Against Method – An essay on the importance of studying projects and results for more creativity in RE!

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Abstract

Creativity is an important part of requirements engineering work. Innovative requirements can significantly contribute to the development of innovative software systems. This essay argues that research on creativity techniques and methods is within limits beneficial for developing innovative software. However, a significant advancement in the area of innovative software systems requires a paradigm shift. Creativity and design deserves a dedicated profession. This essay introduces digital design as an example for such a profession and argues that research on creativity in requirements engineering requires a paradigm shift as well: Research should start to study concrete projects and real results instead of abstract techniques and methods.

Keywords 1

software engineering, requirements engineering, digital design, creativity, methods

1. Research Overview

In this invited paper, I share my thoughts on the future of creativity in requirements engineering (RE). Personal thoughts are best understood in the context of a person's background. Therefore, I start with a brief overview of my professional and scientific background.

I am a professional requirements engineer by education with over 10 years of industrial experience. I wrote my PhD thesis in the field of formal specification and verification of software product line requirements [15]. Compared to research on creativity, this type of work seems to be at the other end of universe of research. It is formal and works with proofs and algorithms rather than the typical clichés that people have in mind when talking about creativity.

From my background in psychology, especially cognitive psychology, I know that the opposite is the case. The models and structures (e.g., requirements templates) that are used for working on requirements can have a significant impact on the mental processes of the people that work with them. For example, we have previously shown that the type of requirements taxonomy used (e.g., talking about quality requirements instead of non-functional requirements) has an impact on the ability of people to differentiate requirements from other statements [12]. Furthermore, there are indications, that the structure of requirements templates may have an impact on the ability of people to remember requirements [14]. All in all, I am convinced that the psychological dimension is not sufficiently addressed within requirement engineering research and practice [13].

Why is the psychological dimension important for creativity, especially for creativity in RE? First of all, creativity is an act of the human brain. A lot of research has been performed in the field of psychology on creativity and on the way the brain becomes creative. A good overview of recent research in this area is the Cambridge Handbook of Creativity [10]. And a good summary of all this research is a quote from John Cleese (cf. [3]):

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Creativity is not a talent, it is a way of operating

This means in the essence that creative ideas can occur only under certain circumstances and with a certain way of operating or working. Understanding this way of working has a lot to do with the human brain. Therefore, I am very interested in the relationships between the ways we work in RE and the insights from cognitive psychology. In my current work, I am studying mental models. The following quote by Johnson-Laird [9] gives a good definition of mental models:

"*When humans perceive the world, vision yields a mental model of what things are where in the scene in front of them. Likewise, when they understand a description of the world, they can construct a similar, albeit less rich, representation—a mental model of the world based on the meaning of the description and on their knowledge."*

Mental models appear to be quite close to what we call conceptual models in RE. However, mental models are not written on paper or created in a tool. They are created only within our brains. Nevertheless, there should be some relationships between the mental models, that have in our minds when we work on the requirements for a new system and the models that we use to document the requirements that we have elicited.

2. Creativity and Requirements Engineering

The title of this paper is inspired by that of the book "Against Method: Outline of an Anarchistic Theory of Knowledge" from Paul Feyerabend [6]. In the essence, the argument of this book is that scientific progress requires various methods and approaches. In the same sense, I am convinced that working on creativity techniques and methods for improving creativity in RE will not provide substantial improvements with respect to innovative software.

The call for papers of CreaRE workshop states "The CreaRE workshop provides a platform for introducing, discussing and elaborating creativity techniques used for Requirements Engineering (RE)". The call for papers further states "Creativity techniques help stakeholders identify delighter requirements, which make aspects of the new system a real positive surprise".

The emphasis of CreaRE so far was on methods and techniques for stakeholders which at first glance seems to be perfectly in line with the quote from Cleese. Creativity is a way of operating and capturing this way of operating by means of methodological studies seems to be reasonable approach. However, methodological studies have certain limits and in the following, I give my view on the limits of this research focus.

2.1. Benefits of Studying Methods and Techniques

From my understanding, a method or technique can be defined as a systematic description that consists of a number of steps or activities to achieve a defined objective. With this understanding, a creativity technique describes a number of steps or activities that lead to a creative idea. The RE literature is full of such creativity technique: Brain storming, six thinking hats, the Osborne checklist, etc. There are also more sophisticated methods like the human-centred design process, design thinking, or design sprints that define a larger frame in which creative ideas can be developed.

Using methods and techniques as an entity to talk about is important for defining a focus point for communication and research. Studying methods and techniques has become an interesting topic. The CreaRE workshop contributed a lot in this area and provided interesting overviews of existing creativity techniques, of their application, and their benefits.

