Changing the Perspective: Improving Generate thinkLets for Ideation

Stefan Werner Knoll
Faculty of Computer Science
University of Magdeburg, Germany
sknoll@sim-md.de

Graham Horton
Faculty of Computer Science
University of Magdeburg, Germany
graham@sim-md.de

Abstract

Creativity techniques provide a variety of approaches for supporting an ideation process. These techniques can be executed using a Group Support System (GSS), thus allowing the ideation process to be distributed across geographical distances. However, experience is necessary for the selection of an appropriate creativity technique, its implementation in a GSS, and the facilitation during the ideation process itself. To tackle these problems, 101 creativity techniques were analysed with respect to their underlying cognitive processes. The results show that there are only three cognitive principles that stimulate the ideation process by providing a change of perspective. Change of perspective can be used to formalize the cognitive process of creativity techniques. The paper shows how this change of perspective can be used to implement an ideation process with a GSS via Generate thinkLets and discuss how this formalisation can improve the applicability of GSS for ideation processes.

1. Introduction

In a world of rapid change, the ability to generate new ideas for products or services is essential for any organization to maintain its competitive position. Moreover, different strategic goals—such as incremental and platform innovations—require different types of ideas. So-called creativity techniques provide a variety of approaches for supporting a goal-oriented ideation process. These techniques can be executed using a Group Support System (GSS), thus allowing the ideation process to be distributed across geographical distances. However, experience is necessary for the selection of an appropriate creativity technique, its implementation with a GSS, and the facilitation during the ideation process itself.

In the field of Collaboration Engineering, the concept of thinkLet has been developed as a reusable activity for creating a known pattern of collaboration. Research has shown that practitioners that use thinkLets can predictably and repeatably engender collaboration activities with a GSS, even without any facilitation expertise. We propose to use thinkLets to improve the GSS-based ideation process. The challenge is to define thinkLets which can enable a reliable and effective goal-oriented ideation process, which is readily teachable and transferable to a GSS.

Until recently, the space of creativity techniques has been unstructured, and no clear guidelines have been available for the selection of an appropriate creativity technique for a given innovation goal. We have used an engineering approach to reduce the large number of published creativity techniques to a small number of fundamental principles. Each principle defines a sequence of formal steps, which stimulates the ideation process by providing a different change of perspective. In this paper we will show how these changes of perspective can be used to inspire new ideas. We will introduce a new approach that implements these changes of perspective with thinkLets and argue how it can be used to improve the applicability of GSS for ideation process.

2. State of the Art

Over several decades, a variety of approaches to creativity have been developed. These approaches can be discriminated by the perspective they take, which focuses on the creative *person* (creativity as a property of an individual), the creative *product* (creativity as a property of a process outcome), the creative *press* (creativity as a result of the environment and context) or the creative *process* (creativity as a result of a defined process or technique) [5]. We are interested in the creative process.

The purpose of this paper is to understand how a Group Support System (GSS) can be used to manage and assist a goal-oriented ideation process of a group. As most researchers [5, 12, 14], we see the creative process as the main factor that can be manipulated when using GSS to support creative tasks. The creative process can be described as the exploration and transformation of conceptual spaces of an individual to generate new ideas. Different stepwise models of

creativity [1, 14, 20, 29] exist which assume that various phases occur in this process. Warr and O'Neill [30] combine common creativity models and extract a generic creative process model and divide the process into the three phases of *Problem Preparation, Idea Generation* and *Idea Evaluation. Problem Preparation* involves building up knowledge about the problem from information resources. By gathering relevant information about the problem and reviewing it, the individual knows what a potential solution may necessitate. In the *Idea Generation* phase, the individual produces novel ideas through combination of existing knowledge. *Idea Evaluation* assesses the novel ideas for their appropriateness as a solution to the given problem.

Creativity researchers aim to enhance the performance of a creative process by formalising protocols [21] called *creativity techniques* which provide step-by-step sequences of actions or instructions to guide the *cognitive process* of an individual. More than 100 creativity techniques have been published [15, 27]; each of them reflects personal experience, popular assumptions or scientific research about the creative process.

In most cases individuals work with others, as part of a formal or informal group to generate ideas. Under these conditions, the creative process of a group is both a *cognitive process* within individual group members and a *social process* as group members interact [8]. The resulting *social phenomena*, like *production blocking* [10], *evaluation apprehension* [11] or *intrinsic motivation* [1] influence the performance of a creativity technique in a face-to-face workshop.

Research has shown that the creative process of a group can be improved by using GSS [22]. A GSS provides means to influence social phenomena which occur in a face-to-face workshop. For example, during the creative process, a group can generate ideas anonymously, which mitigates evaluation apprehension [19]. Ideas will be generated and stored simultaneously, so there is no production blocking [9]. As a result, the group size for ideation can be increased.

To enhance the cognitive process by GSS, researchers focused on the impact of technological aspects on creativity [23] and the cognitive structure behind the creative process [18, 21]. The purpose of this research was to create cognitive models for explaining the effectiveness of existing creativity techniques, and to represent a basis for new techniques and technologies which enhance the creative process.

