Requirements Engineering and Creativity: An Innovative Approach Based on a Model of the Pragmatics of Communication

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Abstract. This paper proposes the application to requirements elicitation of an innovative creativity technique based on a model of the pragmatics of communication, the Elementary Pragmatic Model (EPM). The EPM has been used to define a creative process, called EPMcreate that consists of sixteen steps. In each step, the problem is analyzed according to one elementary behavior identified by the EPM. Each behavior suggests that the analyst look at the problem from a different user's viewpoint. The feasibility and effectiveness of the technique in requirements elicitation was demonstrated by experiments on two projects with very different characteristics. Each experiment compared the performances of two analysis teams, one of which used EPMcreate and the other of which used brainstorming. The results of both experiments confirmed the higher effectiveness of EPMcreate.

1 Introduction

The role of creativity in software development is undeniable. Some authors have investigated creativity's importance to the entire software development process (e.g., [1]). Others have focused their attention on its importance to requirements engineering [2–5]. However, the potential of techniques to foster creativity in requirements engineering are still under-investigated. The most popular creativity technique used for requirements identification is brainstorming [6] [4] a classical technique which dates back to 1935[5] [7]. More recently, role-playing-based scenarios have been applied in an attempt to bring more creativity to requirements

[4] A list of papers about applying brainstorming to requirements analysis is given at http://www.economia.unitn.it/etourism/risorseCollegateBrainstorming.asp.

[5] Even though the original work was done in 1935, the work was not published formally until 1953.

elicitation [5] and to JAD [8]. A common characteristic of these techniques is that each of them tries to address the problem of identifying the viewpoints of all the stakeholders, albeit in a different way.

In this paper, we propose an innovative creativity technique, called EPM-create, based on a model of the pragmatics of communication, the Elementary Pragmatic Model (EPM), developed more than thirty years ago by Piero De Giacomo and Alberto Silvestri[6]. The model was developed to describe the relational patterns [9] of interacting subjects and to predict their evolution [10]. Since the end of the 1970s, the model has been applied successfully to solve relationship problems in families [11–13] and in company teams [14]. It has been applied also in economic psychology [14], to model electronic communication in the area of CSCW (Computer Supported Cooperative Work) [15] and to model e-learning web-site users [16]. More recently, the EPM has been used to develop a technique for fostering mental flexibility [17].

The technique consists of sixteen steps. In each step, a problem is analyzed according to one of the elementary behaviors identified by the EPM. To apply EPM in requirements elicitation, we regard each step of the process as suggesting a way for an analyst to look at the problem from a different stakeholder's viewpoint. EPMcreate suggests looking at the problem in sixteen entirely different ways, as suggested by the sixteen basic Boolean functions [18, 19]. To evaluate the feasibility and applicability of EPMcreate, we conducted experiments on two projects with very different characteristics. In each experiment, we compared the performances of two analysis teams, one of which used EPMcreate and the other of which used brainstorming. The results of the experiments were analyzed both

1. quantitatively, counting the numbers of ideas and requirements generated, and
2. qualitatively, comparing the feasibility and the novelty of the ideas and requirements.

Each experiment confirmed that EPMcreate is more effective than brainstorming.

This paper is structured as follows: Section 2 describes the twofold and paradoxical role of creativity in requirements engineering. Section 3 introduces the EPMcreate technique, starting from a short description of the EPM on which it is based. Section 4 describes the experiments we designed and carried out to investigate the feasibility and effectiveness of EPMcreate. The experiments were conducted on the developments of a web-based tool for distant learning and of a software system (SWS) for public administration. Finally, Section 5 describes some proposals for future research.

