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Embedded Trust: An Experiment on Learning and Control Effects

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Workshop
"Rational Choice Sociology: Theory and Empirical Applications"
Venice International University
December 1-5, 2008

venice_08_v141108

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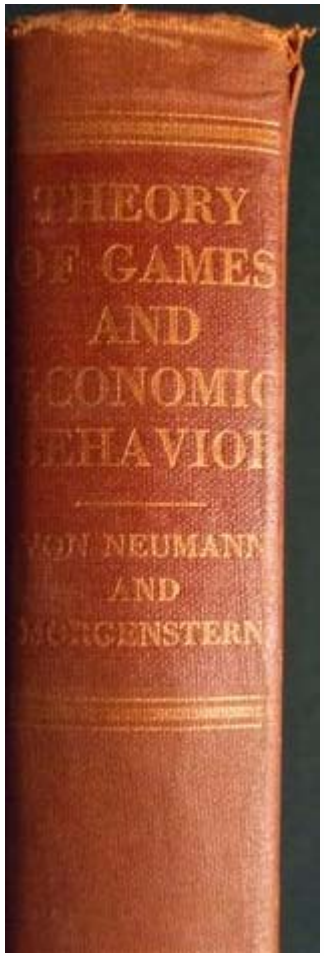
Trust by Example I

July 18, 2007: end date to purchase a copy of the first edition of *Theory of Games and Economic Behavior* by John von Neumann and Oskar Morgenstern at eBay from the seller "bibliomonster" for US-$ 1,900.00. The item had a fixed price listing (eBay's "Buy It Now" option) and could only be purchased without bidding in an auction. Item description: "Bound in original publishers red cloth a bit rubbed at head of spine. Black (ink?) mark on top board. Minor shelf wear, else very good. Internally, clean and free of ink, marginalia and soiling. No dogeared pages or tears. Includes the often missing corrigenda leaf. A nice, collectable copy."



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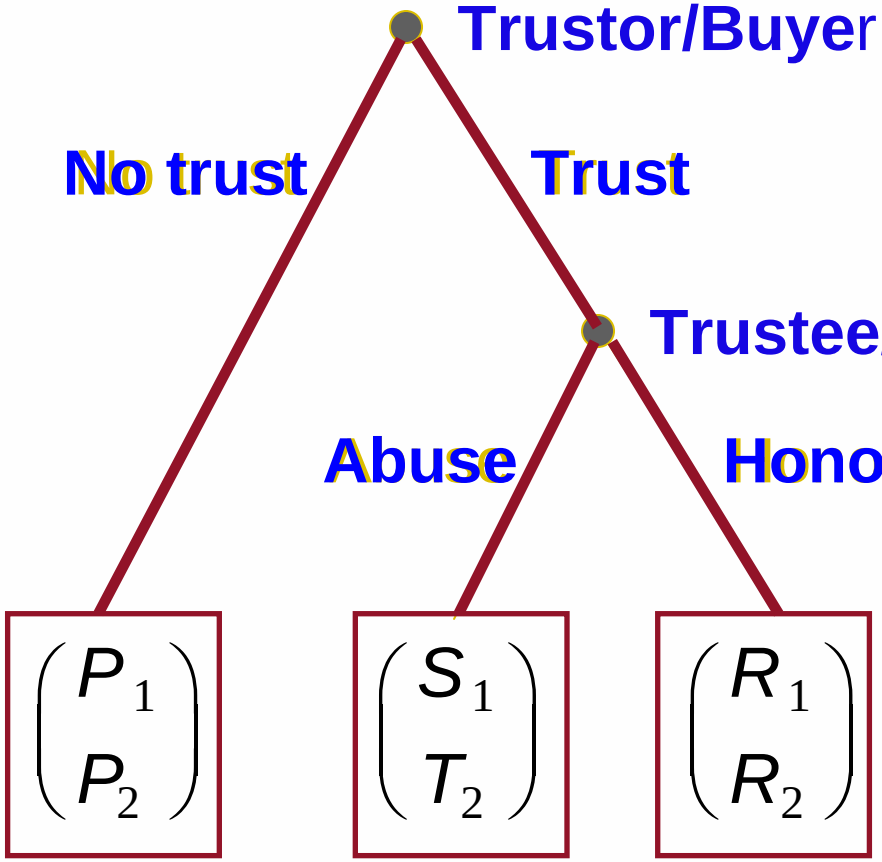
Trust by Example II