Knowledge about techniques is important for sharing new ways of working with others and for sharing experiences on the application of creativity techniques. Brainstorming and design thinking are perfect examples for this effect. I have seen people learn about brainstorming for the first time and start working with it immediately. They do well with brainstorming because it is very easy to follow the instructions. From my experience, design thinking creates a very similar effect. Most of the time, when people learn about design thinking, they are very interested in the topic and want to work with it.

2.2. The Case against Isolated Methods and Techniques

As stated above, studying methods and techniques provides important contributions for creativity in RE. However, I think this way of looking at creativity in RE is limited for two reasons. Firstly, a method/technique is always an abstraction. Secondly, the description of a method is always incomplete.

Methods/techniques are developed based on the experience of one or more people. A typical situation is that a group of people employ a certain way of working (e.g., talking freely about ideas with criticism) and have made very positive experience with this way of working. Now, the group of people tries to generalize their experience and create a description that captures their understanding of their way of working. This description typically consists of steps, activities, and rules and is then called a method or technique (e.g., brainstorm). This description is an abstraction because it is generalized from the method that developers experience.

The second reason is related the abstraction but important for applying methods/techniques. Even the detailed description of a method or technique in the context of creativity is incomplete and cannot recreate the same behavior that the inventors of the method employ during their work. This is especially important for creativity because creativity is not a deterministic process that can be enforced by methodological approaches (cf. [10]).

2.3. The Case against the Creative Stakeholder

Another risk for creating innovate software systems that I see in the context of creativity in RE is that fact that RE hands over the need for being creative to the stakeholders. They are the ones that shall be inspired or motivated by means of methods/techniques to somehow invent or ideate so that great requirements can be defined. From an RE perspective, this is a very comfortable position because the real work and responsibility is with the stakeholders. The core responsibility of RE as a role is "only" the selection of a proper method or technique so that the stakeholders can become creative.

The previous paragraph is certainly very harshly worded and overstates the situation. In my experience, however, this occurs very frequently in practice. A project applies certain creativity techniques with its stakeholders and pushes the responsibility for the result onto the stakeholders. This is especially difficult when the client who is responsible for the project expects substantial innovations or creative ideas from the project and the project is not able to fulfill these expectations. In such situations, the stakeholders are often blamed for being unable to be creative.

Looking at research in creativity in general, this is not a surprising result. Kaufmann and Beghetto define four levels of creativity in the 4c model [11]: mini-c, little-c, pro-c and big-c. Mini-c and little-c is everyday creativity. Pro-c represents the ability to be creative at a professional level (e.g., industrial designer or architects). Big-c is the level of creativity that becomes part of history books (e.g., the famous Bauhaus building or Master houses from Walter Gropius in Dessau [1]).

An important message of the 4c model is that pro-c and big-c requires substantial education and that a creative result requires a certain amount of time and effort. When we now look at stakeholders, they typically do not have a professional training for being creative in terms of innovative requirements. We therefore use creativity methods/techniques to support them. Nevertheless, compared to a professional education, it seems very unlikely that following the instructions of a documented method will enable them to produce creative results that are on a professional level.

2.4. Intermediate Conclusion

To avoid misunderstandings: I think research on creativity techniques in RE is an exciting and interesting field. However, I question whether this work will significantly advance our ability to develop innovative solutions. I gave two arguments for this conclusion. Firstly, using documented methods instead of practical education and training is a weak tool for teaching competence in creativity. Secondly, trying to empower stakeholders to become creative is suboptimal, as creativity at a professional level requires substantial education.

3. Outlook on Creativity in Requirements Engineering

Industrial designers and architects are interesting role models for people that work on the pro-c level. In order to become an industrial designer or an architect, a full-fledged bachelor/master program is necessary that teaches various skills and included intensive practical exercises. A second important observation with respect to industrial designers and architects is that both work in a special field. Industrial designers work on industrial products and architects work on buildings. Their education therefore includes the study of materials (e.g., wood, concrete, steel) and the study of production / building processes. This education gives them the ability to take part of the whole development process of products / buildings and to continuously contribute to the form and function of products or buildings.

Their creative process is therefore not limited to a certain period of time (e.g., a workshop); their creative process extends to a significant part of the development process. For example, a good architect observes the building side to take care of important decisions and to observe if the building is being realized according to the original ideas.

3.1. The Need for a Dedicated Digital Design Profession

With respect to software, I am convinced that we need similar professions that are educated for pro-c level creativity skills in the area of shaping innovative software system. Certainly, creativity must continue to be studied and also taught throughout the software process. However, with regard to innovative software, I think it is more promising if we bring creativity and design work to the level of a profession. In this way, we give the topic an appropriate visibility and anchoring in industrial practice and also in the scientific community.

