Can synectics help to solve real world problems?

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Abstract

This research paper focuses on synectics, which is an innovation method developed by George Prince and Bill Gordon. Guided by a consistent ten-step plan participants will be enabled to address a problem from various viewpoints. The basis for synectics in this paper is the A⁴ innovation process, which is grounded on analogical thinking. We will show that analogies take a great part in the innovativeness.

To test the method we conducted a workshop at Zeppelin University in a class for innovation named “Knowledge Management”. The participants were asked to apply the method of synectics to a real world problem. Our findings fall in line with other researchers and prove that groups need to be preselected carefully as well as a very clear definition of the initial problem is required, which leads us to limitations and suggestions for further research.
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Fig. 1 A^4-Innovation Process for New Product Innovation by Analogical Thinking
1. Introduction

This paper examines the innovation method of synectics, which was developed by George Prince and Bill Gordon (Gordon, 1961). Before giving a detailed description of synectics, this paper will introduce the A^4-innovation process, which is used if a solution shall be found by applying a creativity method (Gassmann & Zeschky, 2008). This process can also be seen as the cornerstone of synectics, as the A^4 process came out of analogical thinking, which itself is a key part of synectics.

The method of synectics was designed to give everybody a procedure that, if followed, will enhance the outcome (Prince, 1968). Therefore, it is also called a “creative problem solving technique” (Nolan, 2003, p. 24). Synectics is accomplished in a one at a time guideline with ten defined steps to be handled along the chronological order and “follows a formal procedure” (Schild, Herstatt, & Lüthje, 2004, p. 4). The steps cover the whole process from the definition of the problem to creating specific solutions. Hence it provides a “set of process tools which can be used successfully in a variety of situations.” (Nolan, 2003, p. 24). To maximize the innovative solutions that can be presented at the end, synectics uses various different methods such as analysis, model-seeking or analogy (Prince, 1968).

First published in the 1960s synectics is of constantly growing importance as “many organizations have established synectics groups for problem solving.” (Highsmith, 1978, p. 24) But what accounts for this success? Can it help to solve a real world problem?

In order to answer this question, we conducted a case study in which students applied synectics to find a solution for a major problem. They were asked to use the synectics method to work with analogies as given by the method of Prince and Gordon. The results were collected via distributed answer sheets and also presented by the leader of each group. Therefore, we could not only gather the results the students came up with but also got a deeper understanding of possible upcoming problems while using synectics.

This practical experience will be used to give an evaluation of the method of synectics and to work out if it can work in a mixed team like a class constitutes. These findings will underline managerial implications that result
out of the synectics method and in the conclusion the method will be evaluated if it was applicable for the given problem and limitations will be named.

2. Theory

2.1 Analogical Thinking and the A⁴ Process

The A⁴-process is based on analogical thinking, which can be described as a “creative method for a problem that needs a solution” (Gassmann & Zeschky, 2008, p. 98) in which information from existing contexts is transferred and used to construct new ideas (Dahl & Moreau, 2002). Thereby it not only features a degree of structure but also offers some alteration (Gentner, Brem, Ferguson, Philip, Markman, & Forbus, 1997). One example of analogical thinking is - introduced by Gassmann and Zeschky (2008) - the BMW Group, which used the joystick of the gaming industry as a pattern for a new control device for their car entertainment system. Especially when analogical thinking is applied across industries it can help to find highly novel innovations because of a higher innovation potential based on distant pieces of knowledge (Gassmann & Zeschky, 2008; Hargadon & Sutton, 1997). Furthermore, since it worked in a similar environment, analogical thinking enables a reduction of uncertainty (Gassmann & Zeschky, 2008). An important condition for the finding of these analogies is a given similarity between the problem source and the solution source (Ibid.). Following Dahl and Moreau (2002), analogies have to be differentiated between far or structural and near or surface analogies.

