

Collaborative Software Design & Development

Coordination 6

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Papers

→ How free software developers work

The mobilization of “distant communities”,

↳ Didier DEMAZIERE (CNRS, laboratoire Printemps, UVSQ)

↳ Francois HORN (CLERSE, IFRESI)

↳ Nicolas JULLIEN (MARSOUIN)

→ Coordination in Software Development

↳ Robert E. Krant

↳ Lynn A. Streeler

How Free Software Developers Work

→ How free software developers work

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→ Topics:

- ↳ Aspects of free software organizational structures
- ↳ Reasons for users commitment
- ↳ Case studies for four different free software developers

Aspects of free software organizational structures

→ Modular Structure

- ↳ Divide the software to small modules, “bits and pieces”
- ↳ Implement every module in parallel
- ↳ Assemble the fragments
 - Does not need hierarchy
 - Identifies every contributors major role
 - Facilitate cooperation between contributors

→ Technological Complexities

- ↳ Developers having same technical experience working together
- ↳ Distributed intelligence: every user can benefit from improvements and skills of other users

Aspects of free software organizational structures (cont.)

→ Verification of Individual Production

- ↳ Controlling and validating different contributions
- ↳ Proposing different solutions to solve problems
 - Competition between developers (flat organization)

→ Identification of the work

- ↳ Author's name written as part of the source code
 - Judge the quality
- ↳ "Credits" file
 - "sense of pride"

Aspects of free software organizational structures (cont.)

→ Competition

↳ Developers seek recognition

- Proposing ideas to add to the program
- Suggesting a solution/correction for a problem
- Integrating a contribution in the distribution
- Having large number of downloads

↳ Developers seek reputation

- Improving quality of code

↳ Analogous to scientific research

- Circulation of information
- Verification by peers
- Proposal of alternative solutions
- Competitions between teams

Different Organizational Groups

→ Monopoly of decision-making process

↳ Initiators of the project

- Keeping recognition and legitimacy being the guarantor of the product

↳ Decision making monopoly

- Individuals, institution, contributors with common links (alumni, colleagues in a study...)

Does the increase in number of users and contributors diminish the monopoly of the initiators?

Different Organizational Groups (cont.)

→ Group of initiators with common interests

- ↳ Define standards
- ↳ Contributors are added by voting
- ↳ Groups divide tasks between group members
 - Advantage of this type of organization is in the ability to extend it to multiple groups of initiators from various institutions.

→ Central institution

- ↳ Private or public company
- ↳ Salaried work
- ↳ Open to outside contributions
 - The company maintain decision-making power

Different Organizational Groups (cont.)

→ When the group expands dramatically

- ↳ Need to maintain modular structure

- ↳ Create different membership applications

- ↳ Debian application:

 - Sponsorship by a member of the group

 - Technical aptitude test

 - Test for candidate's knowledge of Debian's philosophy

Is it always a good idea to have more contributors as much as possible?

When is the point to stop?

The Process of Individual Commitment

→ Economic incentives

- ↳ Getting an interesting job

- ↳ Consulting contracts

- This is based on the fact that the free software development recognizes the contribution of every person precisely.

→ Reputation acquired between developers could spread world wide

What if you already have a good paid job? Do you quit to work in a free software team for less \$money\$!?

The Career as a Free Software Developer

→ Why interested in free software?

- ↳ Satisfying personal needs in contributing in a software
- ↳ Curiosity to read source code
- ↳ Ability to examine and change the program
- ↳ Have control in society
- ↳ Doing something in your field of competency
- ↳ Change the world!

→ How to start?

- ↳ Participate in mailing lists
- ↳ First contributions are usually
 - Reporting bugs
 - Translations
 - Improving documentation

The Career as a Free Software Developer (cont.)

→ Becoming a free software contributor

- ↳ Contribute code to the project
- ↳ Control the quality of the code submitted
- ↳ Create a network of connection with team members
- ↳ Integrate the changes in the final release

→ Becoming a free software “professional”

- ↳ Devote a significant number of working hours working on the free software
- ↳ Have greater time commitment in terms of length and stability
- ↳ Make up the core of the organizational structure in the process of developing the software

Case Study (1)

→ A selfless activity akin to public research

- ↳ A university mathematician who contributed in LaTeX development.
- ↳ Adapted Latex for French typography
- ↳ Worked on developing more modules during and out of working hours
- ↳ Share a spirit for free open source development
- ↳ Provides satisfaction and different kind of recognition which is more “rewarding” than research in mathematics.

