

# KREA-FUN: Systematic Creativity for Enjoyable Software Applications

Daniel Kerkow and Christian Graf

Fraunhofer Institute for Experimental Software and System Engineering  
Fraunhofer-Platz 1  
67663 Kaiserslautern, Germany  
{Daniel.Kerkow, Christian.Graf}@iese.fraunhofer.de

**Abstract.** This paper is about how to enhance software applications with engaging interaction. A methodology is presented that provides a structured way to elicit how to turn boring tasks into enjoyable challenges, giving users the possibility to grow or compete, or empowering users to perform sophisticated tasks and as a consequence gain social appreciation. The paper is addressed to practitioners who want to know more about how to make applications more appealing and to researchers, who want to see theories from emotion, motivation and organizational growths successfully put into interactive applications.

**Keywords:** user experience, fun-of-use, business goals, interaction pattern, user interface engineering

## 1 Introduction

There is a gap between the world of creativity (e.g., in design) and the world of structured thinking (e.g., in engineering). Nevertheless, to make a product successful, design and engineering have to work hand-in-hand. Other industries have regarded that fact as essential for long time (e.g., with cars that must be functional on the hand but emotionally appealing on the other hand to be a success on the market). Whereas usability has been a topic in the Human-Computer-Interaction (HCI) community for 15 years, software-makers and their clients are just at the beginning to realize the importance of hedonic aspects [1,2]. This new way of looking at products (i.e. as combination of functions and hedonics) cannot only be applied to material products but also to software products, like business applications [3]. The users of such software are forced to use it as part of their jobs. It would be beneficial to their motivation, their health and their performance if the application they use are not only functional in the sense that the job can be done with it but that doing the job is a pleasure for them [4]. The challenge is in engineering intrinsic aspects into the product in a systematic way by applying creativity techniques and finding a decent equilibrium between the right amounts of functional aspects and hedonic aspects.

In the following chapters we will introduce different types of intrinsic aspects as potential bridges between users' and the businesses' goals (chapter 2.1) and a

systematic theory based methodology to tune up interactive systems in a way that meets human delighters (chapter 2.2). In chapter 2.3 we introduce evaluation criteria for the resulting ideas. Finally in chapter 3 we present lessons learned and a few descriptive statistics from four different case studies from different domains, where KREA-FUN has been applied.

## 2 KREA-FUN: a moderated Requirements Elicitation format

We have developed a systematic method to facilitate the elicitation and identification of ideas for new and innovative ways how users of software might enjoy more fun when working with the software: the KREA-FUN workshop.

KREA-FUN packages many important principles from the intersection of Usability Engineering, Requirements Engineering, Emotional Design, Creativity and Psychology with the intention to improve the interplay between organizational goals and user goals. Figure 1 sketches the four phases preparation, exploration, transformation and evaluation, as well as the information and techniques that serve as input for the workshop. Each element will be explained in the following sections of this chapter.

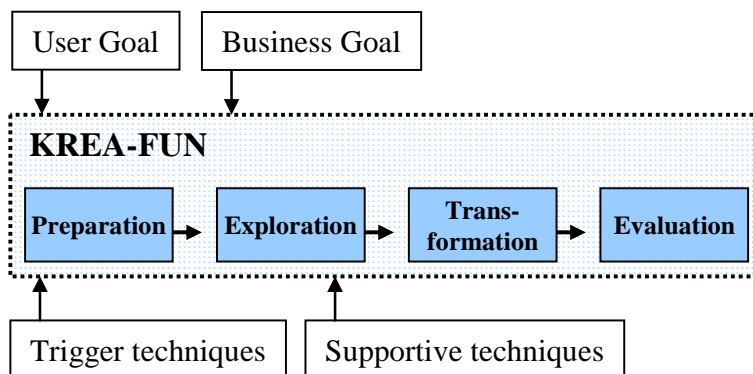


Figure 1 The KREAFUN workshop: Inputs and process

### 2.1 Preparation

Typically, organizations pursue other goals than people strive for. Thus organizations pay their employees, i.e. the users, to follow their business goals. Obviously, there is a gap between the users' interest and the businesses' interest. Usually, the user of software wants to pursue his interest with and neglect the one of the organization, e.g. to write a letter to his friend instead of writing an invoice for another company. But some organizations manage to present their own goal in a way that is tempting for the people. A good example illustrating is the Google Image

