Experimental Economics
Slides 8

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Based in part on course materials by Sandra Maximiano



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Volunteer Dilemma

Bystander effect: The Case of Kitty Genovese (video discussion)
https://www.youtube.com/watch?v=0jKtugVokaY

Main Questions

- What is a volunteer dilemma?
- What are the pure-strategy and mixed-strategy Nash equilibria?
- What is the impact of increasing the number of players?

Volunteer Dilemma

	INVEST	NOT INVEST
INVEST	0.85, 0.85	0.85, 1.00
NOT INVEST	1.00, 0.85	0.20, 0.20

Sometimes it takes only one. Who will be the one? Many people want a situation corrected, but only one needs to incur the cost

Our lab experiment: two Players

- Given $V - C > L$, both choosing Not Invest cannot be an equilibrium.
- Given $V > V - C$, both choosing Invest cannot be an equilibrium.

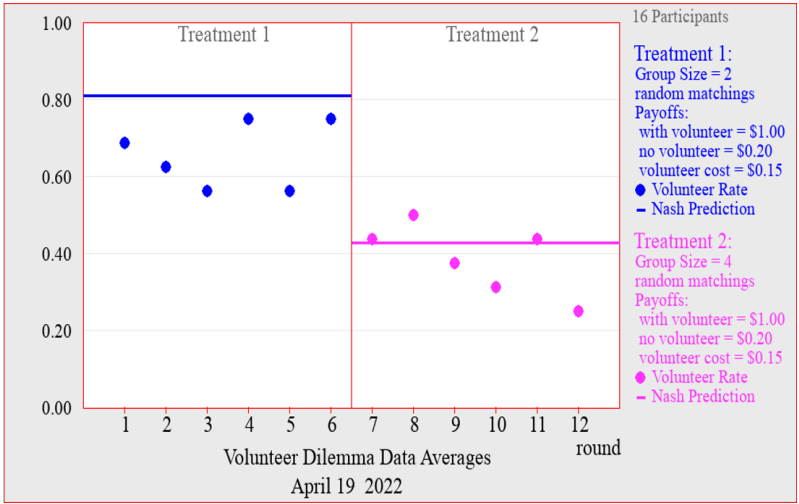
Pure-Strategy Equilibria

- One player volunteers and the other does not.
- Each player prefers to volunteer if the other refrains.
- With two asymmetric pure equilibria, players may alternate.
- What happens as group size increases?

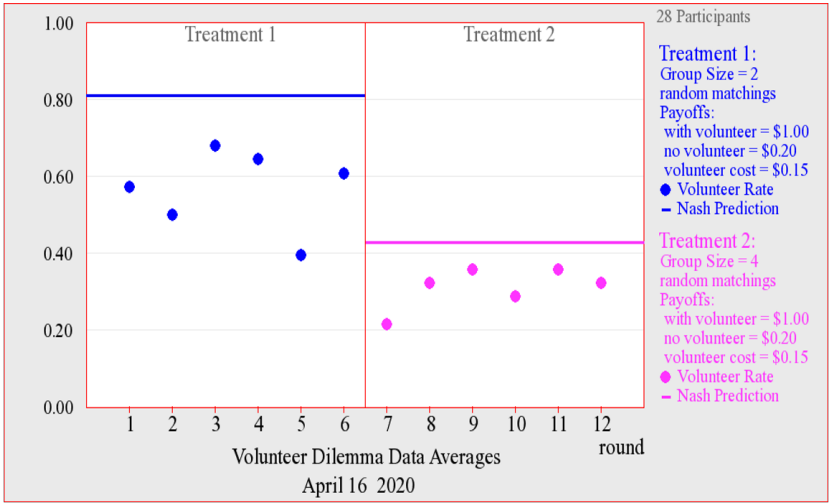
Laboratory Results (2022)

	Individual investment rate	Rate of no-investment outcomes
Treatment 1 (rounds 1–6)	$92/144 = 0.639$	$9/(12 \times 6) = 0.125$
Treatment 2 (rounds 7–12)	$77/144 = 0.535$	$2/(6 \times 6) = 0.056$

Volunteer Dilemma: Data (2022)



Volunteer Dilemma: Data (2020)



The Volunteer's Dilemma

- Sometimes only one person needs to take action to generate a benefit for everyone.
- Volunteering involves a private cost, while the benefit is shared by the entire group.
- Each individual prefers that someone else incurs the cost.
- However, if nobody volunteers, everyone receives a lower payoff.

The Volunteer's Dilemma: Payoffs

Consider a group of N players.