- **A potential buyer at eBay has to decide whether to buy the rare first edition of a book offered by a seller and to send the money**
- **The seller, after receiving the money, has to decide whether or not to ship the book to the buyer**
- **If the seller ships and the book corresponds with the specifications, both buyer and seller are happier after the deal than before the deal**
- **If the seller does not ship the book, he can try to sell it again, while the buyer has lost her money**

The Trust Game



$S_1 < P_1 < R_1$

$P_2 < R_2 < T_2$

Outline

1. Theory and hypotheses on embedded trust
2. Design of the experiment
3. Results
4. Related findings from other empirical studies using complementary research designs
5. Conclusions

Theory and Hypotheses on Embedded Trust

Embedded Trust

- **Many trust situations (and other social and economic interactions) do not occur in isolated encounters but are embedded in a larger context of interactions (Granovetter *AJS* 1985), e.g.,**
  - **repeated transactions between the same actors**
  - **actors encounter partners of their partner**

➔ need to extend predictions for trust situations to embedded settings

Embeddedness Mechanisms

	Dyadic embeddedness	Network embeddedness
Learning	**Common history of past interactions: information about the partner from own experiences**	**Information from third parties about their past experiences with the partner**
Control	**Expected future interactions: opportunities for conditional cooperation via, e.g., "tit for tat"**	**Opportunities for conditional cooperation involving third parties: "voice" (reputation effects)**

Research Problem

- **Distinguish between different embeddedness effects**
  - **theoretically**
  - **empirically**

- **We neglect:**
  - **strategic network formation: embeddedness is exogenous in the experiment**
  - **"non-selfish utility": focus on trust as a result of "enlightened self-interest"**

Available Formal Theories

	Dyadic embeddedness	Network embeddedness
Learning	**Adaptive learning models; information diffusion models**	
Learning and control	**Models for repeated games with incomplete information**	
Control	**Models for repeated games with complete information**	

Hypotheses – Summary

	Dyadic embeddedness	Network embeddedness
Learning	**Trust increases (decreases) with positive (negative) own experiences with the trustee**	**Trust increases (decreases) with positive (negative) information on the trustee received from other trustors**
Control	**Trust and trustworthiness increase with the likelihood of future interactions**	**Trust and trustworthiness increase with the trustor's control opportunities through her network with other trustors**

Design of the Experiment

Lab Experiment

- **Subjects (mostly students) play repeated Trust Games in the lab**
- **Interactions are with actual other subjects in the lab**
- **Interactions are anonymous**
- **Complete game structure is provided in the instruction; no deception**
- **Points earned represent actual money for the subjects**