2 The Role of Creativity in Requirements Engineering

Many authors have investigated the subject of creativity [20–24]. Some have investigated creativity experimentally and in the context of the development of

[6] http://www.pierodegiacomo.it/english/modello.htm

information systems [25, 26]. There are many definitions of creativity. However, fortunately there appears to be convergence on a concept of creativity related to problem solving (e.g., [27, 28]), encompassing also problem finding and solution thinking. In particular, creativity is understood as the generation of innovative, unexpected solutions to complex, non-trivial problems, or to ill-formed, wicked problems. A wicked problem [29] is one whose very definition is part of the problem itself. Other characteristics of a problem that calls for creative approaches are that it is interdisciplinary, that it has multiple stakeholders, that it has a highly dynamic context, that it has uncertainty in its parameters, and that it has many possible tradeoffs. In other words, a wicked problem is not structured enough to allow a straightforward rational, scientific, or engineering approach. Requirements engineering deals often with wicked problems [30], and thus calls for a creative approach. However, there is more.

Ironically, creativity is both a cause and a solution of the inevitable pain of requirements engineering [31] in the software development process. The two sources of pain in requirements engineering are

1. requirements engineering itself
2. and dealing with the effects of changes in requirements as
   (a) clients and users find more requirements they want,
   (b) as errors in requirements understanding are found and corrected, and
   (c) as deployed SWSs change their environments and their own requirements.

Requirements engineering itself is painful because developers want to move on to what is perceived as more useful work, design and coding. Moreover, if one is doing a fully documented requirements engineering process, the inevitable, relentless changes require painful rework of all previously written documents to maintain their consistency with each other.

One manifestation of creative requirements engineering is suddenly seeing a, perhaps radically, different way to achieve the goals that have just emerged after having done significant requirements engineering. If the old way of thinking has been extensively documented, creativity exacerbates the pain of change, as a vast amount of previous work is abandoned. On the other hand, creativity can yield exciting new ideas, the kind that motivate us to willingly and enthusiastically abandon old-fashioned ideas in favor of a cool new way to do things.

Another dilemma is mentioned frequently in the literature about creativity. Beside those that recognize creativity as a fundamental factor in software development [1, 25, 26, 32–34], there are those that see creativity as a threat, as something to monitor and control carefully in order to prevent it from compromising their projects [35].

These two positions capture the nature of creativity itself. For any project dealing with a wicked problem, creativity needs to be encouraged, but in a structured and controlled way. Techniques that foster creativity can be used for this purpose.

It is worth noting that requirements engineering [6] has all the characteristics of problems that call for creativity, in particular when groups of stakeholders are involved. Andrew Leigh [28, pp. 123–124] provides a checklist for evaluating decisions arrived at by groups.

(i) Are there many potentially correct solutions or choices?
(ii) Will a solution be difficult to verify objectively?
(iii) Does the problem or decision have many steps or subdivisions?
(iv) Does the choice require more information to decide than a single individual is likely to possess?
(v) Will the solution or decision need to convince others? Will have to be not merely effective but also acceptable and thus involve explanations and communications?
(vi) Might other people refuse to accept or implement the solutions unless they themselves are involved in the process of discussion to arrive at choices?
(vii) Does the nature of the task demand relatively few creative skills?
(viii) Should the decision be of a particularly high quality?
(ix) Are there sufficiently competent and compatible people with adequate time available?
(x) Is the group likely to be effective and possess adequate and sustained leadership?

The relevance of this checklist to requirements engineering is startling.

It is not surprising that the role of communication and interaction is central in many of the creativity techniques[7]. It is worth noting that the complexity of these techniques ranges from advice like "Interrupt your routine in order to pay deliberate attention to some particular issue." from the Creative Pause Technique (CPT), to structured methods like Creative Problem Solving (CPS) [36].

The CPT is simple but is not necessarily easy to do. Thus, other techniques may be preferred[8]. In any of most techniques, a process is given. The steps of the process resemble partially those of a problem-solving approach. For example, CPS has the steps

1. objective finding,
2. fact finding,
3. problem finding,
4. idea finding,
5. solution finding, and
6. acceptance finding.

Moreover, each of many of these techniques combines the process with a toolkit of creativity techniques to be used in one or more of the steps. At the theoretical level, EPMcreate satisfies the need to foster creativity in a controlled

[7] A survey of these techniques is given by Anesi [19], and a list of the related references can be found at http://www.economia.unitn.it/etourism/risorseCollegateCreativityTechniques.asp.

