Crowding Effects:
How Money Influences Open Source Projects and its Contributors

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1. Different Perspectives on Community Building
2. About Economics, Motivation and Crowding-Out
3. Incentive Systems in Open Source Communities
4. Debian/dunc-tank and Google Summer of Code
5. Conclusions
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Macro and Micro Perspective on Communities

- Macro
  - Best practices of successful OSS projects
  - Some hints based on anecdotal evidence

- Micro
  - Interaction between actors: social behavior
  - Human behavior: Crowding-out of intrinsic motivation

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Best Practices of Successful OSS Projects

- Modular structure of the code
- Documentation for different stakeholders
- Controlled release management
- Efficient collaboration platform
- Regular physical meetings
- Real-world organization such as a foundation
Some hints based on anecdotal evidence

- Structure follows problems → re-act, not pro-act
- Openness for newcomers, new ideas, new leaders
- Do provide incentives for writing documentation

→ More about OSS leadership and preconditions for new OSS projects: Stuermer, 2005
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Standard Economic Model

Source: Frey & Jegen 2001
Intrinsic vs. Extrinsic Motivation

- **Intrinsic Motivation** (from within the person)
  - Enjoyment-based
  - Obligation-based

- **Extrinsic Motivation** (underlying preferences)
  - Non-monetary: reputation, career options...
  - Monetary: employment, rewards, sponsoring...
Importance of Intrinsic Motivation

- Basis for uncompensated voluntary work → foundation of OSS contributions
- When results cannot be observed and attributed (complex tasks)
- Necessary in all knowledge-intensive tasks
- Relevant for team work

Source: Weibel et al. 2007
Crowding-out effect: Experiment 1 of Gneezy & Rusticini (2000)

- **Voluntary collection:** 180 pupils divided in 3 groups
  - 1: Motivation speech and no reward
  - 2: Motivation speech and 1% of collected sum
  - 3: Motivation speech and 10% of collected sum

- Who collected the **most money**?
  - Group 1: Highest intrinsic motivation

- Who collected the **least money**?
  - Groups 2: Crowding-out of intrinsic motivation

- Conclusion: “Pay Enough or Don't Pay at all”
Crowding-Out with a Negative Net Effect

Source: Frey & Jegen 2001

crowding-out effect shifts supply curve, e.g. because of introduction of money

Extrinsic Incentive

Working Effort

supply curve

new supply curve
Experiment 2 of Gneezy & Rusticini (2000)

- Parents come late to pick up their child from day-care
- **Deterrence theory:** Penalty reduces bad behavior
- **Results** from introducing fine for coming late:
  - Parents arrive even later!
  - After withdrawing fine, parents still come later
- **Conclusions** from experiment:
  - Incomplete contracts become preciser with fine
  - New perception of the situation: “A fine is a price”
  - Outcome of intervention depends on initial perception
Crowding-in and -out of Intrinsic Motivation

- External intervention has two opposite effects:
  - Price effect
  - Crowding-out effect

- Big question: Which effect is stronger?
  → Determines if net effect of intervention is positive or negative
Combining Standard Economic Model and Crowding-Out Effect of Intrinsic Motivation

Source: Weibel et al. 2007
Effects of Motivational Incentives on Effort

- Decision Making
- Goal Setting
- Constructive Feedback
- Performance-Contingent Rewards
- Extrinsic Motivation
- Intrinsic Motivation
- Work Effort

Source: Weibel et al. 2007; Frey and Jegen, 2000
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The Motivation Mix of OSS Contributors

- **Intrinsic motivation**
  - Fun, curiosity
  - Ideology („Software must be free.“)
  - Responsibility, commitment (maintainer's fate)

- **Extrinsic motivation**
  - Reputation
  - Career options (learning effect, student projects)
  - Employment, contracts, own business

→ How much are we really intrinsically motivated?
Unattractive Tasks in Open Source Projects

- What gets done? → Itches of developers
- Unattractive tasks 1: Usability
  - High quality documentation for different target groups
  - GUI design
  - End user features
- Unattractive tasks 2: Quality
  - Code review
  - Bug fixing

→ Tasks of „The Last Mile“ are often neglected.
Why introducing incentive system?

1. **Gaps of contributions:** Solve unattractive tasks
2. Motivate **new people** getting into the community
3. 'Weed-out' **old, inactive people**

→ Who should be attracted with incentive system?
   Long-term vs. short-term contributors
Examples of Extrinsic Incentives in OSS

- **Monetary**
  - Employment of contributors
  - Bounty system
  - Sponsoring of projects
  - Awards, competitions

- **Near-Monetary**
  - Flight and hotel for conference

- **Non-Monetary**
  - Acknowledgments
  - Credit point system
  - Activity ranking

How does it affect self-determination? (performance-contingent or fixed)
Controlling Effect of Extrinsic Incentives

Theory predicts crowding-out

Perceived external control

Performance-contingency

Credit point system
Activity ranking
Contingent-Reward Employment
Bounty system
Sponsoring
Awards
Flight and hotel for conference

Acknowledgments

„Extrinsicy“

Fixed-Salary Employment
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Unhappy example: Debian/dunc-tank

- Disclaimer: Highly controversial topic in Debian community
  Google “Debian dunc tank”: ≈ 10'100 entries... (and much more 'private')

- About Debian/dunc-tank
  - Paying 2 release managers to get out Debian 4.0 on time (Dec 4\textsuperscript{th})
  - Started Sept 2006, goal of Dec 4\textsuperscript{th} not reached because of...?

- Preliminary conclusions
  - Impossible to measure crowding-out of intrinsic motivation
  - Envy because of selection process → Why not silently employed?
  - Payment from Debian itself vs. from external entity
  - Don't experiment with money – or at least don't declare it as this!
  - Employment issues depend on community characteristics
Successful example: Google Summer of Code

About GSoC

- 2007: Accepted 905 students for 136 OSS projects
- Projects sign up, students apply for tasks, mentor supervises
- Student receive 4500$ on completion, mentoring orgs 500$

Preliminary conclusions

- Highly successful: Everybody seems happy, just little chaotic...
- Positive because of funding new community entrants
- Participating in GSoC becomes level of 'certification'
- Focus only on code, documentation is secondary
- Implementation of new code in projects?
Other Influences on Success of Extrinsic Incentive Systems in OSS communities

- **Group effects**
  - Crowding-out occurs only on individual level
  - Envy between contributors → fair/unfair intervention
  - Literature on group dynamics → no data in OSS so far

- **Community characteristics**
  - Target group of software
  - Project age and activity level
  - Software complexity, programming language, OS
  - Working situation of contributors (paid vs. voluntary)
  - Dominant ideology (Free Software vs. OSS)
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Conclusions

- **What intervention is definitively positive? → Moral call**
  - „Make them feel the pain“ (Kasper Skårhøj, TYPO3)
  - Increase identification to elevate importance of certain tasks
  - No penalties

- **New insights and future research**
  - Differentiation between *personal motivation* (=not knowing what others do or receive) and *social behavior* (fair/unfair)
  - Extrinsic incentives in OSS sometimes positive, sometimes negative → perception of participants is relevant
  - Economists often oversimplify, empirical tests are necessary
  - No empirical studies in OSS environments so far
Discussion, Acknowledgments

- What are your experiences in this area?
- To OSS project leads: Interested in collaboration on research about crowding-out?
- Thanks to
  - Kasper Skårhøj
  - /ch/open - www.ch-open.ch
  - LinuxTag

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References