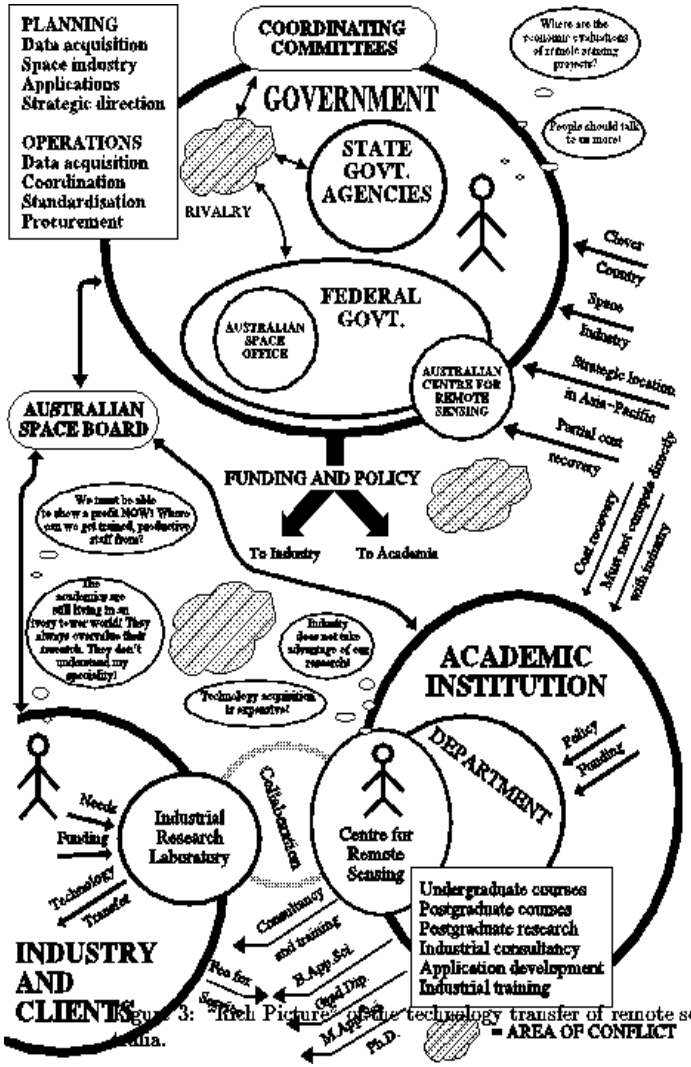


Figure 3: "Rich Picture" of the technology transfer of remote sensing in Australia.

SOFTWARE DEVELOPMENT

Process, Models,
Methods,
Diagrams
Software Development
Life Cyles

Part - V

OVERVIEW

- Extreme Programming (XP) was conceived and developed by Kent Beck to address the specific needs of software development conducted by small teams in the face of vague and changing requirements.
- Extreme Programming nominates coding as the key activity.
- The programmer is the heart of XP.

OVERVIEW

Why Extreme?

XP takes commonsense principles and practices to extreme levels.

- **If code reviews are good, we'll review code all the time (pair programming).**
- **If testing is good, everybody will test all the time (unit testing).**
- **If design is good, we'll make it part of everybody's daily business (refactoring).**
- **If integration testing is important, then we'll integrate and test several times a day.**
- **If short iterations are good, we will make the iterations really, really short – seconds, minutes and hours, not weeks, months and years.**