[8] See also http://www.stuart.iit.edu/faculty/barlow/pdfhandouts/cps.pdf.

way. The method is more structured than any of a majority of the other techniques, and its instructions force the analyst to focus on different stakeholders' viewpoints. In this respect, EPMcreate differs from, for example, the well-known Six Thinking Hats technique [23], which suggests different types of thinking corresponding to six roles for the analyst, associated with hats of six different colors. Two examples are the (1) White Hat role, which is neutral and objective and concerned with facts and figures, and the (2) Red Hat role, which adopts an emotional view.

3 EPMcreate

EPMcreate is a creativity technique that is based on the Elementary Pragmatic Model (EPM).

3.1 The Elementary Pragmatic Model

EPM was devised as an analytical tool to help a therapist analyze the interactions between two people in order to determine the psychological bases for their interaction behaviors. The tool may be applied to groups of more than two by considering all possible pairings within the group.

A single interaction between two persons, $P1$ and $P2$ consists of four steps.

1. Person $P1$ proposes an action $A1$.
2. Person $P2$ proposes an action $A2$.
3. Person $P1$ proposes a possibly different revised action $A1'$ based on $A1$, $A2$, and his perceived relationship with $P2$.
4. Person $P2$ proposes a possibly different revised action $A2'$ based on $A1$, $A2$, and his perceived relationship with $P1$.

Possible examples for Step 3 include $P1$ insisting on his own proposal, $P1$ changing his proposal to match $P2$'s, $P1$ changing his proposal to one contrary to $P2$'s, etc. In Step 4, $P2$'s response could be equally varied.

If the proposal were a binary one, that is, to do or not to do something, then each of Steps 3 and 4 can be regarded as modeled by a truth table on two variables.

$P1$'s Proposal	$P2$'s Proposal	$P1$'s or $P2$'s Response
0	0	R_1
0	1	R_2
1	0	R_3
1	1	R_4

There are 16 possible patterns of responses, corresponding to the 16 Boolean functions on two variables. These functions are named fi for $0 \leq i \leq 15$; fi names the function for which i is the decimal numeral corresponding to the 4-digit binary numeral, $R_1R_2R_3R_4$, obtained from the response column of the table for the function. Some representative function names and their corresponding tables, abbreviating "Pn's Proposal" as "Pn" and "$P1$'s or $P2$'s Response" as "R", are:

$f0$

$P1$	$P2$	R
0	0	0
0	1	0
1	0	0
1	1	0

$f3$

$P1$	$P2$	R
0	0	0
0	1	0
1	0	1
1	1	1

$f5$

$P1$	$P2$	R
0	0	0
0	1	1
1	0	0
1	1	1

$f10$

$P1$	$P2$	R
0	0	1
0	1	0
1	0	1
1	1	0

$f15$

$P1$	$P2$	R
0	0	1
0	1	1
1	0	1
1	1	1

Each function can be considered as representing one pattern of response. The analytical use of EPM ascribes to each function a mode of thinking based on factors such as the responder's self-esteem and his perception of his relationship with the other in an interaction. For example, assuming that the responder is $P1$,

- $f0$ represents a totally pessimistic person who always says "No" to any proposal regardless of his and the other's original proposal.
- $f3$ represents a very confident or very stubborn person who always insists on his own proposal, regardless of the other's original proposal.
- $f5$ represents a person, a so-called yes man, who always says the same as what the other says, regardless of his own original proposal.
- $f10$ represents a person, a so-called contrarian, who always says the opposite of what the other says, regardless of his own original proposal.
- $f15$ represents a totally optimistic person who always says "Yes" to any proposal regardless of his and the other's original proposal.

