</th>
<th>eigenvector_c</th>
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</table>
Why TGEB?

• Fostering exposure to TGEB
  • 1946: Writing and circulating review article on TGEB
  • 1945: Invitation of von Neumann to lecture on TGEB
  • 1949: Seminar series

• Why formal choice theories?
  1. Conformed to proper standards of science
  2. Great power of generalization
  3. Formal concepts specifiable for concrete problems
  4. Quantifiable concepts applicable to data
     (Marschak 1946)
Cowles as “Social Sciences Lab”

“Hybrid institution between a university and a national laboratory” (Düppe/Weintraub 2012, 8; Erickson et al. 2013).

Characteristics

• Close collaboration, also between scholars and director.
• Unbounded brainstorming
• Highly interactive (i.e., in seminars, workshops, informally)
• Short communication channels

→ Similar social structure to RAND Corporation, Center for Advanced Studies in the Behavioral Sciences at Stanford.

Source: Cowles Foundation
Method: Blockmodeling


- **Structural equivalence**: Measure of similarity of individuals by identifying the similarity of their patterns of relations to all other individuals.

- **In our case → structural similarity**: Cluster individuals by identifying their similarity of their network position.

- **In effect**: Rearrange the socio-matrix such that a predefined number of clusters of structurally similar social roles can be identified solely on the basis of the existence or nonexistence of (observed) relations (Doreian et al. 2005, Karrer & Newman 2004, Ziberna 2014, Breiger et al. forthcoming).
Procedure: Sociomatrix

<table>
<thead>
<tr>
<th>Name</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
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<td>Hurwicz, L.</td>
<td>41-61</td>
<td>(1)</td>
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<td>Haavelmo, T.</td>
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<td>Marschak, J.</td>
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<td>58-73</td>
<td>(42)</td>
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</table>
Procedure: Clustering

- Clustering actors by their structural similarity
  - Establish dissimilarities in network relations for each actor pair i-j (1-PPMCC).
  - Partition the network into a predefined number of blocks (hierarchical clustering).
Procedure: Application

Unsorted data

Acknowledged party

\[ n \times n \text{ (author x acknowledged person)} \]

Blockmodel output

\[ \text{Authors: B1, B2, B3, B4, B5} \]
Procedure: Application

Blockmodel Relations

Block 1
Block 2
Block 3
Block 4
Block 5

Blockmodel output

B1
B2
B3
B4
B5

Citing TGEB
Social Structure at Cowles

- Members of block 2 acknowledge members of blocks 1 and 4.
- Members of block 4 acknowledge members of block 1.
- Members of block 3 did not acknowledge each other.
## Summary Statistics (5 Blocks)

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<th>pubs (sd)</th>
<th>pubs citing TGB</th>
<th>years at cowles</th>
<th>at CASBS</th>
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<td>3.14</td>
<td>2.43</td>
<td>0.10</td>
<td>0.10</td>
<td>0.00</td>
</tr>
</tbody>
</table>

Table 1: summary statistics for five blocks
Preliminary Conclusions

• Adoption of rational choice theories depended on scientific engagement of scholars but was also shaped by the presence and influence of academic ‘opinion leaders’ at the Cowles Commission.

• Our research shows the structural importance of (directorial) appointments for initiating the engagement with a scientific innovation.
Thank you!