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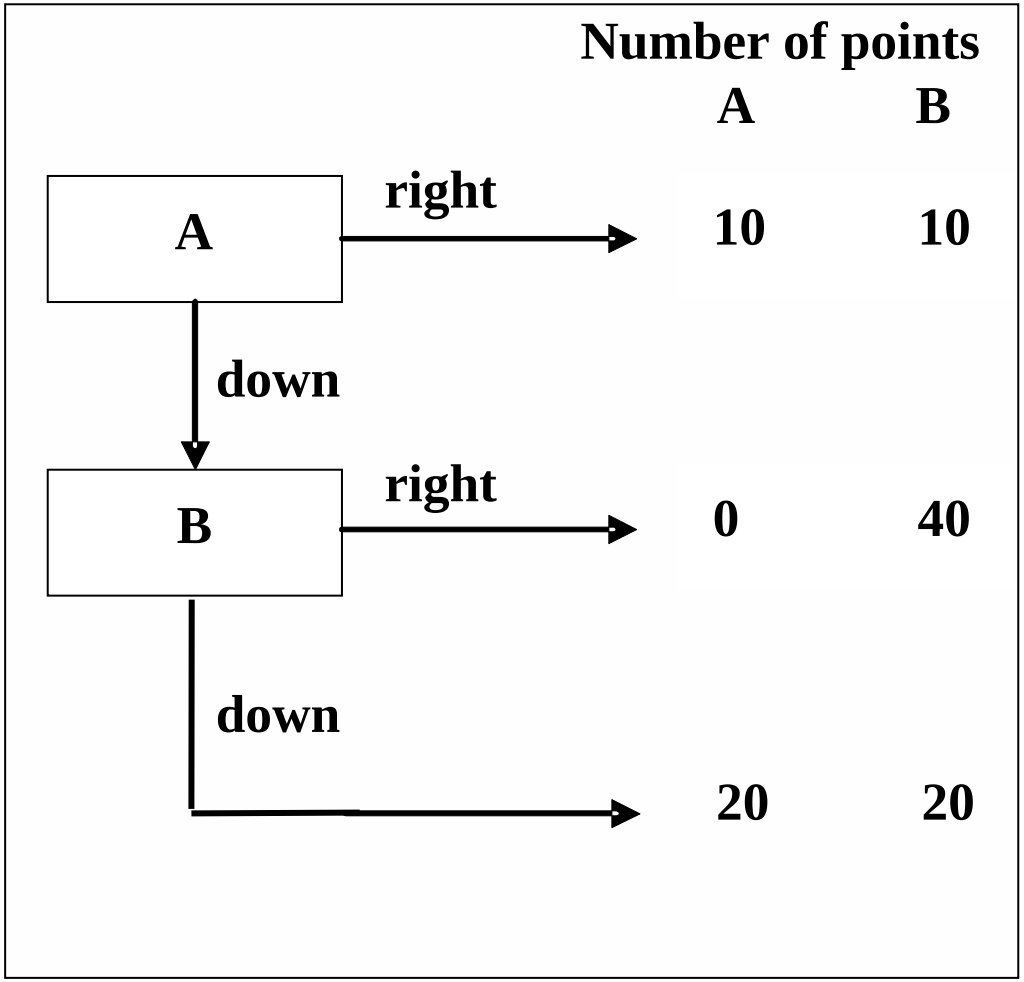
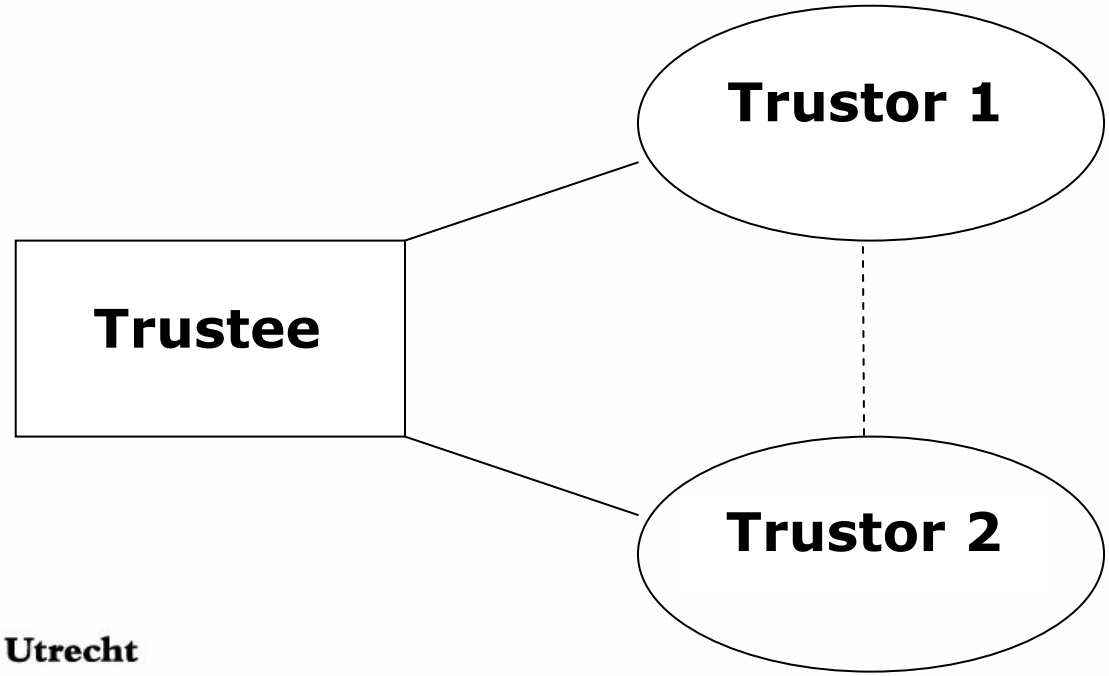
Trust Game in the Lab Experiment