Today, several studies exist that characterize and classify the large number of existing creativity techniques [14, 24, 27]. For example, VanGundy [27] subdivided creativity techniques into group and individual techniques and characterize them along several dimensions: whether idea generation is *verbal* or *silent*; whether ideas are produced by *forced relationships* or *free association*; and whether the technique employs stimuli that are *related* or *unrelated* to the problem. However, most of the classified creativity techniques are generic, i.e. they are presented in a general form, and it often remains unclear how they need to be implemented with a GSS. We see this as a gap between research and practice. We propose to analyse a large number of well-known creativity techniques and to use the existing cognitive models in order to gain a theoretical understanding of the fundamental cognitive principles. We think that these principles can be used to define concepts that enhance the selection of an appropriate creativity technique and its implementation with a GSS.

2. SIAM: A Cognitive Model for Ideation

Until recently, different cognitive models for the cognitive process [6, 18, 21] have been developed. This paper provides a short overview of the model *Search for Ideas in Associative Memory* (SIAM) [18], which we will use to describe the cognitive principles of the creative process.

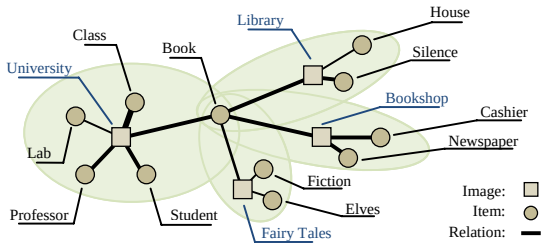

Figure 1. Network of knowledge

Like most cognitive models, SIAM assumes that humans have two memory systems, the *long-term memory* (LTM) and the *working memory* (WM). The LTM is assumed to be the storage area, which is essentially permanent and has unlimited capacity for previous acquired knowledge. Knowledge is stored as a richly interconnected network with numerous levels, categories and associations. This network of knowledge is partitioned into *images*; knowledge structures that group together items of the knowledge according to different principles such as the similarity or typicality of the items. For example, the items *class*, *student*, *professor*, *lab* and *book* may be grouped together into the image called *university*. Images have fuzzy boundaries, may overlap to a considerable degree, and have mutual associations. Thus, an item within an image has links of different strength to other

images that contain related item. For example the item *book* of the image *university* is strongly linked to the images for *library*, *bookshop* and *fairy tales* (see Figure 1). The strength of a link may be due to the frequency of its traversal, or the relatedness among the images that it connects [7]. The WM is assumed to be a temporary storage system which has limited capacity and functions. Humans may use the WM to execute conscious operations, such as rehearsal, recognition and decision making.

2.1. The Ideation Process

Nijstad and Stroebe [18] use SIAM to describe the ideation process as a controlled, associative process that proceeds in two stages. In the first stage the individual activates knowledge in the LTM depending on a search cue. The search cue is generated in the WM by external stimuli that are received through the five senses of the individual. The individual can modify a given search cue by adding previously generated ideas or combining different stimuli. Which image in the LTM will be activated depends on the association between the search cue and the items of the image. An activated image will be temporarily stored in the WM, after which the items and associations of the image will be accessible for the individual.

In the second stage, active knowledge is used to generate ideas by forming new associations or by applying knowledge to a new domain [16]. The individual combines the items of the image with one another or with elements of the search cue. Thus, generated ideas will be semantically related to each other. Over a period of time, the individual will generate more ideas which have already been mentioned. Smith [25] explains this effect with the assumption that a generated idea is strongly associated with the problem, the search cue and the active image from which it is generated. This association will increase the chance that a particular idea is generated again. In this case the individual activates new knowledge by creating a new search cue that can incorporate some of the recently generated ideas. The process will be terminated, if the individual gets the impression that only few additional ideas can be generated.

3. Change of Perspective

The given cognitive model SIAM allows us to answer the question why problem solvers often consider only a small area of the solution space and think primarily within bounded areas of their knowledge networks [13, 16]. SIAM assumes that the individual uses a search cue to activate knowledge in the LTM. Without any external stimuli, the individual will modify the search cue by adding previously generated ideas. Therefore, the active knowledge during the creative process will be semantically related. The likelihood of forming new associations between previously unrelated images decreases. However, creativity research assumes that these unexpected associations between previously unrelated images lead to the formation of creative ideas [16].

Thus, creativity researchers propose using external stimuli as an intervention to lead the individuals to different areas of their knowledge networks. The resulting new perspectives on a given creative task allow the individual to combine items of semantically unrelated images. Therefore, generated ideas will cover larger areas of the possible solution space. We see this intervention as a basic requirement for a creative process and call the resulting cognitive process a *change of perspective* (CoP). This change of perspective helps the individual to leave well-trodden thought paths and overcome occupational blindness (see Figure 2).

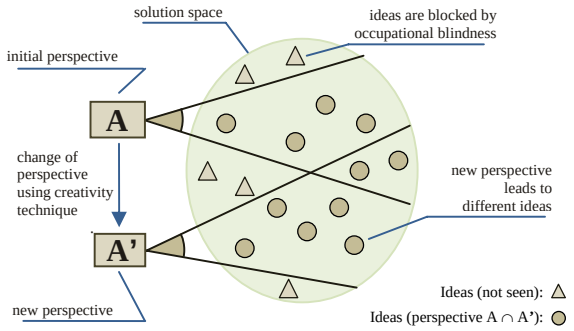

Figure 2. Change of perspective

Most of the common creativity techniques use stimuli as a way to guide the cognitive process. Thus, several approaches exist to generate and use stimuli during the creative process. For example, *Direct-Brainstorming* [21] decomposes the solution space of a given problem and presents a series of stimuli that are derived from the criteria for an effective solution. In contrast, *Greeting Cards* [26] uses random pictures from magazines as stimuli to generate ideas.