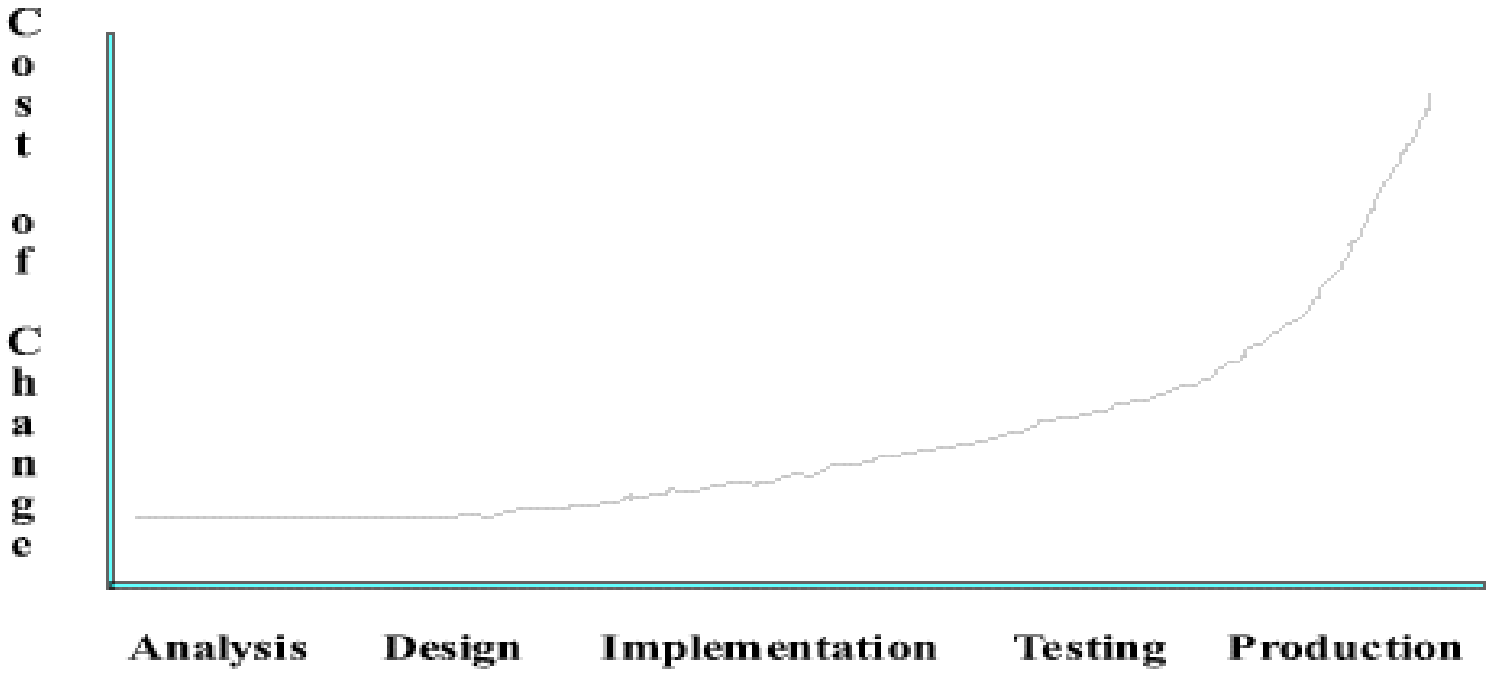
OVERVIEW

- This new lightweight methodology challenges many conventional tenets, including the long-held assumption that the cost of changing a piece of software rises dramatically over the course of time.

- The cost of change curve for XP is a flat curve, which is achieved by simple design, tests, and an attitude of constant refinement of the design.