By analyzing four practical cases of firms from Switzerland with mainly technological problems, which used the approach of analogical thinking to come to solutions, Gassmann and Zeschky (2008) developed the systematic A⁴-innovation process. This process consists of the phases Abstraction, Analogy, Assessment, Adaption and the upstream phase strategic intent. The strategic intent as a foundation takes a crucial part in the success of a new product innovation by analogical thinking. Since especially the sole identification of analogies is not enough firms need a strategic intent, which is
the will to adapt new knowledge and to question own technologies (Gassmann & Zeschky, 2008; Herrmann, Gassmann, & Eisert, 2007). The next phase is the Abstraction, which is the analysis of technical functions, the customer benefits of the product and the problem context. A combined analysis of these functions lead to a higher degree of abstraction from the problem and an increasing number of structural elements can be identified (Gassmann & Zeschky, 2008). This enables to identify underlying mechanisms to look beyond superficial similarities (Ibid.). As a result the solution space is opened up and the use of cognitive abilities is enabled and increased (Gassmann & Zeschky, 2008). Following Ward (2004) a good problem formulation based on the abstraction is very important for the success of innovations (Ward, 2004; Gassmann & Zeschky, 2008).

After structuring and formulating the problem the next phase of the A⁴-process is the Analogy, which consist of the search of surface and structural similarities (Gassmann & Zeschky, 2008). Thereby different industries as well as technologies are looked at (Ibid.). Whereas the first two main phases are in the creativity & divergence sphere the following two phases concentrates on the rigidity and convergence of solutions. Before the founded possible solutions can be transferred they have to be assessed. The phase assessment consists of a deep analyzing and understanding and a subsequent filtering and evaluating of the target source (Ibid.).

The last step is the transfer of the knowledge technology and its adaption. The results of Gassmann and Zeschky (2008) show that a certain adaption to the original problem is necessary (Ibid.). Following Cummings and Teng (2003) the articulability and embeddedness of knowledge is most critical for the transferability (Cummings & Teng, 2003).
Fig. 1 A4-Innovation Process for New Product Innovation by Analogical Thinking (Gassmann & Zeschky, 2008, S. 104)

This process is the basis for the synectics method, the method we also used in the workshop at Zeppelin University. It enables us to understand how we can use creativity methods and analogical thinking.

2.2 Synectics

George Prince and Bill Gordon invented the synectics method. It integrates multiple individuals together to form a group, which can extract the problem out of the circumstances and later on provides possible solutions (Gordon, 1961) and is “designed to provide (each) individual with a repeatable procedure which will increase the probability of his success and hasten his arrival at an innovative solution. The process is described as one which involves analysis, generalization, and model-seeking or analogy.” (Prince, 1968, p. 1).

As a creativity tool fostering abstracting from the original problem and finding analogies it can be used within the A⁴-process phases “Abstraction” and “Analogy”. To get a better understanding of how the method can be used, the following paragraph will describe the concept of synectics in more detail.

The Ten Steps of Synectics:

At the beginning, it is important to understand and define the expectations of the owner’s problem. The owner could be a company, organization or just any person who needs a solution. During the synectics session there is a group leader who is responsible to bring the results together and guide the small group (6 to 10 participants).
1. **Definition of the problem**: The owner explains his problem to the group, which is then discussing and identifying crucial parts together to define the problem (Highsmith, 1978).

2. **Spontaneous ideas**: The second step is comparable to brainstorming. The group will look for spontaneous ideas, which are written down by the group leader (Gobble, 2014).

3. **Re-define the problem**: Each member of the group is asked to re-define the problem by themselves. Therefore, every participant can address the problem from his/her point of view and understand it in the own perspective. Later on, each finding is presented and the best re-definition is chosen to further work on (Highsmith, 1978).

4. **Finding direct analogies**: For this step the participants need to think outside the box. They should leave the problem behind and come up with direct analogies that could be applied to the problem. This enlarges creativity and lets the participants think differently and divagate of the problem. In the end of this step, they have to choose the best analogy they found which shall stimulate the participants and should also fit for the next step (Gick & Holyoak, 1980; Schild, Herstatt, & Lüthje, 2004).

5. **Personal analogies**: The leader invites the group to “be” the analogy, to “be” the object/thing. They describe what they feel being inside this object or even the object themselves. To do that, the leader will ask each of the group members “How did you feel as…” and write down all the answers (Schild, Herstatt, & Lüthje, 2004).

6. **Symbolic analogies**: This step uses objective and personal images. Participants think of symbols or objects, which are representing an analogy to solve the original problem (Schild, Herstatt, & Lüthje, 2004).