Interaction Structure

- **Two trustors play with the same trustee for 15 rounds ("triads")**
- **In each round, trustor 1 plays first, trustor 2 second**
- **Depending on experimental condition: information exchange about past behavior between trustors**



Two Experimental Conditions

- ***No information exchange*** **between trustors: each trustor only knows what happens in her own Trust Games with the trustee**
  - ➔ ***opportunity for dyadic learning and control***
  - ➔ ***no opportunity for network learning and control***
- ***Full information exchange*** **between trustors: after each Trust Game, also the trustor not involved in that game receives information on the choices made in that game**
  - ➔ ***opportunity for dyadic learning and control***
  - ➔ ***opportunity for network learning and control***

Further Set-Up

- **Both conditions: subjects know what kind of information everybody receives**
- **Each subject plays three supergames, in the same information condition, once as trustor 1, once as trustor 2, once as trustee**
- **Subjects were rematched between supergames; never rematched to other subjects they had already played with; rematching process was made common knowledge**
- **Experiment conducted in ELSE lab of UU, using z-Tree**
- **72 subjects, i.e., data on 72 triads and 72x15x2 = 2160 Trust Games (1080 *with* and 1080 *without* information exchange between trustors)**

Lab Experiment and Embeddedness Effects

Lab experiment allows to test hypotheses on effects of dyadic embeddedness and network embeddedness on trust and trustworthiness