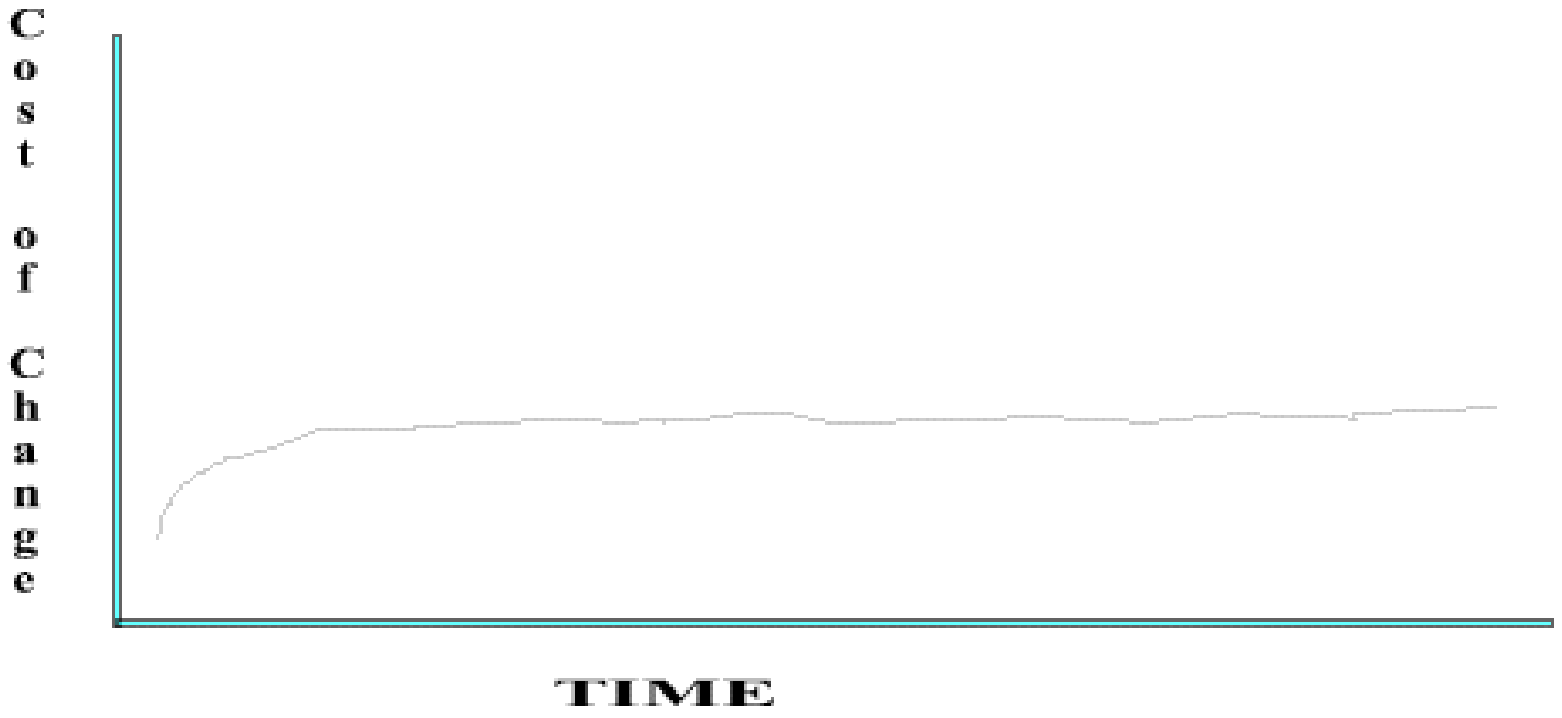
OVERVIEW

Historical Cost of Change Curve - The cost of change rising exponentially over time



OVERVIEW

XP Cost of Change Curve - The cost of change may NOT rise over time



OVERVIEW

Fundamentals of XP include:

- Writing unit tests before programming and keeping all of the tests running at all times.
- Integrating and testing the whole system--several times a day.
- Producing all software in pairs, two programmers at one screen.
- Starting projects with a simple design that constantly evolves to add needed flexibility and remove unneeded complexity.
- Putting a minimal system into production quickly and growing it in whatever directions prove most valuable.

OVERVIEW

Why is XP so different?