In order to gain a theoretical understanding of the different ways how stimuli enhance the cognitive process, we analysed some well-known creativity techniques. The guiding analytical question was: *Which cognitive process is supported by the technique to promote idea generation?*

In the first research phase, we determined the cognitive components of different creativity

techniques. Smith [24] has shown that a creativity technique can be regarded as a combination of the three active ingredients *Strategy* (mental activities of the individual), *Tactic* (tools that support mental activities) and *Enabler* (conditions that support the creative process). With regard to the cognitive process, our research only concentrates on the ingredient *Strategy*. The methodology used in phase one is similar to Smith [24] and focuses on the facilitator instructions and material that excite cognitive activities of the participants. Each of the given facilitator instructions of a creativity technique was analysed with respect to its intended cognitive activity. We focused on the relationship between the creative task, the instruction, the material used as input and the outcome of the intended cognitive activity. For each of the analysed creativity techniques, we formalised abstract cognitive activities and combined them to a sequence of cognitive steps, which we will call a cognitive procedure. These cognitive procedures were subsequently normalised: Recurring cognitive steps were deleted, similar ones were consolidated and new cognitive steps were created. The analysis showed that the resulting cognitive procedures can be clustered into four abstract cognitive principles. On a given creative task, three cognitive principles create a new change of perspective by modifying the task or adding further stimuli. These three changes of perspective are called *Analogy*, *Provocation* and *Random*. In contrast, the fourth cognitive principle *Brainstorming* represents a cognitive process similar to the creativity technique Brainstorming [20] and uses only the given creative task as a stimulus. These four cognitive principles will be explained in more detail with the help of SIAM in the next section.

In the second research phase, 101 creativity techniques [26] were reviewed to determine the completeness of the defined cognitive principles. The researchers analysed and clustered the cognitive procedure of each of the creativity techniques with respect to the defined cognitive principles. The results of this study are reported in Table 1.

3.1. Change of Perspective: Analogy

Analogy searches for similar situations and use the knowledge about these situations to generate ideas for the creative task. To find a similar situation, the individual uses the images of the given creative task and selects characteristic items. These items will be combined with an external stimulus (i.e. facilitator instruction) that requests to search for analogous situation with the same items. The resulting search cues lead to images of analogous situations. For each of these images, the individual can activate knowledge about analogous tasks and how it has been or might be solved there. Resulting ideas will be incorporated into a new search cue with the goal to apply these ideas to the original task.

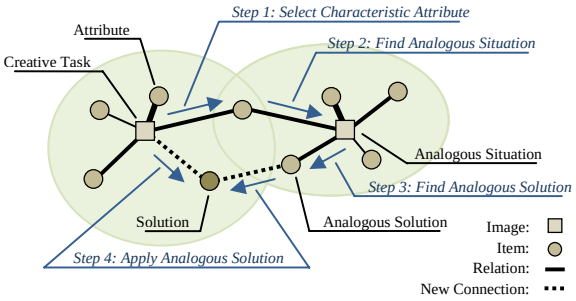

Figure 3. Change of perspective: analogy

The following list describes these steps for an example (compare to Figure 3):

The creative task:
A supermarket wants to provide new services.

1. Select characteristic attribute of the creative task:
   A supermarket displays a large number of items.
2. Find analogous situation with this attribute:
   Another place which displays a large number of items is a museum.
3. Find solution which has been or might be applied there:
   An art gallery displays paintings for the enjoyment of its visitors.
4. Generate ideas by applying these solutions to the creative task:
   Decorate the walls of the supermarket with paintings by local artists or kindergarten children.

We found that 10 of the 101 [26] creativity techniques use *Analogy* to enhance the creative process. The methods which they use to generate the change of perspective can be distinguished in *to use a defined analogous situation* and *to create an analogous situation*. For example *Stereotype* and *Imaginary Mentor* claim to think of how a stereotype or experienced person would solve the creative task. *Bionic Ideas* and *I Like It Like That* analyse the creative task and search for similar principles which they use to generate new ideas.

3.2. Change of Perspective: Provocation

Provocation challenges the assumptions of the creative task to generate a new perspective on the creative task. This will helps the individual to leave well-trodden thought paths and overcome occupational blindness. Like *Analogy*, the individual selects items which describe the creative task. These items will be modified by an external stimulus that requests to challenge the existing relationships between the image and items (i.e. by combining or switching the items).

The individual analyses the resulting situation for consequences or processes and uses them as stimuli to generate ideas for the creative task.

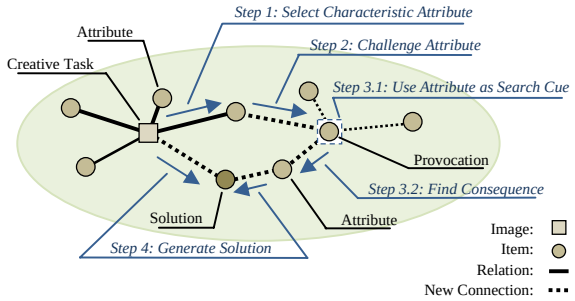

Figure 4. Change of perspective: provocation

The following list describes these steps for an example (compare to Figure 4):

The creative task:
A bank wants to attract new customers.