Results

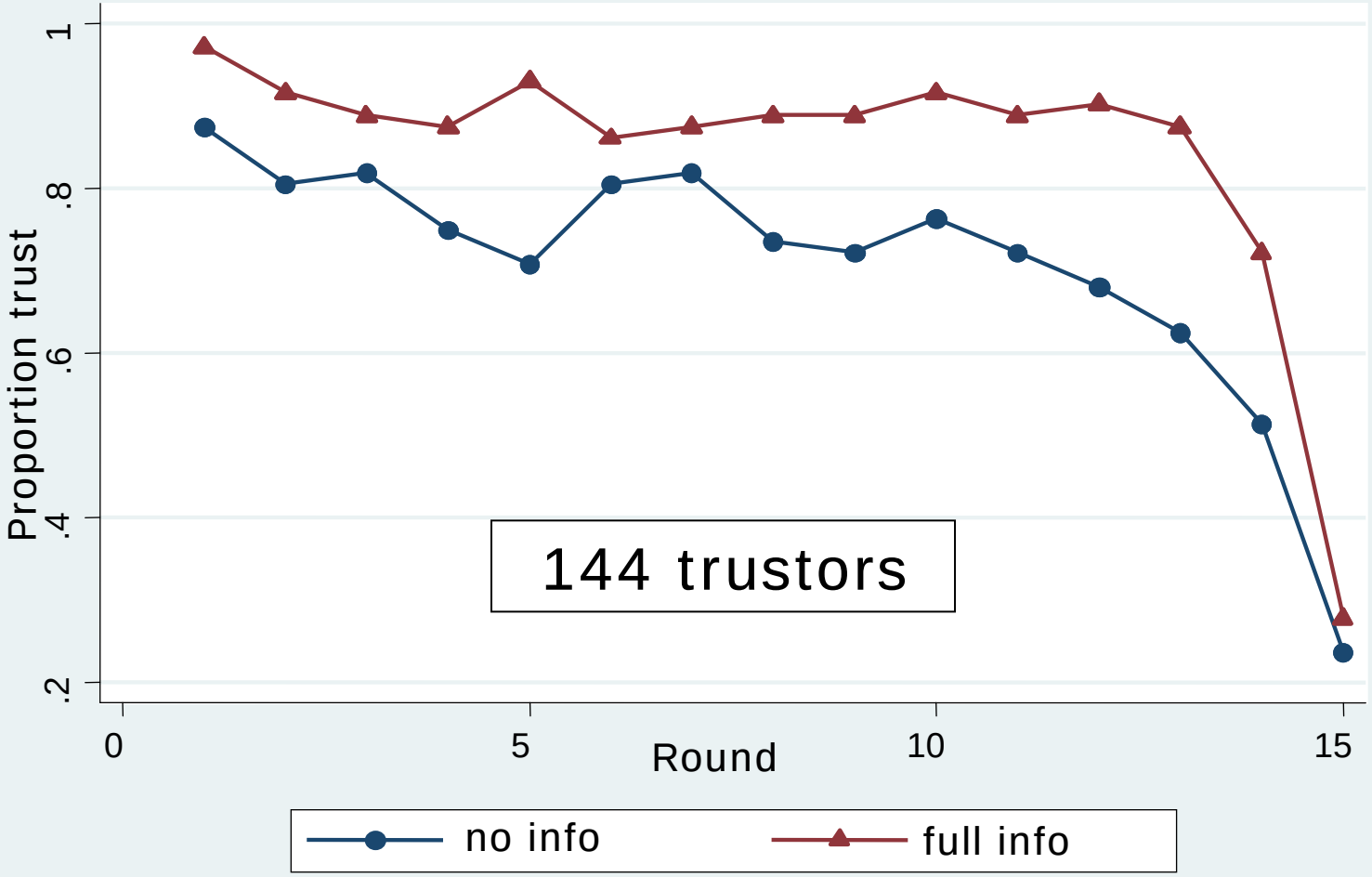
Three-Level Logistic Regression

- **Estimate probability to trust / honor trust conditional on past experiences, rounds to go, information condition**

- **Three-level random effects model:**
  - **Levels: decision – trustor – triad**
  - **2160 decisions by 144 trustors in 72 triads**
  - **1542 decisions by 72 trustees in 72 triads**

- **Clustering within trustors in *different* series of games neglected**
  - **Trustor level variance is small**
  - **Results are rather robust for the specification of random structure**

Effects of Embeddedness on *Trust*



Effects of Dyadic Embeddedness on *Trust*

- **Trustors are more (less) likely to trust…**
  - **after having experienced more honored (abused) trust in own interactions with trustee (*dyadic learning*)**
  - **the larger the number of rounds still to be played (also: strong endgame effect) (*dyadic control*)**