- XP doesn't force team members to specialize and become analysts, architects, programmers, testers, and integrators--every XP programmer participates in all of these critical activities every day.
- XP doesn't conduct complete up-front analysis and design--an XP project starts with a quick analysis of the entire system, and XP programmers continue to make analysis and design decisions throughout development.
- Develop infrastructure and frameworks as you develop your application, not up-front--delivering business value is the heartbeat that drives XP projects.
- Don't write and maintain implementation documentation--communication in XP projects occurs face-to-face, or through efficient tests and carefully written code.

OVERVIEW

XP - What is involved: The four basic activities of Extreme Programming are coding, testing, listening, and designing.

- **Coding:** You code because if you don't code, at the end of the day you haven't done anything.
- **Testing:** You test because if you don't test, you don't know when you are done coding
- **Listening:** You listen because if you don't listen you don't know what to code or what to test
- **Designing:** And you design so you can keep coding and testing and listening indefinitely (good design allows extension of the system with changes in only one place)

XP VALUES/PRINCIPLES

There are four basic values in XP:

Communication, Simplicity, Feedback, Courage

Principles

- Rapid feedback
- Assume Simplicity
- Incremental Changes
- Embrace Change
- Quality Work

KEY PRACTICES OF XP

- Planning Game
- Small releases
- Metaphor
- Simple design
- Testing
- Refactoring
- Pair Programming
- Collective ownership
- Continuous integration
- 40-hour week
- On-site Customer
- Coding Standards

PLANNING GAME

Business People

- Scope
- Priority
- Composition
- Release Date

Technical People

- Estimates
- Consequences
- Process
- Detailed Scheduling

SMALL RELEASES

- Every release must be as small as possible
- Contain the most valuable business requirements
- Release has to make sense

METAPHOR

Helps understand

- Basic elements of the project
- Relationships

SIMPLE DESIGN

- The system must communicate everything you want to communicate
- No duplicate code
- The system should have the fewest possible classes
- The system should have the fewest possible methods

TESTING

Sources

- Programmers
- Customers

Types of Testing

- Unit Testing
- Functional Testing

REFACTORING

- After getting something to work we refactor
- Revise and edit
- Followed by running all the tests

We cannot check in our code until:

✓All tests are green.