In any situation requiring therapeutic intervention, e.g., a dysfunctional married couple, family, work group, etc., the therapist as analyst, observes the interaction of each pair of participants and tries to identify a pattern in the form of one of $f0, \ldots, f15$ for each person's responses in that pair. Once a pattern is identified, the therapist tentatively ascribes the identified basis as dictating the person's interaction in the pair. While the EPM is excellent in terms of exhaustively covering all possible interactions, classifying an interaction on the model's basis is fuzzy at best. First, any given interaction between a pair may not be typical of that pair's interaction. Second, it is the rare relationship that consistently follows only one interaction pattern. Therefore, the classification must be made empirically on the basis of many observations, and the conclusions would be subject to the same statistical uncertainties that any other experiment's conclusions are. Moreover, unless the history of observations for a pair includes an instance of every truth table line, the conclusion can be based on insufficient data. Finally, there may be possibly temporary reasons other than have been catalogued for a particular history of interaction. For example, on board a Star Fleet vessel, a very logical Vulcan science officer may adopt what appears to be a yes-man response towards the proposals of a very competent chief engineer, not because the Vulcan is a yes man, but because the Vulcan knows that the chief engineer just happens to be right all the time.

EPM has been employed, as mentioned in Section 1, in family therapies in which the therapist *searches* for a family's problems. In a similar way, EPMcreate could be viewed as a requirements *elicitation* [3] technique. For more information about therapeutic, analytic uses of EPM, please consult some of the references cited in the second paragraph of Section 1.

3.2 The EPMcreate Technique

EPMcreate, as a creativity provoking technique, is based on sort of an inverse use of the EPM. Rather than trying to deduce an individual's behavior pattern by observation of his interactions with others, EPMcreate uses the EPM as a means to help a requirements elicitor (RE) to generate *all possible* reactions to two stakeholders' positions. Thus, each of the 16 Boolean functions represents one method of combining two stakeholders' viewpoints to generate yet another viewpoint from which creative ideas can flow. If there be more than two stakeholders, the technique is applied several times, for different pairs of stakeholders (up to $\binom{n}{2}$ times for n stakeholders; normally, not all pairs of stakeholders are used; the analyst chooses pairs thought to be informative).

The description of technique refers to the Venn diagram in Figure 1. In

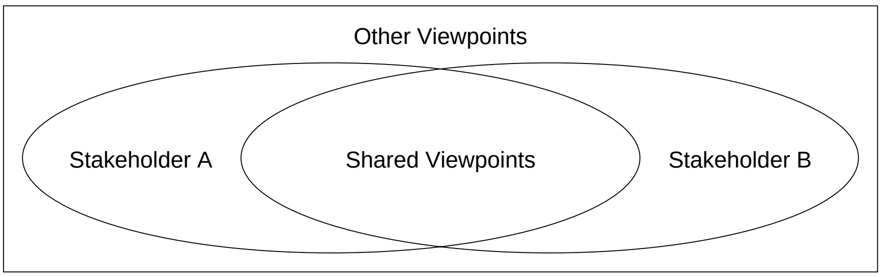

Fig. 1. Venn Diagram of Two Stakeholders' Viewpoints

this diagram, the two ellipses represent two different stakeholders' viewpoints. Thus, for example, the intersection region represents the stakeholders' shared viewpoints.

A creative session supported by EPMcreate starts with the identification of two stakeholders, or classes thereof, that are relevant for the SWS to be developed. For example, for an e-learning application, two possible stakeholders are students and lecturers. For an information system that supports a company's

B2B activities, two possible stakeholders are employees of the selling and the buying companies.

Then a multi-step process is started in which the RE has to assume different attitudes towards the stakeholders' viewpoints. The steps actually follow the boolean functions $f0, \ldots, f15$ in order of increasing index.

In the first step, corresponding to $f0$, the RE must blank her mind. This step resembles the CPT and allows the RE to increase her concentration for the subsequent steps.

In the second step, the first operative step, $f1$ suggests that the RE focus on elements common to the stakeholders' viewpoints in order to seek solutions of the problem that can be shared by the identified stakeholders.

Then, $f2$ asks the RE to focus on elements that are in only the first stakeholder's viewpoint, in order to seek solutions favorable to only the first stakeholder, to the exclusion of the second.

Step $f3$ allows the RE to concentrate on all elements that are in the first stakeholder's viewpoint, in order to seek solutions that are favorable to the first stakeholder, even those that are favorable to the second.

Step $f4$ is symmetric to $f2$, having the RE switch the focal stakeholder.