Labeler, based on the ESP Game [6]. Google's goal is to get good and comprehensive image labels for its image search functionality, for free. Hence, they set up a collaborative online tagging game that makes it fun to label images: Two randomly paired players try to find the same words describing a randomly selected picture without being able to communicate with each other. Thus Google can benefit from people who are even not connected with this organization – they employ the interest of humans in playing and comparing each other. This example shows how the gap between user interest and organizational goals can be closed and brought to a win-win situation: both, organization and users, are satisfied with the result. This process can be seen as building a bridge that closes the gap between satisfying user interests and organizational goals. There is not only one bridge of joyful interaction that can be built to span a problem, but several ones. To build our “bridges” on solid ground, we have developed a model that guides our efforts.

The e4 FUN model [28, 29] approaches the concept of joy during the usage of interactive systems in a cognitive behaviorist manner. It completely abstains from subjective experience and focuses on behavioral and cognitive effects software properties have on users. Hence, fun-of-use in the e4 FUN model is not about feeling happiness, but about motivation, attitude, creativity, concentration and willingness to work. It is divided into the following four dimensions:

1. *Execute- FUN is when nothing hinders me:* Here, user goals and business goals match. The application should not prevent the user from accomplishing his task, but allow for an effective, efficient and adequate working, that is, usability. This dimension is mainly founded on models of human cognition and human failure.
2. *Engage- FUN is when I meet my motives:* In this dimension, the user knows and has accepted the business goals. The user is pursuing plain goals, but might lose sight of the goals, or the goals lose priority due to external factors. The key concept of this dimension is motivation, Users shall be (re-) motivated and engaged during interaction.
3. *Induce- FUN is when I change attitude:* . Users who are not aware of or interested in business goals should be “persuaded” to subsequently adhere to them. Here, users' attitude should change towards a predefined goal. Its key concepts are attitude and persuasion.
4. *Expand- FUN is when I get illuminated:* The main concept in this dimension is creativity. The target behavior for the users would be to acquire new tasks or goals by developing novel and creative ideas or usage scenarios the product has not been designed for.

Bridging means that each of the dimensions described above, is able to initiate the desired change in motivation, attitude or mood. For the “engage“ dimension for example the challenge of our approach is to propose interaction designs that strengthen the motivation of users and therefore support the achievement of the business goal “performance”.

In the preparation phase before the actual elicitation of ideas for engaging applications the moderators ensure an activation of relevant and useful knowledge and information. With regard to the quality model, they have to identify users and business goals and the quality level the organization targets (from mere usability to creativity support).

For business goals, the moderators have to find out what the organisation pursuits and which business goals have been already defined. For the workshop it will be especially interesting what qualitative aspects (aside from the pure quantitative) are considered important in the organisation (most efficiently done by interviews with the management). Such aspects are, for example, how the management interacts with the employees and employees with each other, how proposals by employees are regarded and handled by the management etc. The 7-S-Model [7] that relates quantitative and qualitative aspects of business can help to discover possible implicit business goals when analysing the organisation. If identification is not possible beforehand, this activity has to be postponed to the workshop and business goals must be elicited later.

## 2.2 Exploration

Exploration refers to the usage of pre-existing associations between cognitive elements in order to activate and understand the problem and solution space. These associations can be internally or externally triggered and pre-structured. The principles used for the exploration phase basically are free, structured or intuition triggered associations. Domain experts will be supported by moderators to find creative ideas for engaging interaction. The software that will be spoken about in the workshop was agreed on beforehand. If the business goals or the software under consideration are not entirely known by some participants or the moderators they should be presented to all for having a common level of knowledge.