1. Select characteristic attribute of the creative task:
   A bank keeps money in a vault.
2. Challenge the attribute of the creative task:
   A bank keeps money in the open. (to reverse the situation)
3. Find consequence that results from the new situation:
   If the money is kept in the open, customers can see the money.
4. Generate ideas by using this consequence:
   Place a see-through bank vault door in the centre of the bank.

The analysis has shown that 18 of the 101 creativity techniques [26] use *Provocation* as a change of perspective to enhance the creative process. Checklists were used as stimuli to challenge the creative task (i.e. *Bend It, Shape It* or *SAMM I Am).* A generalized checklist for this modification is represented by the *Osborn's Checklist* [20] that includes the following verbs: *put to other uses*, *adapt*, *modify*, *magnify*, *minify*, *substitute*, *rearrange*, *reverse* and *combine.*

Table 1: Classification of 101 creativity techniques [26] by the change of perspective used

CoP: Analogy

- Copy Cat
- Stereotype
- Switcheroo
- Imaginary Mentor
- Bionic Ideas
- Chain Alike
- I Like It Like That
- What's The Problem?
- Battle Of The Sexes
- It's Not My Job

CoP: Provocation

- Bend It, Shape It
- Get Crazy
- Bi-Wordal
- Circle Of Opportunity
- Combo Chatter
- Ideas In A Box
- Noun Action
- Noun Hounds
- Parts Is Parts
- SAMM I Am
- Exaggerate That
- Tabloid Tales
- What If…?
- Law Breaker
- Problem Reversal
- Turn Around
- Be #1
- Altered States Handout

CoP:Random

- Excerpt Excitation
- Idea Shopping
- A Likely Story
- Picled Brains
- Picture Tickler
- Rorschach Revisionist
- Say What?
- Text Tickler
- Tickler Things
- Mad Scientist
- Preggy Thoughts
- 666
- Word Diamond
- Fairy Tale Time
- Best Of…
- Grab Bag Forced Association
- Rolestorming
- Roll Call
- Sculptures
- Super Hero
- Ballloon, Balloon, Balloon
- Bouncing Ball
- Doodlin' Around The Block
- Greeting Cards
- Post It, Partner!
- Puzzle Pieces

No Change of Perspective:

- Brain Borrow
- Dead Head Deadline
- Idea Diary
- Mental Breakdown
- Music Mania
- Name Change
- Wake-Up Call
- Ideatoons
- Parts Purge
- Brain Mapping
- Doodles
- Essence Of The Problem
- Idea Links
- Lotus Blossom
- Say Cheese
- Sense Making
- Skybridging
- We Have Met The Problem And It Is We
- What Is It
- Blender
- Drawing Room
- Get Real!!!
- Idea Showers
- Modular Brainstorming
- Pass The Hat
- Phillips 66
- Play By Play
- Rice Storm
- Spin The Bottle
- Story Boards
- That's The Ticket!
- Brain Splitter
- Force-Fit Game
- As Easy As 6-3-5
- Brain Purge
- Group Not
- Idea Mixer
- Idea Pool
- Museum Madness
- Organizational Brainstorms
- Out-Of-The-Blue Lightning Bold Cloudbuster
- You're A Card, Andy!
- Your Slip Is Showing
- Brainsketching
- The Name Game
- Pass the Buck
- The Shirt Off Your Back

3.3. Change of Perspective: Random

Random changes the perspective by external stimuli which are unrelated to the creative task. To generate new ideas, the individual combines knowledge about a random element with the items of the creative task. The individual can be supported in focusing on characteristic items by using external stimuli that request to identify context specific attributes of the random element. These attributes can be combined with the items of the creative task to generate ideas.

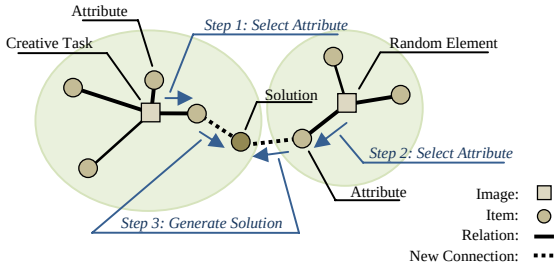

Figure 5. Change of perspective: random

The following list describes these steps for an example (compare to Figure 5):

The creative task:
A university wants to provide a new service.
The random element:
A parrot

1. Select characteristic attribute of the random element:
   A parrot repeats phrases and imitates the human voice.
2. Select characteristic attribute of the creative task:
   A student uses notes from the lecture to learn for a subject.
3. Generate ideas by combining these attributes:
   A university offers audio notes with extended information from the professor.