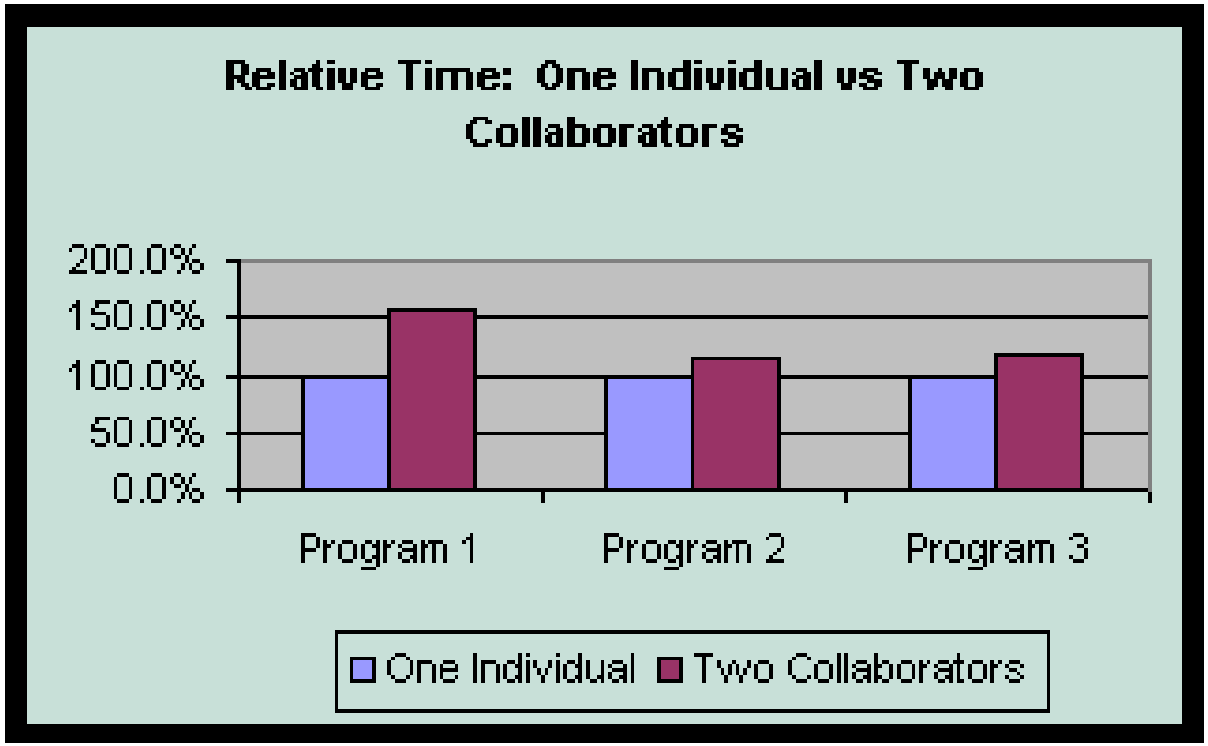
✓All duplication has been removed

✓The code is as expressive as we can make it

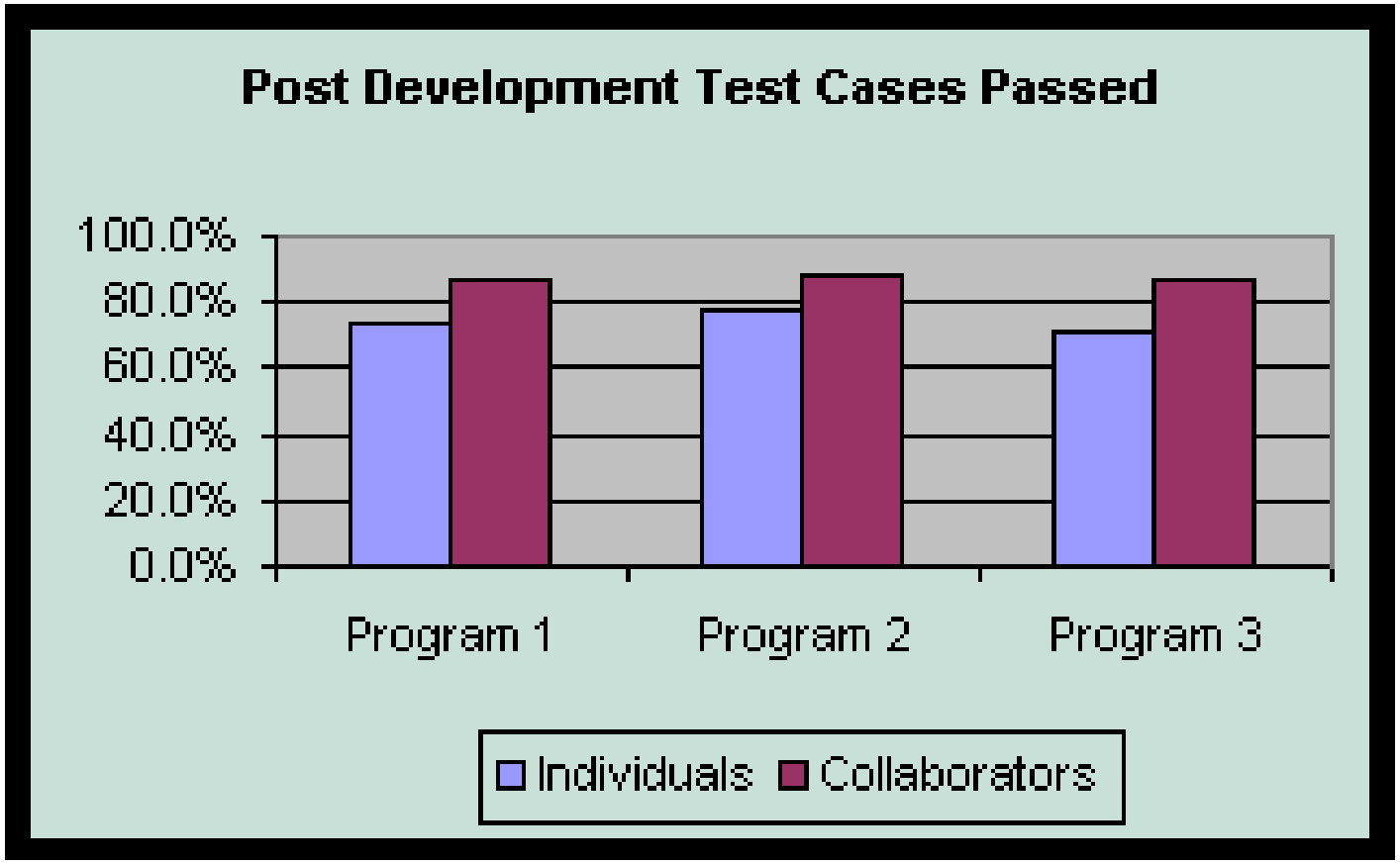
PAIR PROGRAMMING

- Two programmers collaborate on the same design, algorithm, code or test case
- Pairing is dynamic
- Encourages communication, productivity and enhances code quality