The software to be enhanced should be investigated in terms of activities it supports, the context it is used in (e.g. frequently or sporadic), how it is currently used (e.g. what people typically do with it), who uses it (e.g. users' education), and if there are any already known issues that should be addresses with the ideas to be developed. Moderators use these facts as background in the workshop. They can be used later as starting point for further investigations into enhancements of the software.

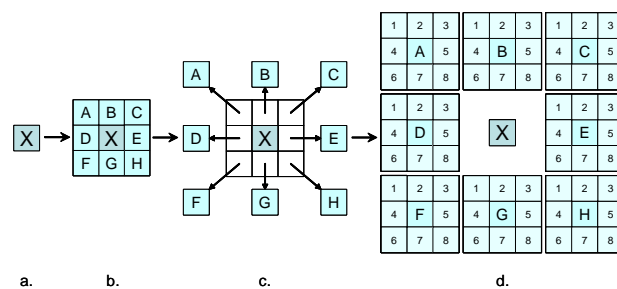


Figure 1: The Lotus-Blossom-Technique: a) an initial idea is the seed; b) some adjacent ideas are added, that in c) are takes as seeds themselves, to produce more ideas as visualized in d).

During the exploration phase, the participants try to evoke reactions from the domain experts. The goal is to activate the experience of the domain expert and gather implicit knowledge from them. Most probably, some of the domain experts will state a problem that exists with the current version and how it could possible be solved. All

participants are then asked to comment on how this problem might be solved in a novel way. Each idea is noted down on a paper card that is then hung up in front of the group. When the initial round of free ideas comes to end, the moderators use creativity techniques to route the participants further away from controlled thinking, provoke divergent thinking, and elicit more ideas (for example with the “Lotus-Blossom Technique”).

### 2.3 Transformation

The Transformation phase, concerned with modification or creation of associations, refers to associations that are improbable or impossible from a certain starting point, but become probable by moving away from that starting point. Included in this phase are such principles as alienation, analogy, induction, transfer, adoption. We primarily use a trigger based technique in this phase. The trigger words are used to formulate questions, signal words, or scenarios in support of the participants’ divergent thinking about user goals. Our set of triggers was derived from psychological models that explain mechanisms of thought, behavior, or attitude. We extracted essential concepts and gained useful knowledge about the relationship between specific psychological models and the dimensions of the quality model.

SOURCES FOR TRIGGERS TO ENABLE	SOURCES FOR TRIGGERS TO ENGAGE	SOURCES FOR TRIGGERS TO INDUCE	SOURCES FOR TRIGGERS TO EXPAND
<p>COGNITIVE MODELS</p> <ul style="list-style-type: none"> <li>•Usability engineering</li> <li>•Cognitive psychology</li> <li>•Mental models</li> <li>•Gestalt theory</li> <li>•Learning psychology</li> </ul>	<p>MODELS OF MOTIVATION &amp; NEEDS</p> <ul style="list-style-type: none"> <li>•Attribution theory</li> <li>•Self-efficacy</li> <li>•Locus of control</li> <li>•Goal orientation</li> <li>•Flow</li> <li>•Need fulfillment</li> </ul>	<p>ATTITUDE, PERSUASION &amp; ACCEPTANCE MODELS</p> <ul style="list-style-type: none"> <li>Consistency theories</li> <li>•Cognitive dissonance</li> <li>•Balance theory</li> <li>•Self-perception theory</li> <li>•Persuasion</li> <li>•Elaboration Likelihood Model</li> <li>•Social judgment theory</li> <li>•Abundance theory</li> <li>•Captology</li> </ul>	<p>MODELS OF CREATIVITY</p> <ul style="list-style-type: none"> <li>•IPC- Model</li> <li>•Phase models</li> <li>•Creative problem solving</li> </ul>

Figure 2: Psychological models are sources for trigger words

#### Execute – FUN is when nothing hinders me

This quality dimension is one of the most well understood ones among practitioners and is encapsulated in the traditional discipline of usability engineering, using a wide range of knowledge from the areas of cognitive psychology, mental models, gestalt theory, learning psychology, etc. ([8], [9], [10], [11], [12], [13], [14]).

