

INTEGRATING CREATIVITY INTO EXTREME PROGRAMMING PROCESS

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Abstract: Human and social factors are very important in developing software and the development of new software requires the generation of novel ideas. In this paper, the Agile method called eXtreme Programming (XP) is analyzed and evaluated from the perspective of the creativity. The conclusion is that XP can be fostered from a creativity perspective.

1 INTRODUCTION

Software engineering research is technical and de-emphasizes the human and social aspects, although Software is developed for people and by people (John et al., 2005). By other hand, the traditional development process of new products has been recently criticized by Kotler and Tras de Bes (Kotler and TríasdeBes, 2004), they point out that fundamental creative aspects are not considered at all and as a consequence this development is not useful, viable or innovative. In this context, it is interesting to consider the new proposals of agile methodologies for software development in order to analyse and evaluate them at the light of the existing creative expositions, mainly considering the teamwork practices.

The agile principles and values have emphasized the importance of collaboration and interaction in the software development and, by other hand, creative work commonly involves collaboration in some form and it can be understood as an interaction between an individual and a sociocultural context. We believe that the innovation and development of new products is an interdisciplinary issue (Takeuchi and Nonaka, 1986), we are interested in the study of the potential of new concepts and techniques to foster creativity in software engineering (Gu and Tong, 2004).

2 CREATIVITY

Considering the object of analysis: a software development teamwork, that must respond to the requirements of a specific client for a particular problem, a suitable definition of creativity is the one raised by Welsch (Welsh, 1967):

Creativity is the process of generating unique products by transformation of existing products. These products, tangible and intangible, must be unique only to the creator, and must meet the criteria of purpose and value established by the creator.

More specifically, and from an eminently creative perspective, it is possible to distinguish three aspects at the interior of a group developing new products: a) The purposes that the team tries to reach, which demand two scopes of results (Csikszentmihalyi, 1998; Guilford, 1968; Hallman, 1963; Hallman, 1966a; Hallman, 1966b):

- Those related to the creative result that must be original, elaborated, productive and flexible.
- Those related to the creative team, so that it reaches its goals, developing cognitive abilities and presenting an improved disposition to the change. All this in order to obtain a better creative team performance in the future.

b) The performance shown by the team in connection with the main aspects of the complex dynamics that the persons build inside a team. We describe three

aspects:

- The personal conditions of the members of the team, in terms of the styles and cognitive abilities, the personality, their intrinsic motivation and knowledge (Woodman et al., 1993; Amabile, 1998; Amabile et al., ; Csikszentmihalyi, 1998).
 - The organizational conditions in which the creative team is inserted, and that determines, at least partly, its functioning. These conditions, in the extent that present/display certain necessary particular characteristics - although non sufficient - for the creative performance. They emphasize in special the culture (communication, collaboration, trust, conflict handle, pressure and learning) (Woodman et al., 1993; Kotler and Armstrong, 2003; Isaksen et al.,); the internal structure (formalization, autonomy and evaluation of the performance) (Woodman et al., 1993; Kotler and Armstrong, 2003; Isaksen et al., ; Amabile, 1998); the team available resources (time disposition) (Woodman et al., 1993; Kotler and Armstrong, 2003; Amabile et al.,) and the physical atmosphere of work (Leonard and Swap, 1999).
 - The conditions of performance of the creative team, mainly the creative process realized, which supposes the set of specific phases that allow to assure the obtaining of a concrete result (creative product) (Leonard and Swap, 1999; Wallas, 1926).
- c) The structure of the creative team, particularly the group characteristics, such as norms, cohesiveness, size, diversity, roles, task and problem-solving approaches (Woodman et al., 1993).

Of the mentioned aspects, here we are interested in the team for the development of new products, specially considering: the creative process and the roles surrounding this process.

2.1 The Creative Team

Lumsdaine and Lumsdaine (Lumsdaine and Lumsdaine, 1995) raise the subject of the required cognitive abilities (mindsets) for creative problem resolution. Their typology is excellent for the creative team, and the different roles to consider. These roles are: Detective, Explorer, Artist, Engineer, Judge and Producer. Leonard and Swap (Leonard and Swap, 1999) have mentioned additional roles, possible to be integrated with the previous ones, because they try to make more fruitful the divergence and the convergence in the creative process: provoker, think tank, facilitator and manager.

Kelley and Littman (Kelley and Littman, 2005), on the other hand, have raised a role typology similar to Lumsdaine and Lumsdaine (Lumsdaine and Lumsdaine, 1995), being interesting that they group the roles in three categories: those directed to the learning of the creative team (susceptible of corresponding with the detective, explorer, artist, provoker and think tank roles), others directed to the internal organization and success of the team (similar to the judge, facilitator and manager roles) and, finally, roles whose purpose is to construct the innovation (possibly related to the role of the engineer and judge).