Case Study (2)

→ An alternative activity transposed, in the business world

- ↳ Business closed due to Apple's decision to discontinue Newton PDAs
- ↳ Started a project for fun, living on unemployment benefits
- ↳ His new company commercializes services related to the free software program
- ↳ Free software is the only thing remaining that is not privatized
- ↳ Idea of creating network of free software companies

Case Study (3)

→ An innovative activity that corresponds to a commercial niche

- ↳ Has his own free software developed
- ↳ Convinced that free software will invade different layers of IT...and pervade the entire information system of companies and reject proprietary software from the market
- ↳ Convinced that companies should invest in free software development
- ↳ Feels “proud” to belong to the “economic sphere” of free software

Case Study (4)

→ A buoyant activity supported by intense militancy

- ↳ First experience was reading source code of a game
- ↳ Contributed in a free source mathematical library
- ↳ Established a company developing software using free applications available
- ↳ The framework created by his company is free software
- ↳ He believes that open source should be combined with proprietary software
- ↳ He criticizes developers of free software who are only preoccupied with the technical perfection without taking into account users' needs, from a business point of view militancy

Collaborative Software Design & Development

Coordination in Software Development

Svetoslav Ganov

Overview

→ **Goal:** Examine the role of formal and informal communication on coordination in software projects

→ **Coordination:**

↳ Separate pieces fit together

↳ No redundancy

↳ Components are handled on time

↳ Requires agreement on:

➤ What the software should do

➤ How software should be organized

➤ How it should fit with other systems

Characteristics of Software Development

→ Scale

- ↳ Beyond the ability of a single person or group to develop or understand
- ↳ Division of labor based on geographic, organizational, and social principles

→ Uncertainty

- ↳ Many software systems are one-of-a-kind with no prototypes
- ↳ Specifications change over time
- ↳ Specifications are inevitably incomplete
- ↳ Different groups in the project have different beliefs what the system should do and how

→ Interdependence

- ↳ Precise integration of separate modules is required

Communication

→ Communication is still a challenge in SE

↳ Experience and organizational theory suggest the problem is not solved in large projects

→ Traditional approaches for improvement

↳ Technical tools - workstations, higher level languages etc.

↳ Modularization

➤ Technical - OOP etc.

➤ Managerial - separated requirements, development, testing etc.

↳ Formal procedures

➤ Technical - version control, specification languages etc.

➤ Managerial - test plans, requirements documents etc.

↳ These techniques only partially address the problem

Communication

→ Formal - through writing and other non interactive impersonal channels

↳ Specification documents, structured meetings, status review meetings, etc.

→ Informal - personal, peer oriented, and interactive

↳ Personal interaction, ???????

↳ Heavy and effective use in research and development

↳ Potentially a valuable method for achieving coordination

↳ Speech is inherently imprecise and ephemeral

→ The article is empirical study of which conditions suggest different communication techniques

Survey

→ Scope and focus

- ↳ Across 65 projects in large software company
- ↳ What coordination practices are used?
- ↳ Which structural characteristics of the projects suggest the use of a particular coordination techniques?
- ↳ What is the success of the project in several dimensions?

→ Research site

- ↳ Wide range of projects (from PC software to mainframe systems with 14M LOC) organized around the waterfall development model
- ↳ Median project has 15 people on staff
- ↳ Projects were in different stages in their lifecycle
- ↳ Projects employed formal and informal communication

Survey

→ Sample

- ↳ What coordination practices are used?
- ↳ Which structural characteristics of the projects suggest the use of a particular coordination techniques?
- ↳ What is the success of the project in several dimensions?
- ↳ 65 projects (from PC software to mainframe systems with 14M LOC) organized around the waterfall development model
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Survey

→ Sample

↳ 150 supervisory groups

↳ 80 software systems

↳ Survey sent to 750 people (150 managers and 600 staff)

↳ 75% returned usable data

↳ From 2 to 47 respondents per project

↳ Mean 7.6 and median 4

Survey - Measures

→ Structural characteristics

- ↳ Project size and age - number of employees, years
- ↳ Stage in lifecycle - requirements or architecture ...
- ↳ Organizational interdependence - communication with members from other groups
- ↳ Project certainty - stability, well understood tasks, enough local expertise

→ Coordination techniques

- ↳ Formal impersonal - requirements, modification requests etc.
- ↳ Formal interpersonal - status reviews, code inspections etc.
- ↳ Informal interpersonal - co-location, personal conversations
- ↳ Electronic communication - email, electronic bulletin boards
- ↳ Interpersonal networks - recently contacted outsiders