We found that 26 of the 101 creativity techniques [26] use random elements to create a change of perspective. These random elements can be provided as word (i.e. *Picled Brains*, *Say What* or *Fairy Tale Time*) or physical elements like sculptures or inkblots (i.e. *Sculptures* or *Rorschach Revisionist).*

3.4. No Change of Perspective

We defined a change of perspective as a cognitive process that allows the individuals in covering large areas of their knowledge networks, which they do not cover generally in a creative process. Under this condition, the analysis has shown that 47 of the 101 creativity techniques do not change the perspective to generate ideas at all. Most of these techniques describe a collaboration process that instructs the participants to generate ideas (Figure 6 shows this cognitive process of a participant for generating ideas) and share them to inspire one another (i.e. Brainstorming [20]). But ideas generated by a homogenous group (participants with similar knowledge about the creative task) cannot inspire a change of perspective in this group. Therefore, sharing ideas will activate unrelated knowledge only by accident. In this case, the facilitator has no significant influence on the cognitive process of the participants. As a result participants consider only a small area of the solution space and can not overcome occupational blindness.

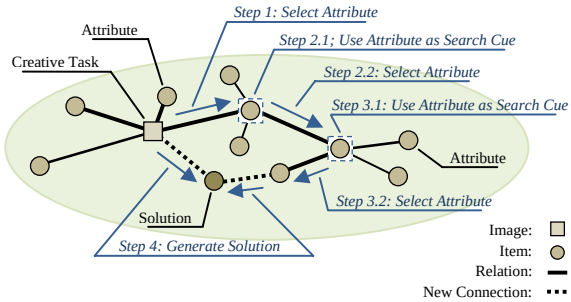

Figure 6. No change of perspective

An explanation for the large number of techniques that do not change the perspective can be given by existing classification frameworks for creativity techniques. One approach is given by Smith [24] who regards a creativity technique as a combination of different ingredients. His classification framework bases on the three active ingredients *Strategy* (mental activities of the individual), *Tactic* (tools that support mental activities) and *Enabler* (conditions that support the creative process). With regard to this framework, most of the analysed techniques use similar mental Strategies (i.e. *to analyse the problem* or *to generate ideas*) and only differ in their Tactic or Enabler. For example, the technique *Idea Pool* [26] instructs the group members to write down ideas on a sheet of paper, to collect them in the center of a table and to use the idea of others to generate new ideas. In contrast, the technique *Museum Madness* [26] defines the procedure to write ideas individually on a sheet of flip-chart paper; walk around and read each other's ideas and to use these ideas as stimuli for new ideas. Therefore, several new creativity techniques can be simply developed by changing the Tactic or the Enabler of existing techniques. However, all of these apparently new techniques used the same cognitive process.

3.5. Summary

Our analysis has shown that many common creativity techniques can be classified by their cognitive processes and the resulting change of perspective. A sequence of formal steps can be used to define the cognitive activities of an individual that lead to a change of the perspective. In order to improve a GSS-based ideation process, we propose to use this formal description to support the facilitator in the selection of an appropriate creativity technique and its implementation with a GSS.

4. ThinkLets: Pattern for Ideation

Our approach for a reliable and effective goal-oriented ideation process with a GSS uses the concept of thinkLets that were developed in Collaboration Engineering (CE). The purpose of CE is to create collaboration processes for recurring high value tasks in companies that can be executed by practitioners without ongoing support by professional facilitators [3]. CE classifies these collaboration processes into the six key patterns of collaboration *Generate*, *Reduce*, *Clarify*, *Organize*, *Evaluate* and *Build Consensus* [2]. Each pattern describes the collaborative activities of a group over a period of time as the group moves from a starting state to some end state [17]. Researchers use this classification to collect, create, document and test the collaboration activities of a group, called thinkLets, which together form a pattern language for group collaboration [3, 4]. Kolfschoten and Santanen describe a thinkLet "as a named, scripted, reusable, and transferable collaborative activity that gives rise to specific known set of patterns of collaboration among people working together toward a goal" [17]. Research has shown, that practitioners that know the specification of a thinkLet can predictably and repeatable engender the pattern of collaboration a given thinkLet is intended for, even without any facilitation expertise [28]. Through this, CE represents an interesting approach to support the efficiency and effectiveness of ideation when using GSS. The thinkLet concept could build a structural principle for the design of reusable collaboration activities based on a change of perspective.

We focus on the thinkLets of the pattern *Generate*, which define collaboration activities that move from fewer to having more concepts in the pool of concepts shared by the group [2]. *Generate thinkLets* can be used to implement different collaboration processes with a GSS, like gathering concepts, structuring concepts or generating ideas. Kolfschoten and Santanen [17] studied the use of Generate thinkLets for the ideation process. They define a specific set of basic Generate thinkLets and use *Modifiers* to impact both the creative processes and their resulting outcomes. The basic Generate thinkLets are *OnePage*, *LeafHopper*, *FreeBrainstorm* and *BranchBuilder*:

ThinkLet: OnePage

1. Allow participants to add in parallel any number of contributions to the list.
2. Allow participants to add only contributions that match the contribution specification.
3. Ensure that participants read the contributions of others for inspiration.

ThinkLet: LeafHopper

1. Allow participants to add in parallel any number of contributions to any category.
2. Allow participants to add only contributions that are relevant to the categories in which they are placed.
3. Allow participants to add only contributions that match the contribution specification.
4. Let participants shift focus from category to category as interest and inspiration dictate.
5. Ensure that participants read the contributions of others for inspiration.

