Coordination and Network-based Proximity: Experimental Evidence from the Field

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Summary

- Many social and economic interactions require the **coordination of behavior**. Coordination failure is a source of inefficiency (Schelling, 1960, 1978)
- Coordination takes place in a social context; **social connections** might influence the potential to coordinate behaviour.
- Our focus: **network-based social proximity** as a possible **coordination device**; using three established concepts in network analysis (closeness, maximum network flow, and clustering)
- **Empirical approach**:
  - Two-player **lab-in-the-field coordination experiment**, where we vary identity disclosure of players, and cost of effort
  - **Real existing social networks** in small-scale communities
- **Results**:
  - **Social proximity increases efficiency of coordination** through **clustering**; i.e., in pairs of friends who share friends
  - No support for alternative measures of network proximity

Our contribution

- Comparison of **three network based concepts of social proximity**, emphasizing the potential importance of indirect connections
- Use of **real existing networks**
- Differences from existing approaches in the literature:
  - Dyadic perspective; but with multiple pairs
  - Allow for different behavior towards different interaction partners
  - Do not mention networks
  - Focus on the role of altruism instead of information sharing (similar to the approach used by Leider et al. (2009))

Experiment

Two-player Minimum Effort Game (MEG): a one-shot simultaneous-move coordination game where payoffs depend on the minimal effort of either player.

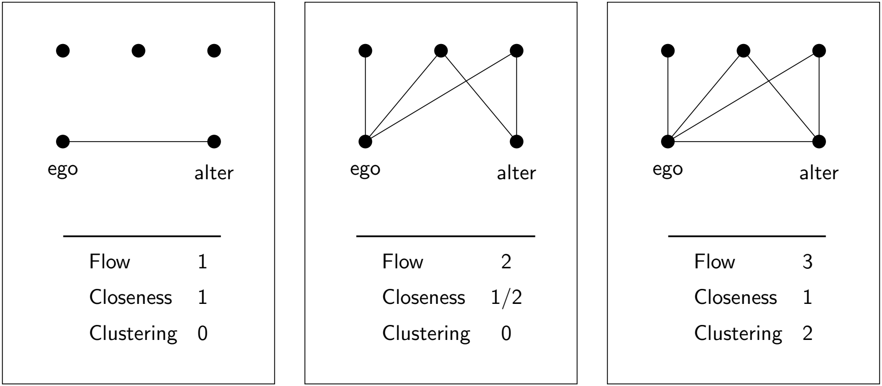
- A player i's individual payoff Π_i is defined as:

$$\Pi_i(e) = a \times \min\{e_i, e_j\} - c \times e_i \quad (1)$$

- a is the marginal benefit of effort, while c is the marginal private cost of effort, with $a > c > 0$.
- Any combination of (e_i^*, e_j^*) with $e_i^* = e_j^*$ is a **Nash equilibrium**.
- Equilibria can be **Pareto-ranked**; higher e, higher efficiency

Network-based proximity

Three concepts of network-based proximity: **maximum network flow** (Ford Jr and Fulkerson, 1956), **closeness** (Freeman, 1978), and **clustering** (Coleman, 1988)



a) b) c)

Treatments

- **Identity disclosure** (within-subject)
  - We exogenously change **information about the identity of the participants**, thus, about network position
  - In a pair, participants either had information on the other's identity (**full disclosure condition – FD**), or not (**anonymity condition – AN**). (Note: it is impossible to manipulate real existing networks)
- **Effort cost** (between-subject)
  - **Low Effort Cost (LEC)** and **High Effort Cost (HEC)**
  - A higher effort cost lowers effort in MEG (Goeree and Holt, 2001, 2005)
  - A higher effort cost increases the room for an influence of social proximity.

Hypotheses

We focus on **difference in effort between FD and AN (FD-AN)**:

Hypothesis (effort costs): Proximity increases the FD-AN difference in effort. This increase is stronger in HEC than in LEC.

Hypotheses (cont.)

Specific hypotheses, using the three concepts of network-based proximity.

Hypothesis (Direct tie):

1. **A direct tie in FD** increases ego's effort relative to that in AN
   a) **independently of** whether ego and alter have any friends in common (**Flow** and **Closeness**).
   b) **only if** ego and alter have at least one common friend (**Cluster**).

Hypothesis (Common friends):

1. **Having common friends in FD** increases ego's effort relative to that in AN
   a) **independently of** whether ego and alter have a direct tie (**Flow**).
   b) **only if** ego and alter <u>do not have</u> a direct friendship tie (**Closeness**).
   c) **only if** ego and alter <u>have</u> a direct friendship tie (**Cluster**).

Experimental procedures

Study was conducted in Sironko district in **eastern Uganda**, **22** randomly selected **villages**, surveyed (almost) all households in village; **197 participants**

1. **Survey**: a few weeks before experiment
   - Network elicitation: full network in village
   - Socio-economic characteristics
2. **Experiment**: incentivized MEG
   - Two decisions with different opponents in each disclosure condition; Order of the disclosure conditions randomized at the individual level
   - In **FD condition** both opponents were from the same village; allows to observe within-subject variation in behavior along social proximity.
   - In **AN condition** participants were once paired with someone who lived in the same village and once with someone from a different village.

Influence of proximity on FD-AN difference in effort

Direct test (not shown): Both having a **Tie** and having a **Common** friend increases effort in FD relative to AN.