Survey - Measures

→ Outcome measures

- ↳ How informed project members and their managers were - information about project status and responsibility
- ↳ How coordinated the projects were according to project members - current trend and synchronization with other organizations
- ↳ Senior managers assessment of the product and process - 9 managers controlling 200-600 people rated 59 projects
- ↳ Software metric data on productivity and quality
 - Productivity: new LOC, changed LOC per person
 - Quality: number of errors per 1000 LOC, time to fix faults
- ↳ Client ratings for the quality of the product - data available from a corporate survey for 18 of the projects

Results - Coordination Techniques

→ Criteria - extent of use and value

- ↪ Above the line - more valuable than expected
- ↪ Below the line - less valuable than expected

→ Conclusions

- ↪ Large, certain projects passed the design and requirements use formal impersonal procedures
- ↪ Formal interpersonal procedures more used by large, certain projects. Valuable in the planning stages
- ↪ Informal interpersonal communication widely used regardless of project size, certainty, lifecycle. Valuable for certain project in planning stage
- ↪ Email was extensively used when the project depends on input from other groups
- ↪ Association use/value reliably stronger for email
- ↪ Extensive interpersonal networks in small, certain, and dependent projects
- ↪ Informal interpersonal techniques - significantly more valuable than indicated
- ↪ Formal techniques - less valuable than expected

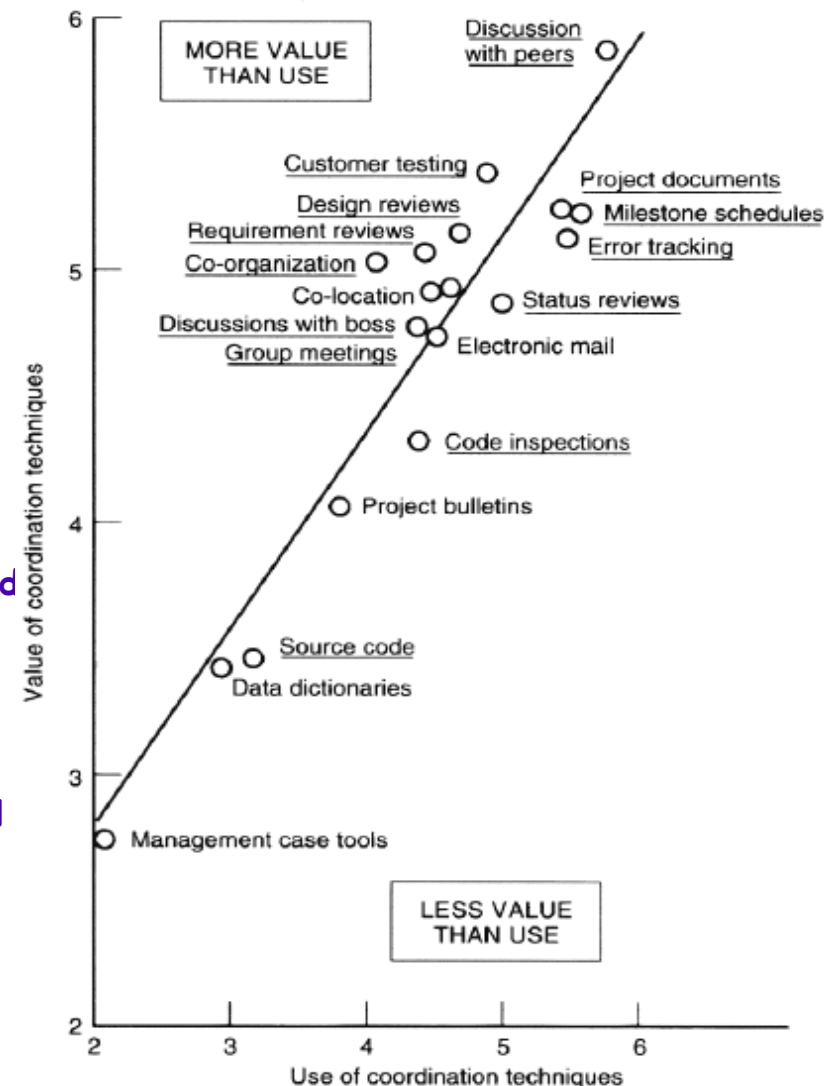


Figure1. Comparing use/value of coordination techniques

Results - Acquiring Help

→ Criteria - extent of use and value

- ↪ Above the line - more valuable than expected
- ↪ Below the line - less valuable than expected