#### Engage - FUN is when I can satisfy my needs

The key psychological construct to be applied in this dimension is motivation. Motivation refers to the initiation, direction, intensity, and persistence of behavior [15] and can be divided into extrinsic and intrinsic motivation.

Extrinsic motivation can be reached by reinforcement and reward, a concept that has been successfully transferred into economies in order to provide controlling instruments.

Intrinsic motivation means that the motivation to perform a certain activity comes inherently from performing the activity itself. This motivation is also observed as being enjoyable, enabling curiosity, interest, etc. There is not one single model of intrinsic motivation, but rather a canon of theories that orbit around the concept: Among them are attribution theory [16], self-efficacy [17], locus of control [18], goal orientation [19], flow [20], and need fulfillment [21], [22], [23]. Generally, the latter (need fulfillment) theories propose typical classes of needs that every human has to some extent. Unless a need is satisfied, a person initiates actions to satisfy those needs. Most of these models propose different levels of needs. There are the basic (hygiene) factors, which are needed for the absence of negative states, and the motivating factors needed for the presence of positive states.

### **Induce - FUN is, when I change attitude**

The most relevant psychological concepts for this dimension are attitude, persuasion, and acceptance. There are numerous theories around these concepts, such as consistency theories [24], cognitive dissonance [25], or balance theory [26], which imply that we must be consistent in our beliefs and values. Other methods are the self-perception theory [27], persuasion [28], elaboration likelihood model [29], social judgment theory [30], abundance theory [31]. The research area that applies the concept of persuasion (influence, motivation, etc.) to computing technology with the goal of changing people's attitudes or behavior is called captology [32].

### **Expand – FUN is when I get illuminated**

Mainly theories from the area of creativity in cognitive or organizational psychology are used to understand the mechanisms of this dimension. We derived triggers from rather process-oriented theories as well as from theories of cognitive problem solving. A complete and comprehensive model that summarizes different approaches is the IPC- Model [33].

Process-oriented theories tend to propose several steps derived from natural cognitive mental processes following each other within creative thinking [34]. The number of steps varies among the different concepts [35, 36].

From a cognitive problem solving perspective, the underlying principles in creativity techniques can be reduced to two areas: first, the usage of pre-existing associations (exploration & evaluation [37] between cognitive elements, and second, the modification or creation of new associations and elements (combination & transformation [37]).

**Table 1: Triggers for FUN derived from different psychological models**

<b>Enable</b>	<b>Engage</b>	<b>Induce</b>	<b>Expand</b>
<i>Usability:</i> <ul style="list-style-type: none"> <li>• Usefulness</li> <li>• Relevance</li> <li>• Consistency and standards</li> <li>• Simplicity</li> <li>• Visibility</li> <li>• Self-evidency</li> <li>• Clear structure</li> <li>• Help and documentation</li> <li>• Error Prevention</li> </ul>	<i>During first contact:</i> <ul style="list-style-type: none"> <li>• Promises</li> <li>• Commitment</li> <li>• Positive product-image</li> <li>• Visual attractively</li> <li>• Wealthiness</li> </ul> <i>During first interaction:</i> <ul style="list-style-type: none"> <li>• Personalisation</li> <li>• Stimulation</li> <li>• Power, control</li> </ul>	<i>Change attitude/ Captology:</i> <ul style="list-style-type: none"> <li>• Goal Substitution</li> <li>• Mere Exposure</li> <li>• Ease Memory</li> <li>• Elaboration-Likelihood</li> <li>• Consistency/ Commitment</li> <li>• Mere-Ownership</li> <li>• Oversufficient-Justification</li> <li>• Reactance Reduction/Increase</li> <li>• Low-Ball</li> <li>• Forced-Compliance</li> </ul>	<i>Creative problem solving</i> <i>Exploration</i> <ul style="list-style-type: none"> <li>• Free association</li> <li>• Structured association</li> <li>• Intuition triggered association</li> </ul> <i>Evaluation</i> <ul style="list-style-type: none"> <li>• Argumentation,</li> <li>• Confrontation</li> <li>• Empirical evaluation</li> </ul> <i>Combination</i> <ul style="list-style-type: none"> <li>• Alienation</li> <li>• Analogy</li> </ul>