One initiative in this area is digital design [2]. The core idea behind this initiative is to establish a dedicated design profession (including education at university level) that has the same self-understanding about software and digitalization as architects have about buildings and industrial designers have about products. From a terminological perspective, it is important to explain the shift from software design to the term digital design. The term software design is already defined and is related to the structure of software (cf. [8]). When talking about software-intensive products, services, or systems, the emphasis is put on software. This perspective is important, but not sufficient. Outside the software world, the terms digital transformation or digitalization are used to refer a phenomenon that is larger than software: transforming economy and society by means of digital technology (cf., e.g., [17]). Software is an important part of digital technology, but only one part beside business processes, networks, hardware, end user devices, and other technologies. With this in mind, digital design aims at designing digital products, services, solutions, or services in the same way as industrial designers shape physical products or architects shape buildings.

According to Biktom [2], a digital designer has a competence profile with two focus points: Competence in digital material combined with design competence. Competence in digital material means an understanding of the capabilities and limits of digital technology that is sufficient to shape a digital solution in the same way as other materials (e.g., wood) can be shaped to create physical products (e.g., a chair). This competence in digital material does not necessarily involve software engineering skills. A very simple example can be used to illustrate this.

Assume, you own a pizza restaurant and want to offer a very simple digital way for selling pizza. You could accept and confirm pizza orders with a public instant messaging service. Payment for the order can be made through an online payment service. As soon as the pizza is paid, it can be made. When the delivery driver has left, you then send a short message to your customer to indicate that the pizza is on the way. This is for sure an oversimplified example, but it shows a way of using digital technology that is independent from software engineering skills. It also shows that existing digital technology can be used to shape simple digital solutions (here an online pizza service).

The other focus point for digital design is design competence. Design competence includes a deep understanding of design as a way of working (cf. [4]) including the ability to communicate design ideas by means of concepts and prototypes, design process competence (e.g., understanding of the human-centered design process, and design thinking), and an understanding of the integration of digital design into the development process of digital solutions.

3.2. Digital Design and Requirements Engineering are best friends

Digital design and RE are not opposites, nor are they conflicting. On the contrary, IREB defines the requirements engineer as a role and not as a profession (cf. [7]), whereas digital design understands itself as a profession and not as a role (cf. [2]). RE and digital design share the same goal, supporting the development of high-quality solutions that full the desires and needs of all relevant stakeholders. Several competences that are part of RE are important in digital design (e.g., the systematic work with requirements and specification), therefore, a digital designer can of course work in the role of a requirements engineer. Nevertheless, the scope of a digital designer's activities is broader. A digital designer is trained in particular to design digital solutions independently and thus to become creative themselves.

At first glance, this distinction is subtle. However, it describes an essential difference in the self-conception of RE and digital design. This difference is not a problem, however, because people who are trained for the role of RE and who would like to work or already work creatively in the areas of software will find a corresponding field of activity in digital design and first initial opportunities for further training (cf. [5]).

3.3. Research on Creativity in Requirements Engineering requires a paradigm shift

It is important for me to state that I believe that creativity in RE will remain an important area. However, as stated in Section 2.2, I am not convinced that working on abstract methods or techniques will provide substantial improvements. Methods and techniques are one way to educate people in becoming creative.

When looking at the history and education of industrial designers (cf., e.g., [16], 7), the literature describes and celebrates concrete results instead of abstract methods or techniques. In addition, every industrial design student must shape various products as part of their educational program. This very concrete level of work is from my understanding a very important source for insights and for the development of a creative skills on a professional level.

I argue that research on creativity in RE should follow these examples and should start to work on a more concrete level. It is of course more difficult to get access to real results and real projects in the software domain. I think this is a problem of our culture; the industrial software community is not used to sharing information with research on such a concrete level. Reasons for this are probably the fear of sharing internal knowledge or the fear of disclosing one's own approach and receiving negative feedback.

Another cultural problem I see is that our research culture is not really open to such concrete work. They don't seem to be recognized as scientific enough or dismissed as not representative enough in the context of empirical research. I have no scientific proof for this observation. I have two indications for this opinion. First, there are that some publications share this view (cf., e.g., [18]). And second, there is only a small number of concrete examples and case studies in the RE literature. I hardly know any papers at scientific conferences that report on a concrete project, as it happens in industrial design literature (cf. [16]), for example.

3.4. An example of creative work at the intersection of RE and Digital Design

I do not want to conclude this paper with a mere demand. Rather, I would like to set a good example and report on a project of my own. This project can be categorized as a creative work at the intersection of RE and digital design. We (a team of three REs including me) had the task to develop a concept for an innovative management system for dental practices including an initial estimation of the development costs of a first version this system. The budget for this project was fixed; in total, we had about 80 person days of work.