ThinkLet: FreeBrainstorm

1. Allow participants to add one contribution to each page they receive, one at a time, in parallel.
2. Ensure that participants randomly swap pages after each contribution.
3. Allow participants to add only contributions that match the contribution specification.
4. Ensure that participants read the contributions of others for inspiration.

ThinkLet: BranchBuilder

1. Allow participants to add any number of sub-contributions to any heading in parallel.
2. Allow participants to add any number of sub-contributions to sub-contributions in parallel.
3. Allow participants to add only sub-contributions that are relevant to the categories or sub-contribution to which they are placed.
4. Allow participants to add only contributions that match to the contribution specification.
5. Let participants shift focus from heading to heading as interest and inspiration dictate.
6. Ensure that participants read the contributions of others for inspiration.

A *Modifier* is defined "as a repeatable variation to create a predictable change in the pattern of collaboration or the result that a thinkLets produces" [17]. Modifiers alter the described collaboration process of a thinkLet and allow the facilitator to design custom-made Generate thinkLets. Until recently, different Modifiers existed to influence the creative process in different ways. For example, the Modifier *Direction* provides a set of stimuli to guide

the focus of the participants during a Generation thinkLet [17]. *Anonymity* is a Modifier that influences the social phenomenon *evaluation apprehension* and proposes to generate ideas anonymously only during a Generate thinkLet [17]. The cognitive process of the individuals can be influenced by Modifier *Analogy* that proposes to use an analogous situation to generate ideas [17].

We assume that Generate thinkLets and Modifiers can be used to design common creativity techniques like Brainstorming and to influence social phenomena, like Production Blocking [10] or Evaluation Apprehension [11]. However, thinkLets present no detailed description how a participant can construct a change of perspective. Furthermore, it is not clear, whether every possible creativity process can be implemented by the currently known Modifiers. Therefore, we propose to enhance ThinkLets and Modifiers by the concept Change of Perspective.

4.1. Formalising Change of Perspective

A creative group process is a physical process that influences the social and cognitive process of the participants. Generate thinkLets define the basis for a group process that focuses on the social process by a sequence of reusable collaborative activities that move from fewer to having more ideas shared by the group. Modifiers describe concepts that influence the cognitive process (i.e. *Analogy* and *Direction*) or create a situation that supports the creative process (i.e. *Anonymity*). Our research has shown that the change of perspective can be used to cluster the cognitive activities of the participants to only three cognitive principles. We assume that these principles can serve as the basis to influence the cognitive process by a sequence of reusable cognitive activities that allow the individuals in covering large areas of their knowledge networks. The following list presents these three Changes of Perspective and describes the collaboration activities to generate ideas.

Change of Perspective: Analogy

Description: Participants use characteristic attributes to find an analogous situation. Existing solutions for the analogous problem will be collected and applied to the original creative task.

1. Ensure that participants understand the creative task.
2. Ensure that participants understand the change of perspective.
3. Let participants collect a characteristic attribute of the creative task.
4. Let participants collect an analogous situation with the same characteristic attribute.
5. Let participants collect a solution how this task has been or might be solved in this analogous situation.
6. Let participants collect an idea how this solution can be applied to the original task.

Change of Perspective: Provocation

Description: Participants challenge the characteristic attributes to create a new perspective. Resulting consequences or processes for the given situation will be collected and used to generate ideas for the creative task.

1. Ensure that participants understand the creative task.
2. Ensure that participants understand the change of perspective.
3. Let participants collect a characteristic attribute of the creative task.
4. Let participants challenge the characteristic attribute.
5. Let participants collect a positive consequence that results from the new assumption for the given situation.
6. Let participants collect an idea how the positive consequence can be used to solve the creative task.

Change of Perspective: Random

Description: Participants use random elements to create a new perspective. The participants generate ideas by transferring the characteristic attributes of the random element to the given situation.

1. Ensure that participants understand the creative task.
2. Ensure that participants understand the change of perspective.
3. Let participants select a random element.
4. Let participants collect a characteristic attribute of the random element.
5. Let participants collect an idea how the characteristic attribute can be used to solve the creative task.

We also implement a concept for No Change of Perspective to design a creative process without the change of the perspective.

No Change of Perspective

Description: Participants generate ideas by thinking about the creative task.

1. Ensure that participants understand the creative task.
2. Let participants collect an idea how the creative task can be solved.

4.2. Combining Generate ThinkLets and Changes of Perspective

Our design process for an ideation process (shown in Figure 7) combines the cognitive and social activities and uses Modifiers to create a situation that supports the creative process for a specific group setting. In order to demonstrate this design process, we shall focus on the implementation of a creativity technique that uses Analogy as a change of perspective. In this example, the facilitator selects in a first step the change of perspective: *Analogy*, which defines a sequence of reusable cognitive activities. This sequence describes the cognitive activities of each participant but does not

define how these activities can be implemented as a collaboration process. Therefore, the facilitator uses Generate thinkLets to define the collaboration activities for each of the given cognitive activities. In this connection different Generate thinkLets can be combined. For example the thinkLet OnePage can be used to collect characteristic attributes about the creative task (see CoP: Analogy/Step3). These attributes can be used with the thinkLet LeafHopper to collect an analogous situation (see CoP: Analogy/Step4). The facilitator will select Modifiers to design a situation that supports the creative process for the given group situation. For example, the social activities of an inhomogeneous group can lead to *evaluation apprehension*. This apprehension can be reduced by the Modifier *Anonymity* that allows the participants to make contributions in an anonymous form. Other Modifiers refer to the used media during the creative process. The facilitator decides how stimuli will be presented (i.e. as video, image or audio file) or how the participants will contribute their ideas.