Steps $f5, \ldots, f15$ are defined in a similar way, using the function name to chose the way to combine the stakeholders' viewpoints in order to look for new solutions.

An important change in the process occurs in Step $f8$, which represents a kind of watershed. From this step on, the RE can draw new ideas from elements that are outside the viewpoints of the identified stakeholders. In particular, for Step $f8$, the RE has to empty her mind, as for Step $f0$, and then follow up on the first solution that comes her mind.

The last step, $f15$, is a catch-all step; any solution whatsoever can be accepted independently of either stakeholders' viewpoint.

4 Experiments

4.1 Design and Realization of the Experiments

To demonstrate the feasibility of the EPMcreate technique in requirements elicitation, we conducted an experiment on each of two projects with very different characteristics. In each experiment, we compared the numbers of ideas generated by two analysis teams, one of which used EPMcreate and the other of which used brainstorming. The experiments thus allow comparing the effectiveness of EPMcreate to that of a well-known and widely used idea generation technique, brainstorming.

The first experiment, called "Corsi Online", concerned a web-based system for distant learning. The second, called "Civilia", concerned a software system for public administration. The subjects for the first experiment were chosen from among students, and the subjects for the second experiment were chosen from among professional analysts working for the company that developed Civilia.

The student subjects for the first experiment had requirements engineering experiences comparable to those of junior analysts in industry, because, as verified by a questionnaire, each had worked in industry prior to becoming a student. The subjects for the second experiment were, as indicated, professional analysts.

Two groups, each with four people, were created for each experiment. For the first experiment, the eight subjects were assigned randomly to the two groups. For the second experiment, the subjects' experiences in system analysis and knowledge of the software system used for the experiment was taken into account in order to create homogeneous groups with equivalent spreads of experiences and knowledge. In each experiment, after assigning the subjects to the two groups, we drew lots to determine which group was going to use EPMcreate.

In order to be able to interpret more correctly the results of the experiments, the subjects were given a creativity test. The test was adapted from one developed by Williams [37]. The goal of the test was to detect the presence of significant differences in personal creativity among the members of the groups, differences that could affect and explain the outcome of the requirements identification sessions.

The results of the creativity tests confirmed that the second experiment's groups were balanced also in personal creativity. However, for the first experiment, the members of the group that used brainstorming showed more personal creativity than the members of the group that used EPMcreate [19]. This particular imbalance did not affect final the results, since the group that used EPMcreate proved to be more creative, in spite of its members' lower personal creativity; in essence, the final result is strengthened!

In each experiment, the groups met at the same time. Each group was given a short training session about the technique it was to use. Then each group worked for a maximum of two hours applying its technique to the experiment's problem.

The development of the Corsi Online system of the first experiment started in 2001 in the Faculty of Economics at the University of Trento. The system was a Web application to help manage on-line courses for the faculty, providing services mainly to students and lecturers participating in the courses. The system provides functions for use also by the course managers.

Since the owners and requirements analysts of the Corsi Online system are in the same institution as the experimenter, the original requirements analysts were available for consultation during the experiment. These analysts helped the experimenter evaluate the ideas generated in the experiment.

The Web-based system has three main sections:

- lecturer area
- student area
- management area.

In the experiment, we asked the subject REs to use the lecturers and students as the stakeholders on which to apply the EPMcreate steps. Thus, the viewpoints considered by the REs were those of lecturers and students involved in the on-line courses.

The second experiment was conducted at the software company that had developed Civilia to support community services for citizens. Civilia is a modular system, made of a number of different subsystems, one for each kind of target user. In the experiment, we asked the subject REs to focus on the people and territory subsystems as the sources of stakeholders and their viewpoints. The people subsystem deals mainly with registration of people, and the territory subsystem deals mainly with registration of land.

For this second experiment, the Civilia project manager helped the experimenter evaluate the ideas generated in the experiment.

4.2 Results of the Experiments

The lists of ideas and requirements produced by the four groups, working with EPMcreate and brainstorming, were analyzed both

1. quantitatively, counting the numbers of ideas and requirements generated, and
2. qualitatively, comparing the feasibility and the novelty of the ideas and requirements generated.