- Each player chooses whether to volunteer.
- V: payoff if at least one person volunteers.
- C: private cost of volunteering.
- L: payoff if nobody volunteers.
- Assume $V > V - C > L$.

A volunteer receives $V - C$, regardless of others' choices.
A non-volunteer receives V if someone else volunteers, and L otherwise.

The Volunteer's Dilemma: Nash Equilibria

Consider the two-player game.

- Both volunteering cannot be a Nash equilibrium: each player would prefer to free ride.
- Neither volunteering cannot be a Nash equilibrium: either player would benefit from volunteering.
- There are two pure-strategy Nash equilibria: exactly one player volunteers.
- There is also a symmetric mixed-strategy Nash equilibrium.

Mixed-Strategy Nash Equilibrium

Let p be the probability that another player volunteers.
For two players:

$$E(\text{Volunteer}) = V - C$$

$$E(\text{Not Volunteer}) = pV + (1-p)L$$

In a mixed-strategy equilibrium, players must be indifferent:

$$V - C = pV + (1-p)L$$

Therefore,

$$\boxed{p = 1 - \frac{C}{V-L}}$$

Mixed-Strategy Equilibrium with N Players

Suppose each of the other $N-1$ players volunteers independently with probability p.

- Probability that none of the others volunteers:

$$(1-p)^{N-1}$$

- Expected payoff from not volunteering:

$$V[1-(1-p)^{N-1}]+L(1-p)^{N-1}$$

Indifference implies:

$$V-C=V[1-(1-p)^{N-1}]+L(1-p)^{N-1}$$

Hence,

$$\boxed{p=1-\left(\frac{C}{V-L}\right)^{\frac{1}{N-1}}}$$

The Effect of Group Size

The symmetric Nash equilibrium predicts:

$$p = 1 - \left(\frac{C}{V - L}\right)^{\frac{1}{N-1}}$$

- The individual probability of volunteering decreases as group size increases.
- Individuals increasingly rely on others to provide the public benefit.
- However, the probability that nobody volunteers is:

$$P(\text{No Volunteer}) = (1 - p)^N = \left(\frac{C}{V - L}\right)^{\frac{N}{N-1}}$$

- This probability increases with group size under the symmetric Nash prediction.

Experimental Evidence: Group Size

Goeree, Holt, and Smith (2017) study groups of 2, 3, 6, 9, and 12 participants.

- Individual volunteering decreases as group size increases.
- For small groups, volunteering is lower than predicted by Nash equilibrium.
- For large groups, volunteering is higher than predicted.
- Observed volunteering rates are therefore less sensitive to group size than Nash predicts.
- The frequency of outcomes with no volunteers decreases with group size, contrary to Nash predictions.

The Complainer's Dilemma

- A public benefit is provided only if at least $m > 1$ individuals complain.
- There are N potential complainers.
- Each individual chooses whether to complain.
- Complaining costs C, while successful collective action generates a benefit B for everyone.
- A complaint may be insufficient to generate the benefit if too few others complain.
- The standard Volunteer's Dilemma is the special case $m = 1$.

The Complainer's Dilemma: Nash Equilibrium

Let p be the probability that another individual complains.

- A player is pivotal when exactly $m-1$ of the other $N-1$ players complain.
- Only in this situation does their complaint change the outcome from failure to success.
- The expected benefit of complaining, relative to not complaining, is:

$$B\binom{N-1}{m-1}p^{m-1}(1-p)^{N-m}$$

In a symmetric mixed-strategy Nash equilibrium:

$$\boxed{B\binom{N-1}{m-1}p^{m-1}(1-p)^{N-m} = C}$$

The Complainer's Dilemma: Predictions

- Unlike the standard Volunteer's Dilemma, nobody complaining is a Nash equilibrium when $m > 1$.
- Pure-strategy equilibria also exist with exactly m individuals complaining, provided $B > C$.
- Symmetric mixed-strategy equilibria may exist, but are not guaranteed.
- When they exist, there are generally two interior equilibria.
- In the stable, high-volunteering equilibrium, a higher threshold m increases the individual probability of complaining.
- A higher cost-benefit ratio C/B reduces complaining in that equilibrium.

The Complainer's Dilemma: Evidence

- Leo (2024) develops a theoretical model of complaint thresholds and strategic participation.
- The model is motivated by administrative complaint data from New York City.
- For large populations, the analysis supports policies combining low complaint costs with sufficiently high complaint thresholds.
- The study does not report a laboratory experiment directly testing the equilibrium predictions of the Complainer's Dilemma.
- A natural experimental test would vary the required number of complaints m and the individual complaint cost C.
- The key outcomes would be individual complaint rates and the frequency of successful collective action.