Regression analysis addresses:

- Tie and Common might be correlated
- interactions between Tie and Common
- reduce remaining omitted variable bias

Our main specification looks as follows:

$$y_{ij} = \beta_0 + \beta_1 \text{ HEC} + \beta_2 \text{ Tie} + \beta_3 \text{ HEC} \times \text{Tie} + \beta_4 \text{ Common} + \beta_5 \text{ HEC} \times \text{Common} \\ + \beta_6 \text{ Tie} \times \text{Common} + \beta_7 \text{ HEC} \times \text{Tie} \times \text{Common} + \beta_8 \text{ X}_i + \beta_9 \text{ X}_j \\ + \mu_e + \epsilon_{ij} \quad (4)$$

with y_{ij} being the FD-AN difference when i (ego) is matched with j (alter)

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$$
\begin{aligned}
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&+ \beta_6 \text{ Tie} \times \text{Common} + \beta_7 \text{ HEC} \times \text{Tie} \times \text{Common} + \beta_8 \text{ X}_i + \beta_9 \text{ X}_j \\
&+ \mu_e + \epsilon_{ij}
\end{aligned} \tag{4}
$$

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Influence of proximity on FD-AN difference in effort

	(1)	(2)	(3)	(4)	(5)
HEC	0.174	0.021	0.214	0.186	0.231
	(0.111)	(0.108)	(0.288)	(0.278)	(0.239)
Tie		-0.190		-0.209	0.085
		(0.144)		(0.157)	(0.242)
HEC × Tie		0.493***		0.546***	-0.517*
		(0.178)		(0.175)	(0.285)
Common			-0.001	0.078	0.112
			(0.143)	(0.146)	(0.162)
HEC × Common			-0.050	-0.231	-0.290
			(0.363)	(0.350)	(0.327)
Tie × Common					-0.321
					(0.339)
HEC × Tie × Common					1.111***
					(0.358)
Constant	-0.511	-0.210	-0.330	-0.243	-0.226
	(0.506)	(0.469)	(0.506)	(0.492)	(0.475)
R^2	0.070	0.087	0.071	0.090	0.093

Notes: OLS regressions with the difference in ego's effort between FD and AN as dependent variable. N = 393. Standard errors in parentheses, clustered and bootstrapped at village level, with 2000 repetitions.

The effect of ‘Common’ on FD-AN difference in effort

a) Effect of Common	LEC	HEC	LEC vs. HEC $^{(a)}$
Tie=0	0.112	-0.178	0.375
Tie=1	-0.209	0.612***	0.005
Tie=0 vs. Tie=1 $^{(a)}$	0.344	0.009	

Notes. Effect of having common friends. Table entries calculated as follows: Tie=0 in LEC: ‘Common’; Tie=0 in HEC: ‘Common + HEC × Common’; Tie=1 in LEC: ‘Common + Tie × Common’, Tie=1 in HEC: ‘Common + HEC × Common + Tie × Common + HEC × Tie × Common’. ***, **, * indicate significance levels at 1, 5, and 10% of a Wald test. *(a)* Two-sided p-value of a Wald test that compares coefficients in the same row/column.

Result (Effect of Common):

(i) The **effect of Common** on the FD-AN effort difference is **positive** and significant in the **HEC** condition and where **pairs are friends**.

(ii) The positive effect of Common on the FD-AN effort difference is larger among friends in the HEC condition, than among friends in the LEC condition, or non-friends in the HEC condition.

The effect if ‘Tie’ on FD-AN difference in effort

b) Effect of Tie	LEC	HEC	LEC vs. HEC [(a)]
Common=0	0.085	-0.432	0.069
Common=1	-0.236	0.358***	0.001
Common=0 vs. Common=1 [(a)]	0.344	0.009	

Notes. Effect of having a tie. Table entries calculated as follows: Common=0 in LEC: ‘Tie’; Common=0 in HEC: ‘Tie + HEC × Tie’; Common=1 in LEC: ‘Tie + Tie × Common’, Common=1 in HEC: ‘Tie + HEC × Tie + Tie × Common + HEC × Tie × Common’. ***, **, * indicate significance levels at 1, 5, and 10% of a Wald test. *(a)* Two-sided p-value of a Wald test that compares coefficients in the same row/column.

Result (Influence of Tie):

(i) The **effect of Tie** on the FD-AN effort difference is **positive** and significant in the **HEC** condition and where **pairs have a common friend**.

(ii) The positive effect of Tie on the FD-AN effort difference is larger among pairs who have a common friend in the HEC condition, than pairs with a common friend in the LEC condition, or pairs without a common friend in the HEC condition.

Conclusion

- **Hypothesis**: higher social proximity in friendship networks between two participants increases effort (i.e., efficiency) in coordination problem.
- **Result**: Common friends increase effort (when costs are high) for pairs with a direct tie, but not for those without. Similarly, having a direct tie increases effort (when costs are high) for pairs with common friends, but not for those without.
- These results provide **support for a positive effect of clustering on efficiency of coordination**.
- In line with other studies that described how clustering fosters trust (Karlan et al., 2009) and increases favor exchange (Jackson et al., 2012).
- Even in an experiment where networks are not mentioned, network structure influences behaviour.
- We cannot exclude that trust and reciprocity might also have contributed to the positive effect of clustering on effort in our experiment.

Thank you!

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