The comparison of the results of the two subject RE teams of each experiment confirmed the higher effectiveness of the EPMcreate technique. In particular, the EPMcreate groups produced 71 ideas in the Corsi Online experiment and 93 ideas in the Civilia experiment, while, the brainstorming groups produced only 22 ideas in the Corsi Online experiment and only 43 ideas in the Civilia experiment.

To measure the quality of the ideas, we classified each idea into one of four categories:

- new and realizable
- new but not realizable
- already known but not realizable
- already known and realizable

For the Corsi Online experiment, the original project manager and the original analysts assisted in the classification. The numbers of new realizable and of new but not realizable ideas generated by the EPMcreate group were each about three times higher than those generated by the brainstorming group. The EPMcreate group generated about three times as many new ideas as did the brainstorming group even though the members of the brainstorming group scored higher in personal creativity.

For the Civilia experiment, the project manager of the software systems department of the developing company classified the ideas. In this experiment, the number of new ideas generated by the EPMcreate group were about ten times higher than those generated by the brainstorming group. Figure 2 shows the numbers by category, method, and experiment.

Observe that in the Corsi Online experiment, ranking of the categories was essentially the opposite of that in the Civilia experiment; i.e., the largest category

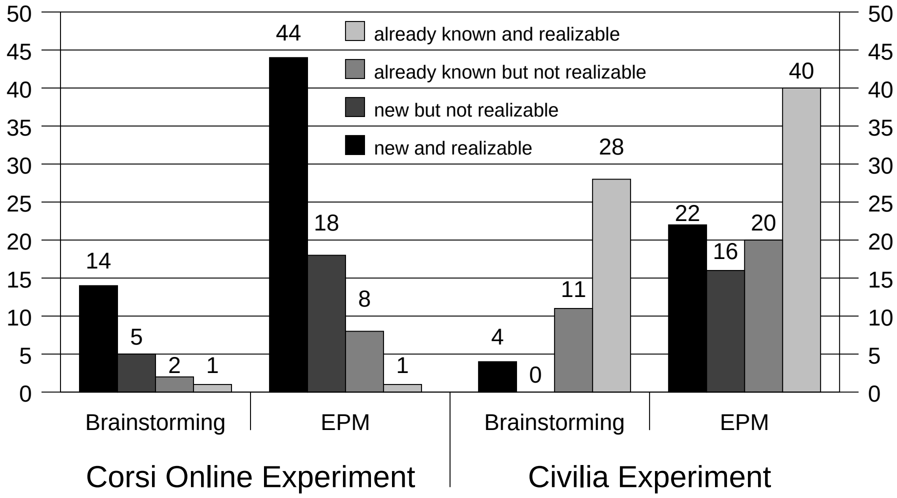

Fig. 2. Graphs of the Numbers of Ideas

in each group of the Corsi Online experiment was the new-and-realizable category while the largest category in each group of the Civilia experiment was the already-known-and-realizable category. This difference in ranking of categories can be explained by the difference in levels of development of the two systems. Civilia is already a mature commercial system that has undergone several revisions. Thus, it seemed only natural that the subject REs, who had not been involved in Civilia's development, would find requirements that had already been discovered by the Civilia development team. This explanation was confirmed by the project manager who had assisted in the classification of the ideas. Even so, the EPMcreate group found 22 new ideas ideas while the brainstorming group found only 4 new ideas.

Altogether, these results are extremely encouraging and point to the higher effectiveness of the EPMcreate technique. However, the results are not conclusive. There are too few data points for a general conclusion. Another threat to validity is the use of students instead of professional analysts. However, these students had had some professional experience. The strongly positive results do say that EPMcreate has merit and do call for additional experimentation aimed at obtaining statistically significant results. Please consult the second author's degree thesis in Italian [19] or a derived paper also in Italian [38] for more details about the experiments, including the relevant statistical measures and a complete discussion of the threats. Other positive results mentioned in these other documents include the ease of learning of the technique as well as the high satisfaction level of the subjects and assisting analysts.