7. **Fantastic analogies**: The participants address the problem from any dimension they like. This step can come up with very abstract or visionary results but there are no limitations. This step bears the most desirable solutions, which may be impossible to implement but which may lead to some further practical ideas (Schild, Herstatt, & Lüthje, 2004).

8. **Discussion and description of analogies**: The group should discuss and analyze the analogies defined earlier. They should end up with a list
of the most important characteristics, functionalities, personal feelings etc. (Schild, Herstatt, & Lüthje, 2004).

9. Connect analogies to original problem: The group leader has to try to solve the problem with help of the team, using the developed list from step eight. The focus should be always the original problem coming from the owner (Dahl & Moreau, 2002).

10. Create specific solutions to solve the problem: The last step is conducted to draw specific solutions out of the ideas that have been developed earlier. The group presents all the developed ideas and possible solutions to the owner who then chooses the best fit according to his needs (Highsmith, 1978).

3. Implementation of Synectics

We conducted a workshop with the participants of the Knowledge Management seminar of Prof. Dr. Enkel at Zeppelin University. Before starting the workshop, the students have been provided with the same information about synectics and the context that was given before in this paper.

The workshop was designed to apply the method of synectics to a given real-world problem: the pollution of the Ganges River in India. The results of the workshop are used to show how synectics could be successfully applied, to show whether the workshop generated useful results and what possible limitations synectics includes.

As explained in the previous chapter, synectics is a ten-step creativity method that stimulates unaware-thought processes through a metaphorical process (Gordon, 1961). In order to ensure a practical and profound workshop we summarized the ten steps into three categories:

1. Definition and first ideas (step one to three)
2. Analogies (step four to seven)
3. Discussion and voting (step eight to ten).

First we gave the participants the definition of the problem so that they could already think about some first ideas how they would solve the problem. Afterwards we presented a short video sequence that summarized the most
important facts of the case and redefined the case to its concrete problem structure.

The task of the workshop was based on the unsolved problem of the pollution of the Ganges River in India. The Ganges is one of the most polluted rivers in the world but it also serves as the water supply for 400 million people (Buncombe, 2010). The holy river is 2500 km long and the Indian population uses it for various functions like bathing, religious customs and transportation. Also farmers living next to the river need clean water for watering their fields and animals in order to provide food for their families (BBC, 2016). Thus the river is enormously essential for the Indians based on religious and natural reasons. However the river is heavily polluted with a toxic mixture of sewage, industrial waste and private trash. One possible reason for this pollution can be found in the leather industry. Located close to the river, due to the need for a good water supply, these companies pass the dirty and toxic water back into the river after their production process (IJzermans, 2007). This alone causes 30 million liters of toxic water every day (Mukherjee, 2013). As the Indian government was not able to adopt a law that prohibits the illegal waste tipping in the last years the pollution of the river has been forged ahead to an unacceptable level (Singh, 2001).

As the technology is constantly improving and digitalization proceeds, the water quality can now be measured with sensors that give information about the degree and the kind of pollution in the water. This information can be used to tackle the problem of the pollution and to find innovative ideas to clean large amounts of water effectively. As the digitalization and the methods how to solve unconventional problems improved over the last years, the unsolved problem with the pollution of Ganges serves as a perfect example how to apply the synectics process in order to find innovative solutions.

As many Indian government officials failed to solve the pollution of the river and the problem urgently needs to be solved, we wanted the participants to feel like a panel of consultants that supports the government with finding innovative solutions. The research question for the workshop participants therefore was to find out how the Indian government could solve the problem with taking into account all stakeholders who depend on the river. The given
time limit of the workshop was thirty minutes. In order to meet this requirement we directly started to work on finding analogies (step four) after the topic was introduced.

The task therefore was to use the synectics process to find analogies and come up with possible solutions to the given problem. After finding the analogies the different groups had to discuss and vote for the best possible combination of analogies and the best final solution to the problem. As the number of participants was too large to work in a single group we split the participants up into four groups. Each group had to determine a group speaker for the later discussion and the voting of the group’s different analogies. To record the findings of each group we distributed sheets to fill out and collected them after the time had expired. According to the synectics process procedure the groups had to start with finding direct analogies. The results have been varying across the whole spectrum of possible ideas as each group came up with highly diverse results.