→ Conclusions

- ↪ Other people - most valued resource (easy)
- ↪ Difficult to access people - substantially less used than other sources and considered valuable
- ↪ Documents - less valuable than personal contact
- ↪ Getting information by interpersonal means from outsiders - especially valuable (difficult to access)

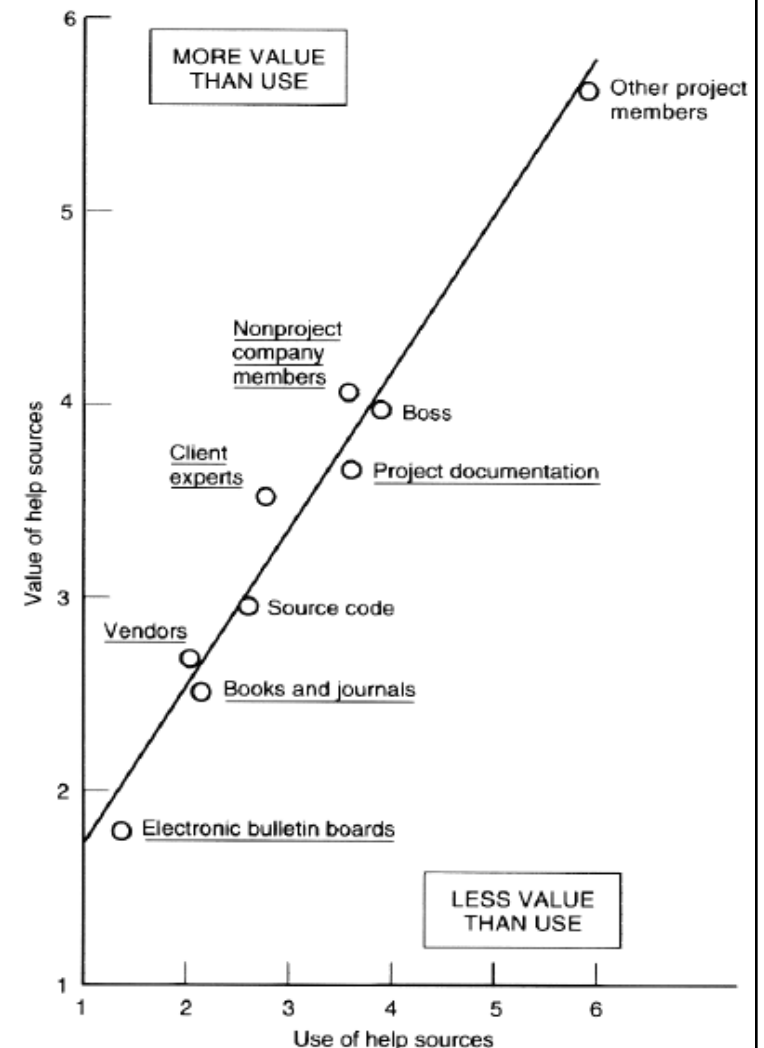


Figure2. Comparing use/value of help sources

Results – Outcome Measures

- Staff members' assessment of coordination in the project correlates with customer satisfaction
- Senior managers' assessment of quality is unrelated to other measures for success
- Software productivity and quality measures are interrelated – projects that produce many LOC also produce good quality
- Software metric data are unrelated to client satisfaction