3 SOFTWARE CREATIVITY

Since human creativity is thought as the source to resolve complex problem or create innovative products, one possibility to improve the software development process is to design a process which can stimulate the creativity of the developers. There are few studies reported on the importance of creativity in software development. In management and business, researchers have done much work about creativity and obtained evidence that the employees who had appropriate creativity characteristics, worked on complex, challenging jobs, and were supervised in a supportive, noncontrolling fashion, produced more creative work. Then, according to the previous ideas the use of creativity in software development is undeniable, but requirements engineering is not recognized as a creative process in all the cases (Maiden et al., 2004). In a few publications the importance of creativity has been investigated in all the phases of software development process (Glass, 1995; Gu and Tong, 2004; Crawford and de la Barra, 2007) and mostly focused in the requirements engineering (Robertson, 2005; Maiden and Robertson, 2005; Mich et al., 2005). Nevertheless, the use of techniques to foster creativity in requirements engineering is still shortly investigated. It is not surprising that the role of communication and interaction is central in many of the creativity techniques. The most popular creativity technique used for requirements identification is the classical brainstorming and more recently, role-playing-based scenarios, storyboard-illustrated scenarios, simulating and visualizing have been applied as an attempt to bring more creativity to requirements elicitation. These techniques try to address the problem of identifying the viewpoints of all the stakeholders (Mich et al., 2005).

However, in requirements engineering the answers do not arrive by themselves, it is necessary to ask, observe, discover, and increasingly create re-

quirements. If the goal is to build competitive and imaginative products, we must make creativity part of the requirements process. Indeed, the importance of creative thinking is expected to increase over the next decade (Maiden and Gizikis, 2001).

4 XP: EXTREME PROGRAMMING

Extreme Programming is an iterative approach to software development (Beck, 2000). The methodology is designed to deliver the software that customer needs when it's needed. This methodology emphasizes team work. Managers, customers, and developers are all part of a team dedicated to deliver quality software. XP implements a simple, yet effective way to enable groupware style development. XP improves a software project in four essential ways; communication, simplicity, feedback, and courage. XP defines the following roles for a software development process (Beck, 2000): Programmer, Customer, Tester, Tracker, Coach, Consultant and Big boss or Manager.

5 CREATIVITY IN XP

Regarding to the structure dimension of a new product development team (in particular software), it is possible to relate the roles in creativity to the roles defined in the XP methodology distinguishing: base roles, that is, those directly related to the creative processes and software development, and support roles, whose function is to support or lead the other roles for a better performance.

In relation with the structure dimension it's important to considerate how the team can operate. In order to implement the functionality of each role, we must considerate two aspects: basic organizational conditions and the pertinent creative process.

5.1 The Correspondence between Creative and XP Roles

The following is the correlation between creative and XP roles:

- The detective function consisting in collecting information related to a problem is made by the client himself in XP, because this one generates the first contact with the software development team.
- The function of explorer consisting in defining completely the problem is made in XP as much

by the client as the manager of the team, all together they appreciate the reach of the identified problem, as well as of the possible solutions. The function of the artist consisting in transforming the information, creating new relations, and therefore generating interesting solutions is made by the developer, that in XP methodology is in charge of the analysis, design and programming of software.

- The function of the engineer referred to clarify and to evaluate the new ideas, in terms of its feasibility is made in XP by the tester and the tracker.
- The function of the judge, understood as the definitive selection of the solutions to implant, is made in XP by the tracker and the client.
- The function of the producer, referred to the implementation of the selected ideas (strictly speaking it is working software) is made in XP by the client in his organization, including the processes and procedures that this function implies.

The supporting roles considered are:

- The provoker; creativity demands that the divergence as well as convergence in the solutions be maximum and complete. There is not explicit reference in XP methodology about divergent thinking.
- The think tank who helps the team work "from outside" is equivalent completely to the role of the consultant.
- The facilitator whose function is helping the team, corresponds in XP to the coach role.
- The manager whose function is to lead to the team in terms of its general efficiency and its effectiveness corresponds with XP's big boss or manager.

6 CONCLUSIONS AND FUTURE RESEARCH

The Extreme Programming methodology includes implicitly central aspects of a creative teamwork. These aspects can be organized according to the structure that the team adopts and the performance that characterizes to the team.

The structure that the team adopts and specially the different roles that the methodology advises to define, nearly correspond with the roles at the interior of a creative team. The performance that characterizes the team through certain advisable practices, from the perspective of creativity, constitutes the necessary basic conditions, although nonsufficient, in order to favor the group creative performance. These conditions

- called practices in XP methodology - are accompanied by concrete phases of constituent activities of an agile software development process, which is possible to correspond with the creative process, which is fundamental to the creative performance.

In spite of the previous comments, we think that XP methodology should have a more explicit reference to:

- The provoker role that is thoroughly described in creativity as a fundamental factor to generate innovation. This can be explained because, in general, agile methodologies do not aim, as a central element, to generate an original software, but an effective one.
- The distinction and formalization of the creative phases to generate options incubation and option choices (that are fundamental in creativity). It is assumed that they take place in the iterative and production process. Again, XP is not focused in "originality", resulting that the divergence is not so fundamental in XP.
- A more direct mention to the physical atmosphere of work, that in creativity are considered as highly relevant to enhance the performance. These aspects should have a greater consideration since software development is a special case of product development.

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