From an RE perspective, such a project should be approached with an initial analysis of the system context and identification of the relevant stakeholders. The relevant stakeholders should then take part

in various requirements elicitation activities. These elicitation activities of course should include creativity techniques because an innovative system needs innovative requirements. As an outcome of this, an initial requirements specification is created that is then validated together with relevant stakeholders. Finally, the requirements specification can be used to estimate the development costs of the initial version.

We have deliberately decided against this way of working. The main reasons were the limited budget and the client's explicit wish that we should not follow existing solution but think freely about the possibilities for innovation. Under these conditions, the approach described above would have meant that we would have had to motivate stakeholders to think beyond existing systems. In my experience, this approach is very difficult and too risky under the given circumstances.

In the essence, the project took place as follows (see Figure 1 for an overview of the steps). We started with a detailed analysis of the work in dental practices to understand their current way of working. This analysis consisted observations and interviews.

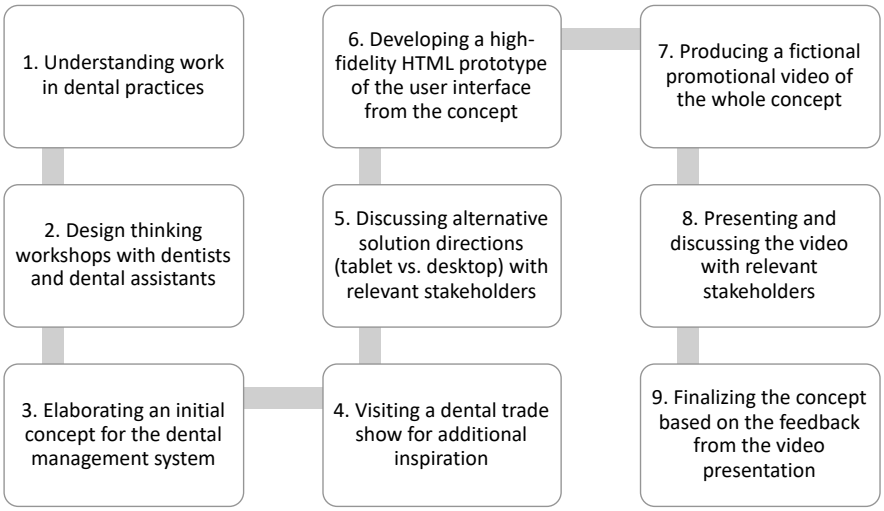

Figure 1: Steps of the sample projects

The second step were two short design thinking workshops (3 days), one with dentists and one with dental assistants. The goal of these workshops was to work on innovative ideas for the management system. In both workshops, my team and myself worked together with the dentists and assistants.

The results of the first two steps were used to create an initial concept with goals, use cases and additional requirements for the management system. The use cases were especially important to document the innovative ways of working with the new system. During the development of the initial use cases, we started to work on user interface mockups to work on different ideas for working with the system. The focus of this step was not so much on the shape of the user interface but on the shape of the device. We followed two alternative ideas, the first idea was a desktop system with stationary devices. The second idea was to portable tablet devices as a replacement for desktop systems.

A further source of input was a large dental trade show. We visited it during the work on the initial concept to get further inspiration on current trends and developments. The initial use cases and mockups were used to discuss the core ideas of the concept with different stakeholders. The outcome of this discussion was that the portable solution was very promising and that the defined use cases contained several promising ideas for innovative ways of working.

After this discussion, about 40% of the budget was spent. We further had reserved 20% of the budget for the cost estimation. So, the next challenge was to ensure that the promising ideas were really good. A key feature of the concept was a new and end-to-end consultation and treatment process that simplified many previously manual steps. Validating such an idea without a real implementation of the process was a real challenge. We decided to develop a high-fidelity HTML prototype of our concept that was able to simulate a typical treatment situation with significant complexity. A real end-user test of this prototype was an option, that we considered. We decided against this option because the

functionality was too limited for a real interaction. Instead, we chose to produce a short fictional promotional video of our concept with which we could transport the process and other core functions of our idea. This concept was presented to various end-users without mentioning that the product did not yet exist. At the end of the movie, we asked the end-users if they would consider buying this new system. The feedback of the stakeholders was very positive. This result showed our client that the new concept had considerable potential. He therefore decided that we should estimate the costs for implementing a first version of the solution.

For me, this example shows that real innovative solutions require more than a creativity technique (e.g., the design thinking workshops). The positive outcome was a combination of several activities, a core element was the fictional promotional video. Using this example to derive a new method is not my intention. Rather, such an example should be discussed from a wide variety of perspectives and, above all, with the people involved. The CreaRE workshop would be a perfect event for this. This kind of discussion is certainly valuable not only for practitioners but also for researchers. Therefore, I would like to see research on creativity in RE going into this direction. Because I believe that there are at least as many insights in the concrete as in the abstract.

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