At the theoretical level, we analyzed also the data for the EPMcreate groups of the two experiments in order to determine relative productivity of the 16 steps of EPMcreate. A preliminary analysis of these data showed that the odd function steps, which focus on elements *shared* by the considered viewpoints, are more effective. This result suggests that additional experiments should be carried out to try to identify a subset of the 16 steps as an optimized creativity technique to reduce the length of requirements elicitation sessions. Other experiments can be done to investigate the effectiveness of alternative orderings of the steps. For example, would it be better to start with Step $f8$, that forces focusing on elements outside both viewpoints, possibly even on absurd viewpoints.

5 Subjects' Observations and New Hypotheses

In the course of talking with the subjects during and after the experiments, we gathered a number of observations about EPMcreate from a user's perspective. Please note that these observations are the subjects' opinions, and they do not necessarily reflect reality. However, the fact that subjects have volunteered these observations is telling.

- More than one subject volunteered that EPMcreate was easier to apply than other creativity facilitating techniques they had used in the past.
- More than one of both kinds of users of EPMcreate volunteered that they felt satisfaction that they were successful in generating new and useful requirements ideas.
- More than one of the student subject users of EPMcreate volunteered that they felt satisfied with their outputs even though they were tired from their efforts.
- More than one of the professional subject users of EPMcreate volunteered that they felt relaxed and satisfied with their outputs.
- More than one of the professional subject users of EPMcreate volunteered that, during the process, they started foreseeing next steps as they began to figure out the EPM basis of EPMcreate, and they felt much satisfaction from this feeling.

Based on these observations by the subjects, it is our opinion that EPMcreate appeals to CS-type (used to algorithmic thinking) people more than do other creativity enhancement methods, probably because of EPMcreate's systematic recipe-book nature. We believe that less psychological expertise is needed to facilitate EPMcreate than other role-playing techniques such as Six Thinking Hats. We even believe that for EPMcreate, no human facilitator is needed. A well trained CS-type person can begin to internalize and apply EPMcreate on his or her own from reading a written description or under the direction of an automated EPMcreate assistant. Future experiments should try to test these opinions.

6 Conclusion

This paper has described two experiments in which EPMcreate technique was used for the first time to try to foster creativity in requirements engineering. The results of the experiments strongly suggest the effectiveness of the technique. The history of the experiments suggest also that EPMcreate is easy to manage and the subjects, particularly the senior analysts in the second experiment, found the process very intuitive and intriguing. This last conclusion is based on the second experiment subjects' direct feedback after their session and on the fact that the brainstorming group did not use all the time available for the elicitation, their having run out of steam and ideas. As a result, it seems that the structured process suggested by the EPMcreate technique plays a positive role. It can be argued that EPMcreate tries to guarantee the presence of ever-new stimuli for the search for new ideas. In particular, each of the Steps $f8$ through $f15$ asks the RE to ask to focus on elements that are outside the problem and the application, for outside-of-the-box thinking.

Given that these were the first applications of the EPMcreate technique to requirements elicitation, it is necessary to redo these experiments with more groups of subjects with the aim of obtaining statistically significant results. The history of the experiments brings to light a number of questions, such as those mentioned at the end of Section 4, that can be the subject of future experiments. It is necessary to compare EPMcreate also with creativity techniques that are more structured than brainstorming, such as the Six Thinking Hats family of techniques [23] or P.a.p.s.a. [39]. Such studies should also investigate whether EPMcreate is easier to learn than the other techniques.

Future research could also investigate the application of EPMcreate in the Joint Applications Development (JAD) approach [8]. A properly run JAD session has the presence of all stakeholders needed to provide the viewpoints that are needed to carry out EPMcreate.

At the cognitive psychology level, it would be worth investigating the relation between an individual's creativity his relational patterns as measured by the SISCI test. It would be necessary to administer a more articulated creativity test and then to analyze the results for the individual's creativity and his relational patterns. We have done some preliminary investigation using the data obtained from the subjects of the experiments described in this paper, who were tested with an automatic version of the SISCI. The results of these preliminary comparisons are consistent with the literature about creative personalities [19].

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