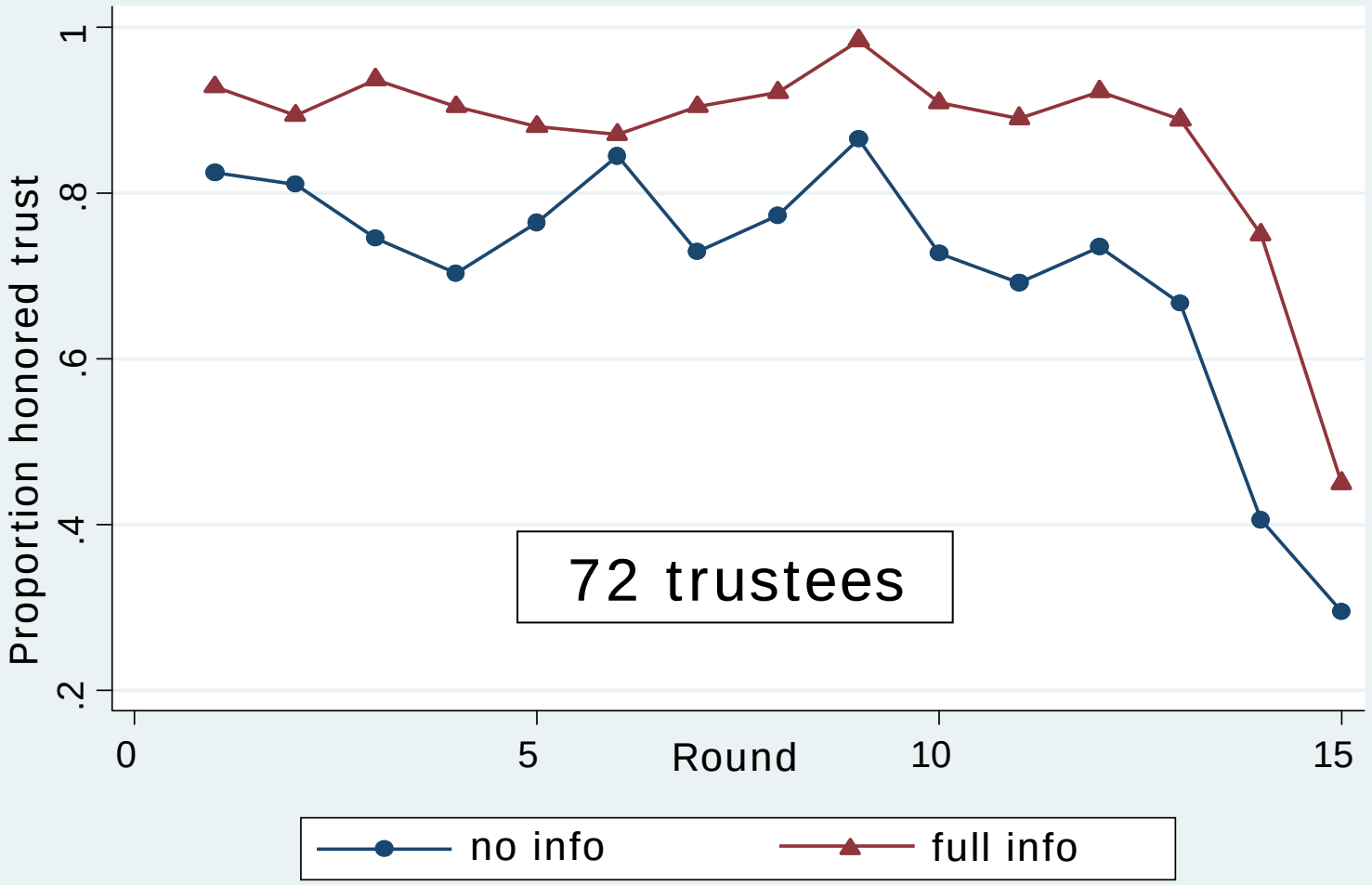
➔Support for hypotheses on dyadic learning and on dyadic control effects on trustor behavior

Effects of Network Embeddedness on *Trust*

- **Evidence for *network learning* effects on trustor behavior: trustors are more (less) likely to trust after having observed more honored (abused) trust in the *other* trustor's interactions with the trustee**

- **No evidence for *network control* effects on trustor behavior: no main effect of information condition; no interaction effect of information condition with rounds still to be played; decrease of trust does *not* start later in condition with full information exchange between trustors**

Effects of Embeddedness on *Trustworthiness*



Effects of Dyadic Embeddedness on *Trustworthiness*

- **Trustees are more likely to honor trust the larger the number of rounds still to be played with the respective trustor**
  - **Also: strong endgame effect**

➔Support for hypotheses on dyadic control effects on trustee behavior

Effects of Network Embeddedness on *Trustworthiness*

- **Positive effect of full information condition on likelihood of honoring trust**
- **Endgame effect stronger for interactions with trustor 2 (who has less control opportunities than trustor 1)**

➔Support for hypotheses on network control effects on trustee behavior

Puzzle

- ***Trustee*** **reacts to trustor's opportunities for**
  - **dyadic control and**
  - **network control**

  ➔Trustee seemingly takes reputation effects of his behavior into account

- **Focal *trustor* reacts to her own opportunities for *dyadic control***

- **Focal *trustor* does *not* react to her own opportunities for *network control***

Related Findings from Other Empirical Studies Using Complementary Research Designs

Evidence on Embeddedness Effects from Complementary Research Designs

- **Idea: use complementary research designs (survey, vignette study, lab experiment) for multiple tests of the same hypotheses (cf.: triangulation, cross validation)**

- **Similar perspective:**
  - **Sociology: J.H. Goldthorpe (1996) The Quantitative Analysis of Large-scale Data Sets and Rational Action Theory: For a Sociological Alliance, *ESR* 12**
  - **Economics: G.W. Harrison & J.L. List (2004) Field Experiments, *JEL* 42(4)**