Predicting Coordination Success

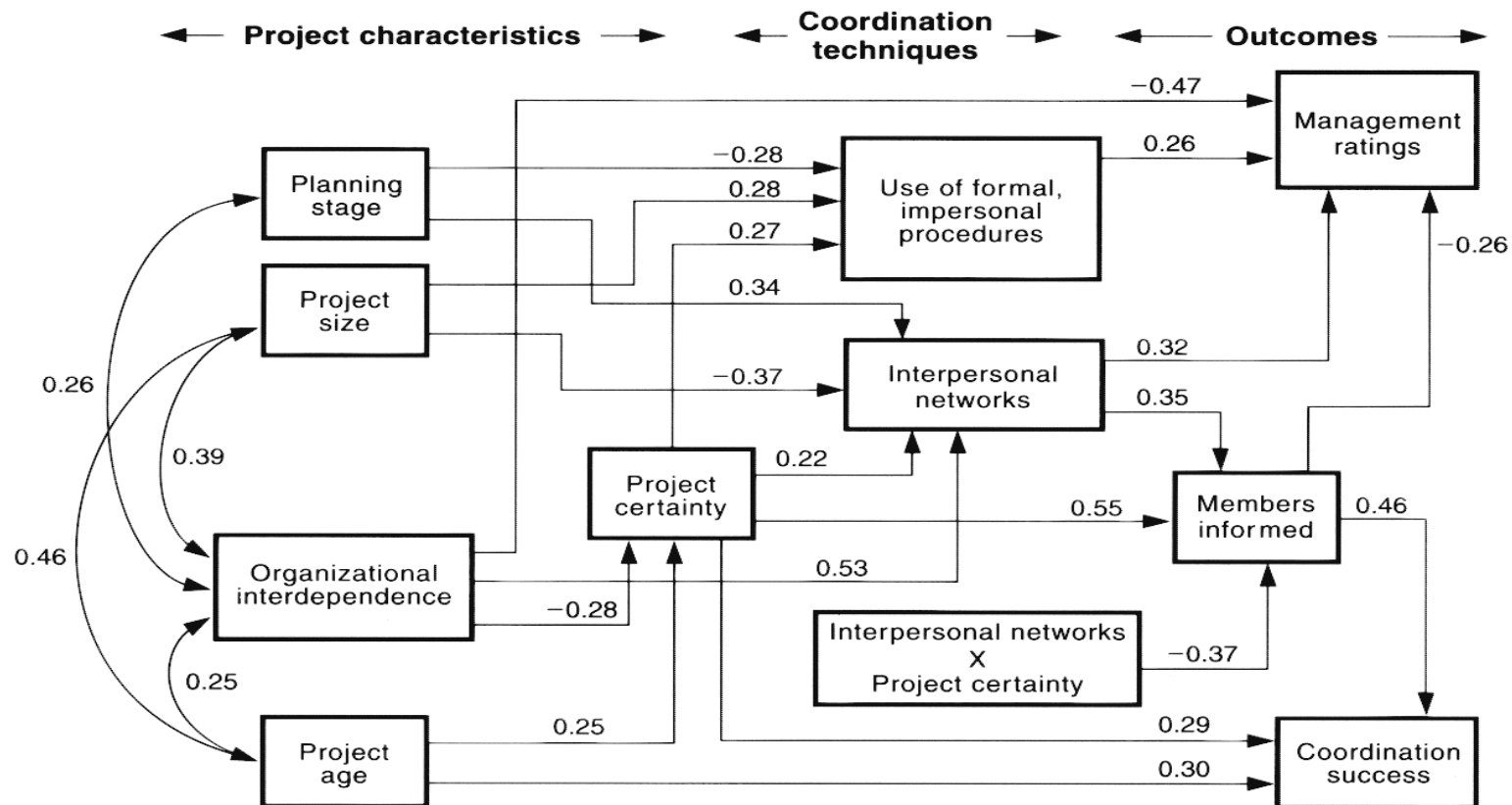


Figure 3. Factors influencing successful coordination

- Measure of strength of association - direction and magnitude
- Example: project size positively predicts use of formal impersonal procedures (weight 0.28)

Predicting Coordination Success

→ Conclusions

- ✚ Older, smaller, and less dependent projects were better coordinated
- ✚ Technically certain projects had better informed and coordinated staff
- ✚ Project age and dependence influenced coordination through certainty
 - Older projects were more certain which makes coordination easier
 - Less dependent projects better control their directions and resources which makes the members better informed
- ✚ Use of formal procedures does not imply better intergroup coordination
- ✚ Members of highly interdependent projects new more people outside the project
- ✚ More certain projects had more extensive interpersonal networks
- ✚ For projects in which members talked to outsiders and their managers were better informed

Discussion

- For a project to be successful formal techniques should be supplemented with interpersonal communication
- Interpersonal contact is not a panacea because:
 - ↳ Excessive transaction costs
 - ↳ The ephemeral nature of speech
- Without technological assistance extensive interpersonal communication could be deleterious
- Goal: make interpersonal communication more efficient
- Formal meetings
 - ↳ Often inefficiently run
 - ↳ Have inappropriate attendance
 - ↳ Rationale for important decisions is often lost
- Reached conclusions are consistent with the large literature about organizational coordination

Questions

- What is your preferred communication technique?
- Do you find the conclusions of the paper valid for the company you work?
- Is the boom of instant messaging (say Skype) a way of improving interpersonal communication?
- Do you think that the way of shortening of the “distance” between project members and senior management is beneficial? (if possible)