- and handling
- Forgiveness
- Error recovery
- Undo and redo
- Efficiency
- Shortcuts
- Workload reduction
- Supportive automation:
- Reduce memory load
- Free cognitive resources for high-level tasks
- Wealthiness
- Success
- Autonomy
- Communication
- Extrinsic motivators (Anonymity and voluntariness are moderating factors):*
- “Cafeteria” and “stock-market” models
- Material appeal
- Status boost
- Combining ranking with extrinsic appeals
- Information ledge
- Equity Theory
- Door in the face/ Thats not all
- Mood
- Social Proof
- Authority/ Expertise
- Being persistent
- Scarcity
- Reduction
- Tunneling
- Suggestion
- Self-Monitoring
- Surveillance
- Cause and Effect/ Simulation
- Attractiveness/ Liking
- Similarity
- Trustworthiness/ Credibility
- Social Facilitation/ Learning
- Normative influence
- Induction (analysis, abstraction, reduction)
- Transfer
- Adaption
- Transformation*
- Restructuring the concepts
- Moving or ignoring system boundaries
- Forgetting
- Decomposing parts of the structure
- Inference
- Reformulation
- Creativity processes*
- Analytical step (problem analysis; goal definition)
- Intuitive step (actual creative phase)
- Critical step (selecting relevant ideas)

It has been shown that this structured approach fosters divergent thinking and produces new ideas for the resolution of the mismatch between user and business goals. In the end, there is a set of novel ideas how a specific user goal might be brought in alignment to the business goal.

Additionally to the Trigger-Technique, we use a set of supportive techniques [38-42] (e.g. Lotus-Blossom Technique or Six-Thinking-Hats, to moderate the workshop and prevent the participants from falling into local minima.

## 2.4 Evaluation

After the workshop has been held, each single idea produced in the workshop is put to an evaluation phase. In the evaluation domain experts rate if a particular feature that realize that specific idea should be tested empirically for the expected fun effect.

For this evaluation, each organization imposes its own quality system with individual quality criteria that are important in the specific business context. Some typical criteria for industrial partners are the effort of implementing the feature, expected novelty, expected marketing advantages, and expected effect of the feature in the running application. The Fraunhofer-IESE as research partner is interested in proving that certain principles from one domain can be successfully transferred to another. For that purpose there must be chance that the effect of a new, innovative feature can be tested empirically. According to both qualities some of the ideas are discarded, some are put on hold, and other are identified for further processing.

## 3 Lessons Learned

The following accounts of experience should give an overview of what we have learned during the preparation, during the sessions of explorations and transformations, and during the evaluation.

When a company holds such a workshop for the first time, one can usually expect that the participants use the opportunity to unload all their ideas they once had to improve some aspect of the software. The workshop is an opportunity for all members of the organization to step back from their usual work, flee the tread-mill and create

new ideas or reactivate old ones. This should be made clear to the organization so that it can send the right people.

When the workshop is conducted with people not familiar with the format of creativity workshops, it might seem unusual to them and they might feel uneasy. The unstructured thinking is unusual for those who have been trained during their whole work life to think in a very structured way. It often happens in technical environments like the premium target group of this workshop format: software development companies. This is why the workshop should be conducted in a structured way, to give participants a feeling of control. It is about the outer structure, not the content of the session. They should know what is going on and why, what is expected from them and that they can rely on the moderators and their help. The role of the moderators should be pointed out: they are support and guide the party through the workshop, but only in exceptional cases they should provide input. The rationale is that the participants should attribute the findings and results to themselves and not to the moderators in the end.

