Public Goods Games
What is a Public Good?

There are three components to a public good.

1. The good is jointly provided.
2. The good is non-excludable.
3. The good is non-rivalrous.

What is your prediction?

It turns out that there is a lot of free riding and underprovision of the good.

Why?

Efficiency and individual rationality are at odds!
Examples

- Parks
- Clean air
- Defense
- Open source software
The Voluntary Contribution Mechanism

Experimentalists use a simple model to describe the central problem with public goods. It is called the Voluntary Contribution Mechanism (VCM) and it consists of the following rules:

1. $N$ players,

2. player $i$ has an endowment $e_i$ of tokens,

3. from which he chooses a number $x_i$ to contribute to a public account (choices are simulataneous), and

4. keeps $e_i - x_i$ to himself, thus earning in total

$$e_i - x_i + m \sum_{j=1}^{N} x_j,$$

5. where $m$ is the marginal per capita return (MPCR).
The Voluntary Contribution Mechanism

The public goods problem (or social dilemma) arises when \( \frac{1}{N} < m < 1 \). The theoretical prediction is 0 contribution.

Consider an example where there are \( N = 4 \) players, everyone is endowed with 100 tokens and \( m = 0.5 \).

What are the efficiency implications?

- If everyone keeps their tokens to themselves, each earns 100, while
- if everyone contributes, each earns \( 0.5 \times 4 \times 100 = 200 \).

Is this the Nash equilibrium of the VCM game?

- No! Everyone should give 0 to the public good.
Why does cooperation fall apart?

• Suppose everyone else is giving the full amount.
• If you give the full amount you earn 200, BUT
• if you give nothing you earn 250!

We call this free riding.
The authors vary the MPCR between L(0.3) and H (0.75) and the number of players $N$ between 4 and 10.
Isaac and Walker (1988)

- The higher the MPCR the more subjects are willing to contribute.

- In these repeated setups, subjects experience what is sometimes called cooperative decay.

- Cooperation rates drop to under 10% with experience in some parameterizations and less drastically in others.

- The evidence is unclear as to the effect of $N$ on cooperation.
Why do people cooperate?

• Kindness: People are conditional cooperators; that is, enjoy the experience of cooperating (warm glow), but only as long as others are cooperating too.

• Confusion: People do not fully understand their best response and are simply making mistakes. In that sense, cooperative decay is just learning ...

Results from Andreoni (1995) indicate that around half of the subjects are confused and half are kind. A lot of subjects are misclassified so kindness could be as low as 43% or as high as 67%. Results from Houser and Kurzban (2002) corroborate Andreoni’s findings.
FEHR AND GACHTER (2000)

Fehr and Gachter (2000) run the VCM with $N = 4$, $MPCR = 0.4$, and 10 repetitions. In the control, they had no punishment (i.e. the standard VCM game), whereas in the treatment with punishment, subjects could pay to reduce the points of other players in the game. Fehr and Gachter (2000) run one set with strangers (i.e. random matching) and one set with partners (i.e. fixed matching).

What does economic theory predict?

Since punishment is costly and identities are anonymous between rounds, nobody should punish and therefore, by backward induction, the ability to punish should have no effect on contributions.
FEHR AND GACHTER (2000) - STRANGERS

Average contributions vs. periods with and without punishment.
FEHR AND GACHTER (2000) - PARTNERS
Contributions go up with punishment, but whether or not this is efficient, depends on the cost of the punishments.

Why do subjects punish even though it is not in their individual best interest?

Fehr and Gachter hypothesize that punishment is due to a strong negative emotion.
Exclusion

An alternative way to support public goods is to exclude those who are not contributing. For instance, infidels are kicked out of religious organizations. Bad employees are fired from firms.

Such actions lead to fewer non-cooperators and encourage conditional cooperators to cooperate freely.

Cinyabuguma, Page and Putterman (2005) find that the overall effect on efficiency goes up with expulsion.
Discrete Public Goods

Discrete public goods are goods that are produced if and only if a certain level of contributions is reached.
Examples

• Collecting money for a coffee machine in the office.

• Signing a petition.

• Setting up a lobby given the political environment.
When the number of potential contributors and their preferences are common knowledge, multiplicity of Nash equilibria may emerge regardless of the group-size (see, for instance, Palfrey and Rosenthal (1984)). Typically, there are two inefficient symmetric equilibria: one is a mixed-strategy and the other is with zero contributions. There is also an efficient equilibrium outcome in asymmetric pure-strategies, where just enough contributions are made so that the public good is certainly provided.
Isaac, Schmidtz and Walker (1989)

If the good is not produced, what happens to the contributions? Under some setups, these contributions are returned to the subjects, whereas in other setups the contributions disappear.

Early experiments were conducted by Isaac, Schmidtz and Walker (1989). The authors run the experiments with low, medium and high thresholds as well as money back and no money back protocols.
Isaac, Schmidtz and Walker (1989)
Isaac, Schmidtz and Walker (1989)

Provision Point = 248

Total Tokens Invested

"Money Back" - 6 Experiments

"No Money Back" - 6 Experiments

Period