Some of the direct analogies were ideas such as the garbage collection in cities, gills of a fish, cleaning of water trough chlorine like in swimming pools, a save all to collect trash flowing down the river or plants who serve as a natural filter system. To follow the procedure of synectics the next step was to identify personal analogies. Some of the participants had the idea to put themselves into the situation of a fish that is suffering from the pollution in the river. They came up with the analogy of the so-called sabre-toothed blenny, a fish that is able to eat plastic garbage and digest it into compost. While evaluation the personal analogies it became obvious that especially this step had been quite challenging for the participants.

After having done half of the ten synectics steps already, step six dealt with the symbolic analogies. This turned out to be the most difficult part as various rounds of explanations and examples have been necessary to give the students a clear idea of what they have to do in this step. Nonetheless, after some starting problems the results were again very broad ranged and inspiring. The most useful analogies were the vacuum cleaner, the toilet flush and the leaf vacuum cleaner. The last step of the analogies category was to find the fantastic analogies, which have been most appreciated by the students and which gave the most appropriate ideas. The participants came
up with the fantastic idea that Moses could come up and that he could divide the Ganges River into clean water and separate the trash. Another interesting fantastic idea was the invention of self-recycling trash. Some findings were a bit too fantastic and therefore led us to the conclusion that the synectics process also has its limitations that have to be mentioned and discussed in the last part of this paper.

Due to the lack of time the workshop participants were not able to completely follow all steps of the synectics process in detail and could not combine their different analogies to a viable solution. But nonetheless we were able to discuss the pros and contras of their selected analogies with the group leaders. Every group leader had some minutes to describe their findings and to illustrate how they came up with the analogies and how they would draw a possible solution out of them.

It turned out that the most viable solution could be to implement a sabre-toothed blenny into the river that cleans the polluted water on its own. All in all the workshop was very successful and the participants founded it inspiring to think about a solution to a problem which cannot be solved with a basic simple approach. Nevertheless, there were also some problems and limitations showing up during the conduction of the synectics method which will be discussed in the following chapters.

4. Managerial implications

The results of the workshop as well as existing experiences of many scholars show that the method of synectics is enhancing innovativeness and creativity of teams. Nonetheless, the teams need to be preselected carefully as the workshop showed. Managers need to define the requested outcome of the work effort and select the teams accordingly because “synectics […] relies on the knowledge and ideas of the participants” (Schild, Herstatt, & Lüthje, 2004, p. 4). Additionally, participants need to have enough time working on the case. If the deadline is set too short this will decrease creativity. Besides, they need to make sure to communicate clearly about the objective the teams are set up and the teams need a supervisor as a reference person. If this is not provided, outcomes may divagate from the needs as the
method of synectics has many paths that can easily lead to a significant change of the topic or issue.

5. Limitations and further research
While heterogeneous teams, consisting out of people with completely different social and academic backgrounds, are favorable for cross-industry innovation approaches the synectics process requires specialized experts in the field of the problem area. Unfortunately the participants of the workshop were no experts in the field of pollution and even more important no experts in the field of cleaning. This hindered the groups to develop technical or biological solutions that are feasible to implement. None of the participants knew to which degree their analogies and solutions required technological improvements and new inventions and research in biology to make the solution realizable. Especially the fantastic analogies are a good way to find complete new concepts, to deal with a given problem and to look across different industries. But if the group members are no experts in this field it is nearly impossible to evaluate if this analogy could lead to a feasible solution.

Despite the fact that the synectics process needs a lot of time and cannot be conducted in-depth in a 30 minutes workshop it also forces you to have participants who are experts in the selected topic. Therefore for future research it could be interesting to have a closer look at the synectics process and to look whether the method could be improved and adjusted in some parts. It could be investigated whether the synectics process could be divided in two phases.

The future research could focus on the investigation of whether the synectics process could be conducted by a heterogeneous group at first, but afterwards, in a second new developed phase, could be finalized by a group of experts. The heterogeneous group could be responsible for finding innovative analogies, due to their various backgrounds, and the group of experts in the second phase then could proof whether the founded analogies could lead to a technically feasible solution. Although there has been done a lot of research in the fields of analogical thinking and although Gordon invented the synectics process in the 1960’s, there is still much room for further research and improvements.
Literature


Affidavit

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Friedrichshafen, 10.05.2016