- Pairing is useful for cross-training established employees and for training new employees
- Pair programming research reveals that:
  - Pairs use no more man-hours than singles
  - Pairs create fewer defects
  - Pairs create fewer lines of code
  - Pairs enjoy their work more

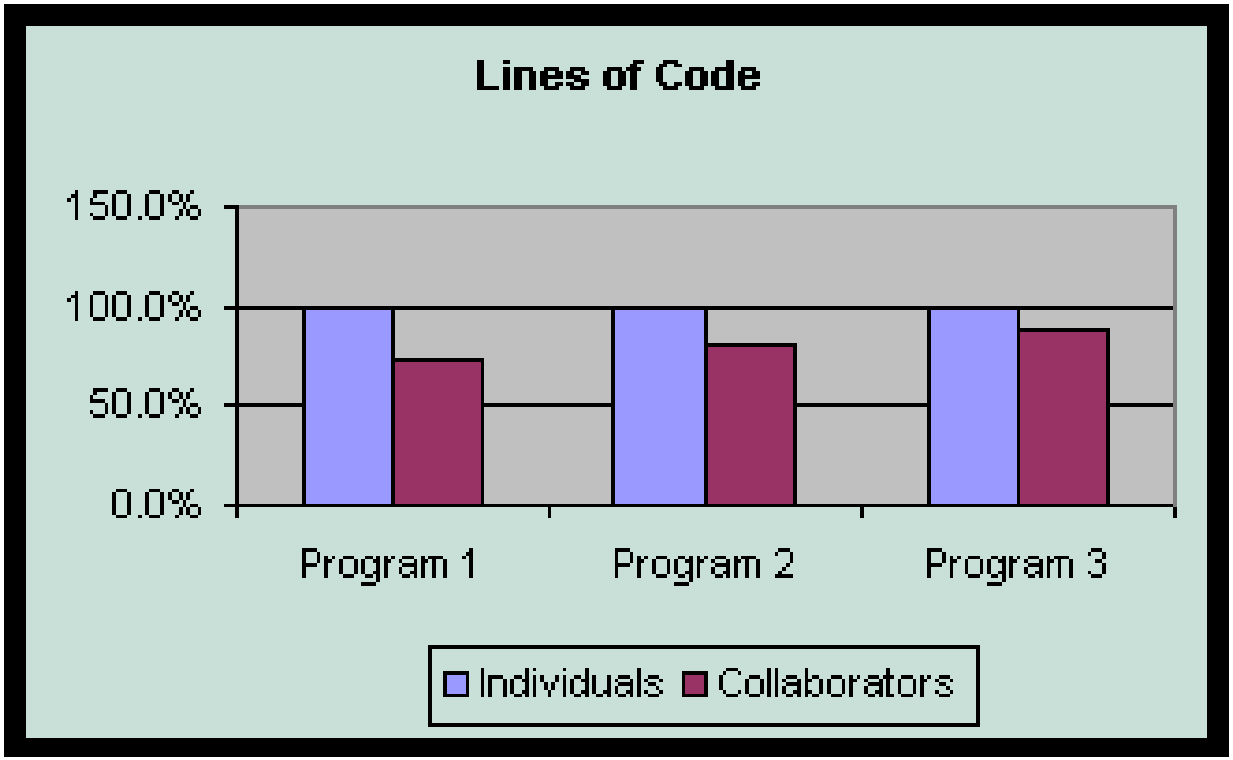
University of Utah experiment: pairs spent 15% more time on the program than individuals