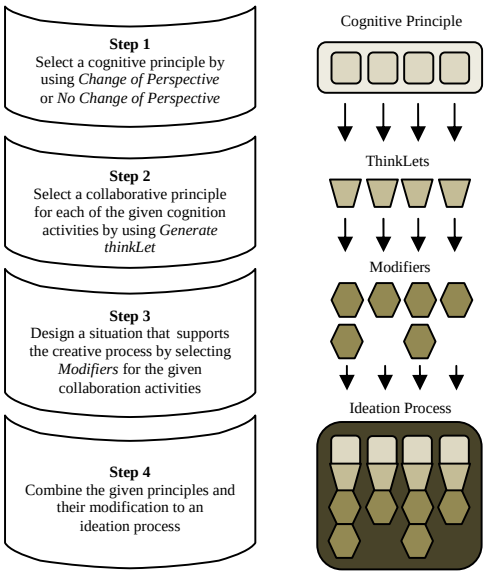

Figure 7. Design process for an Ideation Process

The presented design process allows us to design a custom-made ideation process that fits a specific group setting. The facilitator uses change of perspective to significantly influence the cognitive process of the participants. No change of perspective can be used to design an ideation process that implements common creativity techniques like Brainstorming. The resulting ideation processes define a sequence of reusable collaboration activities which can be implemented with a GSS. These ideation processes simply combine a limited number of formal cognitive and social principles that can be found throughout in most common creativity techniques. A GSS can use change of perspective to classify different ideation processes and guide the facilitator by the design or selection of an appropriate creativity technique. We assume that this will improve the applicability of GSS for ideation.

5. Discussion and Conclusions

This paper introduced the “change of perspective” paradigm as new approach to design and classify creativity techniques. A change of perspective is defined as a cognitive principle that stimulates the ideation process. This is done by supporting individuals in covering large areas of their cognitive network, which they would not use normally in an ideation process. One-hundred-and-one well-known creativity techniques were analysed to gain a theoretical understanding of the different ways how ideation can be stimulated. The analysis showed that there are three cognitive principles which stimulate the individuals by providing a different change of perspective. These changes of perspective are:

- Analogy - to search for similar situations and use the knowledge about these situations to generate ideas
- Provocation - to challenge the assumptions and use the resulting situations to generate ideas
- Random - to use random elements and use the knowledge about these to generate ideas

Creativity research can use these cognitive principles to analyse and compare creativity techniques against their active ingredients. We think that these ingredients can be formalised and combined to new creativity techniques. Furthermore, this formalisation can be used to define guidelines for the selection of an appropriate creativity technique for a given group task or a specific group setting.

In order to improve a GSS-based ideation process, we enhance the given concepts of Generate thinkLets and Modifier by the concept Change of Perspective. Based on the specification of thinkLets we describe the change of perspective by a sequence of reusable cognitive activities. This description is used to develop a design process for custom-made ideation processes. Our research suggests that a basic ideation process can be designed by the combination of cognitive activities (the way how the group generates ideas) with social activities (the way how the group collaborates). This basis ideation process can be adapted to a specific group situation by using Modifiers which influence social phenomena or

stimulate the generation process. In this context, we assume that Changes of Perspective and Generate thinkLets define a limited number of formal cognitive and social principles to design and implement common creativity techniques with a GSS.

Further research is needed to improve ideation with a GSS. Existing creativity techniques need to be analysed against their Modifiers which influence the ideation process. These Modifiers need to be classified and implemented in a GSS. At this stage, the change of perspective is described by formal rules. However, there are no clear guidelines available for the selection of characteristic attributes or the design of facilitation instructions. Therefore, we need to define guidelines and functionalities that support the facilitator in designing, configuring and selecting an appropriate creativity technique. In this manner, we hope to improve the applicability of GSS for ideation processes.

6. References

[1] Amabile, T.M., The Social Psychology of Creativity, Springer-Verlag, New York, 1983.

[2] Briggs, R.O., Kolfschoten, G.L., Vreede, G.J. de, and Dean, D.L., "Defining Key Concepts for Collaboration Engineering", Proceedings of the 12th AMCIS, Garcia I and Trejo R (eds), Acapulco, Mexico, 2006, pp. 121–128.

[3] Briggs, R.O., Vreede, G.J. de, and Nunamaker, J.F. Jr., "Collaboration Engineering with ThinkLets to Pursue Sustained Success with Group Support Systems", Journal of Management Information Systems 19, M.E. Sharpe Inc., Spring 2003, pp. 31-63.

[4] Briggs, R.O., and Vreede, G.J. de, ThinkLets: Building Blocks for Concerted Collaboration, GroupSystems.com, 2003.

[5] Bostrom, R.P., and Nagasundaram, M., "Research in Creativity and GSS", Proceedings of the 31st HICSS, IEEE Computer Society Press, Los Alamitos, Calif. 1998.