It is essential to the result of the workshop that hierarchies are left at the door. Otherwise people will feel observed by their superiors and might think that their performance is monitored. This belief contradicts the idea of freeing your mind and producing even unpopular or “crazy” ideas. The moderator has to make clear that he does not accept any kind of hierarchy in the room, except from the fact that he has the right to guide the interaction between the participants. He should refrain from presenting himself as judging entity. To control his behavior and to level the workload of the workshop (e.g. documenting the ideas uttered) it is advised to conduct the workshop with at least two moderators.

From the experience, we can tell that there should be no discussion if any subjective statement is relevant or not. Discussion will eliminate exploration and divergent thinking. If some disruption should occur (like discussion), the moderators can use the techniques prepared to direct the conversation back on track (e.g. with “Six-Hats” to limit the discussion).

For a successful workshop, it is essential that domain experts come to the workshop. In the conducted workshops, the participants were users, developers, software engineers, managers, support personnel and training personnel. Best is if users of the software are involved and present their impressions right away. They are the premium target for questions for enhancements in handling the software. If there are no real users, there should be at least people who know how the software is used by them (from training or support), what people regard as essential pros and cons of the current version, what difficulties occurs in training, what the marketing and management of the organization regard as unique selling point, and others. Most of the issues named by the people can be regarded as usual usability issues. For sure, these need to be addressed too, but they are not focus of this workshop format. To handle this input, it should not be rejected but noted down and used for later usability improvements.

Generally, there will be little original ideas among the ideas stated in the beginning. Later on when the minds have unloaded and participants got a feeling for the essence of a truly original idea, there will be fewer ideas but more original ones (see Figure 2).



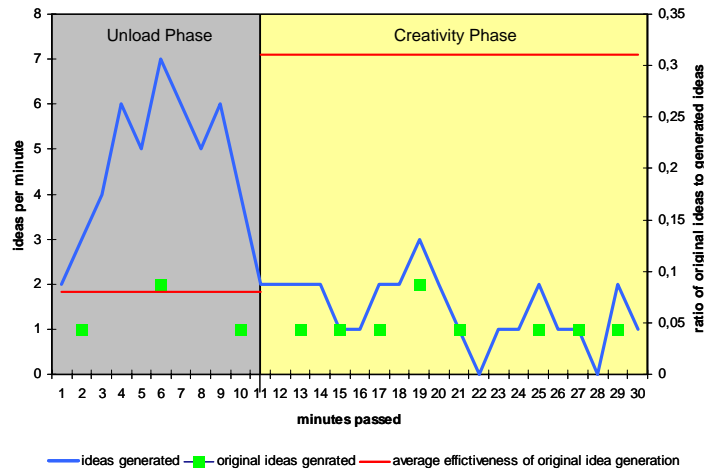


Figure 2: The unload phase and the creativity phase during a typical creativity workshop. In the creativity phase there are less ideas but more of them can be regarded as original. (The data behind this figure is fictitious but reflecting the trends.)

Up to now, we have conducted the KREA-FUN workshop successfully five times with project partners. As the last two take place just recently we can only report results from three. During these three workshops, full size business applications (not prototypes or mock-ups) had to be enhanced with innovative ideas for joyful interaction. In total, the participants came up with 79 suggestions, which were condensed to 28 pattern ideas (35%) and resulted in 8 implemented patterns. The feedback from the workshops was very positive. Many participants mentioned that the experience in the workshop was joyful itself and that the workshop format created an engaging atmosphere.

There is one limitation of the workshop format: We could experience that engineering joy-of-use into a product that lacks a basic usability is almost impossible. Actually, this is not a failure of the workshop but more of the product submitted to the workshop for enhancement. The inappropriateness has two reasons. First, it is doubtful if later user will be influenced by the joy-of-use means if there are strong usability flaws at the same time. The strong negative effect of poor usability will level the subtle positive effect of joy-of-use. Secondly, it is very hard to direct the participants' thinking away from revolving around usability flaws and how to improve them during the workshop. Thus the best time to improve a product through fun-of-use is when it is equipped with at least basic usability, such that the users can do what they want to do without being obstructed. Best would be if usability is already good. Joy-of-use can then add to it to create an advantage for the users and a unique selling point for the business.

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