Alternative Designs: Advantages and Disadvantages

	Advantages	Disadvantages
Survey	**Actual interactions**	**Measurement problems; less control over variables**
Lab experiment	**Control over incentives and embeddedness variables**	**Abstract; external validity**
Vignette study	**Less abstract than lab experiments; control over variables**	**Hypothetical interactions; lack of "incentive compatibility"**

Summary of Empirical Evidence

	Survey	Vignette study	Lab experiment
Dyadic learning	• Consistent support for dyadic learning and control effects on trust of trustor • Quite some support for dyadic control effects on trustworthiness of trustee		
Dyadic control			
Network learning	• Quite some support for network learning effects on trust of trustor • No support for network control effects on trust of trustor • Consistent support for network control effects on trustworthiness of trustee		
Network control			

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Conclusions

Once again the Puzzle

- ***Trustee*** **reacts to trustor's opportunities for**
  - **dyadic control and**
  - **network control**

  ➔Trustee seemingly takes reputation effects of his behavior into account

- ***Trustor*** **reacts to her own opportunities for *dyadic control***

- ***Trustor*** **does *not* react to her own opportunities for *network control***

How (*not*) to Explain the Puzzle?

- **Data and/or measurement problems (including sample selectivity and endogeneity of network embeddedness) could be (part of) the reason why we do not find network control effects on trustor behavior in survey data (see Buskens 2002)**

- **Data and/or measurement problems are much less plausible reasons for the lack of network control effects on trustor behavior in the experiment**

How to Explain the Puzzle: Limits of Strategic Rationality?

- ***General idea*: Trustor anticipation on her own opportunities for network control involves *too many steps of iterated reasoning*, at least for inexperienced subjects**
- ***Network control effects on trustee behavior* require *only* that trustee anticipates that own present behavior affects future trust of the present or other trustors**
- ***Network control effects on trustor behavior* require that trustor anticipates that the trustee anticipates on effects of his present behavior on future trust *of other trustors***

Similar Arguments in the Literature

- **Equilibrium behavior becomes less likely when actors have to reason many steps ahead**
- **Equilibrium behavior requires that actors are sufficiently "experienced"**

(see, e.g., Binmore, Camerer, and Kreps)

Testable Implications of the Explanation of the Puzzle and Empirical Evidence

- **In the experiment, trustors who have been in the role of trustee in an earlier game (and thus have more experience) should be more likely to react to network control opportunities. There is some support for this effect in our data.**
- **We also find support for network control effects on trustor behavior in one of our vignette studies with *experienced* subjects (purchase managers) in the trustor role.**

Related Empirical Evidence from Other Research

Professionals **tend to implement relatively complex equilibrium behavior as well as equilibrium behavior that requires quite some iterated reasoning, also in situations where** ***non-professionals*** **fail to do so:**

- **Professional soccer players (versus college students) in zero-sum games such as penalty kicks (but also strategically equivalent lab experiments): Palacios-Huerta & Volij; Berger & Hammer**
- **Chess Grandmasters versus college students in the Centipede Game: Palacios-Huerta & Volij**
- **… quite some related empirical evidence**

- **Thanks for your attention**
- **Slides of presentation will be downloadable from workshop website**
- **Review paper on the literature on embeddedness effects on trust: Buskens & Raub (2008) Rational Choice Research on Social Dilemmas, *mimeo*, Utrecht – downloadable from our website**

www.fss.uu.nl/soc/iscore

Additional slides

Effects on *Trust*

Information condition	No net effect
Abused own trust in past	–
Honored own trust in past	+
Abused other trust in past	–
Honored other trust in past	+
Rounds to go	+
Rounds to go × information	0
Round 14	–
Round 15	–
Info cond × round 14	0
Info cond × round 15	–

Effects on *Trustworthiness*

Information condition	**+**
Rounds to go	**+**
Rounds to go × information	**–**
Round 14	**–**
Round 15	**–**
Info cond × round 14 × trustor 2	**–**
Info cond × round 15 × trustor 2	**–**