University of Utah experiment: code written by pairs passed more test cases than code written by individuals



University of Utah experiment: pairs consistently implemented the same functionality produced by individuals in fewer lines of code



COLLECTIVE OWNERSHIP

- Any team member may add to the code at any time
- Everybody takes responsibility for the whole system
- Encourages simplicity:
  - Prevents complex code from entering the system
- Increases individual responsibility and personal power
- Reduces project risk:
  - Spreads knowledge of the system around the team

CONTINUOUS INTEGRATION

- Code is integrated and tested after a few hours
- Daily builds are for wimps
  - Build, end to end, at every check in
  - Check in frequently
  - Put resources on speeding build time
  - Put resources on speeding test time
- Reduces project risk:
  - You'll never spend days chasing a bug that was created some time in the last few weeks
- Provides valuable human benefit during development

FORTY HOUR WEEK
(SUSTAINABLE PACE)

- Overtime is a symptom of a serious problem on a project
- Occasionally, programmers may work one week of moderate overtime. Two weeks in a row is out of the question
- Programmers need to be well rested to work efficiently

ON-SITE CUSTOMER

- A real customer must sit with the team full time
- The on-site customer enables an XP team to explore business requirements as it needs to and gives direct access to someone who can make key decisions quickly
- Provides value to the company by contributing to the project, thus reducing project risk.
- In XP, if the system isn't worth the time of one customer, maybe it's not worth building.

CODING STANDARDS

- Programmers write all code in accordance with rules adopted voluntarily by the team
- Make it impossible to tell who wrote what
- Having no standards slows pair programming and refactoring

Constraints

- No duplicate code
- System should have the fewest possible classes
- System should have the fewest possible methods
- Comments should be minimized

ADVANTAGES/DISADVANTAGES

ADVANTAGES

- Customer focus increase the chance that the software produced will actually meet the needs of the users
- The focus on small, incremental release decreases the risk on your project:
  - by showing that your approach works and
  - by putting functionality in the hands of your users, enabling them to provide timely feedback regarding your work.
- Continuous testing and integration helps to increase the quality of your work
- XP is attractive to programmers who normally are unwilling to adopt a software process, enabling your organization to manage its software efforts better.

ADVANTAGES/DISADVANTAGES

DISADVANTAGES

- XP is geared toward a single project, developed and maintained by a single team.
- XP is particularly vulnerable to "bad apple" developers who:
  - don't work well with others
  - who think they know it all, and/or
  - who are not willing to share their "superior" code
- XP will not work in an environment where a customer or manager insists on a complete specification or design before they begin programming.
- XP will not work in an environment where programmers are separated geographically.
- XP has not been proven to work with systems that have scalability issues (new applications must integrate into existing systems).

CONCLUSION

- XP focuses on people
- Values team work over power
- XP works well when there are uncertain or volatile requirements
- **XP is a process not a miracle cure** for all software development problems