[6] Brown, V., Tumeo, M., Larey, T.S., and Paulus, P.B., "Modeling Cognitive Interactions during Group Brainstorming", Small Group Research, 29 (4), SAGE Pub., 1998, pp. 495-526.

[7] Collins, A.M., and Loftus, E.F., "A Spreading-Activation Theory of Semantic Processing", Psychological Review 82 (6), 1975, pp. 407–428.

[8] Dennis, A.R., Aronson, J.E., Heninger, W.G., and Walker II, E.D., "Structuring Time and Task in Electronic Brainstorming", MIS Quarterly 23 (1), MIS Research Center, 1999, pp. 95-108.

[9] Dennis, A.R., and Valacich, J.S., "Computer brainstorms: More heads are better than one". Journal of Applied Psychology 78 (4), 1993, pp. 531-537.

[10] Diehl, M., and Stroebe, W., "Productivity Loss in Idea-Generating Groups: Tracking Down the Blocking Effects", Journal of Personality and Social Psychology 61 (3), American Psychological Association, Washington, Sept. 1991, pp.31-63.

[11] Diehl, M., and Stroebe, W., "Productivity Loss in Brainstorming Groups: Toward the Solution of a Riddle", Journal of Personality and Social Psychology 53, American Psychological Association, 1987, pp. 497-509.

[12] Garfield, M.J., Taylor, N.J., Dennis, A.R., and Satzinger, J.W., "Research Report: Modifying Paradigms—Individual Differences, Creativity Techniques, and Exposure to Ideas in Group Idea Generation", Information Systems Research 12 (3), INFORMS, 2001 pp. 322–333.

[13] Gettys, C.F., Pliske, R.M., Manning, C., and Casey, J.T., "An Evaluation of Human Act Generation Performance", Organizational Behavior and Human Decision Processes 39 (1), Elsevier Inc., 1987, pp. 23-51.

[14] Herring, S.R., Jones, B.R., and Bailey, B.P., "Idea Generation Techniques among Creative Professionals", Proceedings of the 42nd HICSS, IEEE Computer Society Press, Los Alamitos, Calif. 2009.

[15] Higgins, J.M., 101 Creative Problem Solving Techniques: The Handbook of New Ideas for Business. New Management Publishing Company, 1994.

[16] Mednick, S.A., "The Associative Basis of the Creative Process", Psychological Review 69 (3), 1962, pp. 220–232.

[17] Kolfschoten, G.L., and Santanen, E.L., "Reconceptualizing Generate thinkLets: the Role of the Modifier" Proceedings of the 40th HICSS, IEEE Computer Society Press, Los Alamitos, Calif. 2007.

[18] Nijstad, B.A., and Stroebe, W., "How the Group Affects the Mind: A Cognitive Model of Ideation in Groups", Personality and Social Psychology Review 10 (3), SAGE, 2006, pp. 186-213.

[19] Nunamaker, J.F. Jr., Applegate, L.M., and Konsynski, B.R., "Facilitating Group Creativity: Experience with a Group Decision Support System", Journal of Management Information Systems 3, M.E. Sharpe Inc., Spring 1987, pp. 5-19.

[20] Osborn, A.F., Applied Imagination: Principles and Procedures of Creative Thinking. 2nd ed., Scribeners and Sons (eds), New York, 1963.

[21] Santanen, E.L., Briggs, R.O., and Vreede, G.J. de, "Causal Relationships in Creative Problem Solving: Comparing Facilitation Interventions for Ideation", Journal of Management Information Systems 20 (4), M.E. Sharpe Inc., Spring 2004, pp. 167–197.

[22] Santanen, E.L., Briggs, R.O., and Vreede, G.J. de, "The Cognitive Network Model of Creativity: a New Causal Model of Creativity and a New Brainstorming Technique", Proceedings of the 33rd HICSS, IEEE Computer Society Press, Los Alamitos, Calif. 2000.

[23] Shneiderman, B., "Creating Creativity: User Interfaces for Supporting Innovation", ACM Transactions on Computer-Human Interaction 7. ACM, March 2000, pp. 114-138.

[24] Smith, G.F., "Idea-Generation Techniques: A Formulary of Active Ingredients", Journal of Creative Behavior 32 (2), Creative Education Foundation, 1998, pp.107-133.

[25] Smith, S.M.,"The Constraining Effects of Initial Ideas", in Paulus, P.B., Nijstad, B.A., Group Creativity, Innovation through Collaboration", Oxford University Press, NY, 2003, pp.15-31.

[26] VanGundy, A.B., 101 Activities for Teaching Creativity and Problem Solving, Wiley & Sons Inc. San Francisco, 2005.

[27] VanGundy, A.B., Techniques of Structured Problem Solving (2nd ed.), Van Nostrant Reinhold, NewYork, 1988.

[28] Vreede, G.J. de, and Briggs, R.O., "Collaboration Engineering: Designing Repeatable Processes for High-Value Collaborative Tasks", Proceedings of the 38th HICSS, IEEE Computer Society Press, Los Alamitos, Calif. 2005.

[29] Wallas, G., The Art of Thought, Harcourt, Brace & World, New York, 1926.

[30] Warr, A., and O'Neill, E. "Understanding Design as a Social Creative Process", Proceedings of the 5th conference on Creativity & Cognition, ACM, New York, 2005.