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The Discipline of Thinking

in Creative Processes

Byrge, Christian

Publication date:
2006

Document Version
Publisher's PDF, also known as Version of record

Link to publication from Aalborg University

Citation for published version (APA):
Byrge, C. (2006). *The Discipline of Thinking: in Creative Processes*. Centre for Comparative Welfare Studies, Institut for Økonomi, Politik og Forvaltning, Aalborg Universitet.

Title Page

Olav Jull Sørensen _____   Supervisor

Christian Byrge _____   Student

August 2006_____   Time of hand-in

Master Thesis

Title:

The Discipline of Thinking

- in Creative Processes

Master of Science in

Innovation, Knowledge and Entrepreneurial Dynamics

Aalborg University, Denmark

Business Faculty

ABSTRACT

The purpose of this project is to identify the role of the discipline of thinking in creative processes. The problem formulation is: "How and why is the discipline of thinking is central to the idea generation in a creative process?". The project identified creativity as a professional skill that can be taught by anyone through practice and training. Three approaches for creative processes has been analysed regarding the discipline of thinking; TRIZ, Lateral Thinking Creative Thinking. These approaches are representative for the majority of the creative approaches useable for creative processes. From this it has been found that the discipline of thinking is central to the idea generation in a creative process. This is because the ideas are to be found in the knowledge (memory, experience etc) of the participant(s) of the creative process. The ideas are found throughout a structured and systematic process of activating the knowledge and searching for principles and methods to develop ideas for problem solution. The knowledge relevant to a creative process seems to be what is not directly related to the problem of the process, as it is alternative principles and methods that are important for the idea generation. The essential elements of the creative process are the perceptional change and the braking of pattern thinking. These elements are controlled in the discipline of thinking through the use of stimuli. Also knowledge management seem to have an important effect on the creative process through the discipline of thinking.

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1. INTRODUCTION

1.1. Background

The field of creativity is vaguely defined for the common people and it lacks recognition in many of the functions were it can have positive effects. Most universities do not consider it as a field of study and they only use creativity as a function for making classes, projects, studies and likewise "more interesting". The industries use the concept of creativity as a buzzword for attracting employees, customers and capital. However, it is rarely used in a structured way for performing useful functions.[1]

People in general are also lacking in understanding of the concept of creativity. People who do not work within the field of creativity often find the term very confusing. They tend to perceive creativity as a gift for only a few people. In general there is a perception that creativity is something that you are born with. Most do not believe that it can be taught and learned.[2] A lot of people do not bother to work with creativity because they do not believe it is more than a fancy term without any concept behind – like a façade of a beautiful castle with only a shed behind.

The people working within the field of creativity have knowledge of the philosophy, the model, the techniques, the theory and the use of the particular approach they have learned. Most likely they have only learned one approach and have very limited knowledge of others.[3] This is because the different approaches do not collaborate and/or are in conflict to each other and thus in competition. The problem is that most approaches are only known by relatively few people, but wanted by many. Therefore some of the approaches are commercialised for profit maximisation. The commercialisation is based on copyright protection. For example, the three most used approaches are all protected by strong copyrights: Lateral Thinking, Synectics and TRIZ. To become a certified trainer using these approaches to creativity it is necessary to get it at the respective institutions that offer these, which therefore is highly expensive. Therefore it is difficult for people working in this field to get a broad, trans-

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[1] Dingli (2005)
[2] Schweizer (2006)
[3] Dingli (2005)

approach perspective. This makes it difficult to create a comprehensive view on the field of creativity, thus making it difficult to understand the general mechanisms behind creative processes. This is also intensified with the fact that many of the creative approaches are developed from practical experiences and not from academic research.

Before my study of creativity, I too believed that creativity is only for the few and gifted. Then I studied the Lateral Thinking approach for half a year and I went strongly biased, since this was *the* approach for me. Knowing this approach gave me an understanding of how creative processes can be managed and therefore how to manage an idea generation process. This was without fully understanding the mechanisms behind this approach and therefore also without understanding the mechanisms behind creativity in general.

The study of the Lateral Thinking approach feed me a need to understand the mechanisms behind this model and these techniques that I learned to use. Especially when I saw Lateral Thinking working in real creative processes, my search for understanding took off. Preceding this search after finishing my studies of Lateral Thinking forced me to go into other approaches. O learned to practice and understand a number of various different approaches. This search gave me a much more advanced insight into the understanding of creative processes, than I ever had from the Lateral Thinking approach. I found that all models and techniques for creative processes seemed to have the one and same purpose: to affect the thinking of the participant(s) of the creative process. Since this was done very structured and highly efficient, I termed the activities in the creative process as the discipline of thinking.

1.2 The problem formulation

Numerous studies have compared the different creative approaches thus trying to find a "best practice".[4,5,6] These studies have not succeeded in finding a best practice. Instead they find that certain approaches might be better for certain situations. The point of selecting one approach as the "winner" looses its purpose if it is possible to identify the mechanisms behind the approaches, eventually focusing in developing these for better processes. Therefore it is irrelevant to choose the "winner" if it is possibility to find the

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[4] McPherson (1968)
[5] http://www.zideas.com
[6] Parnes (2000)

"magic formula" behind them. It is not the point of this project to find a best practice or explicit to do a comparison of the creative approaches. Instead it is to identify, from the creative approaches, a foundation on which they are built on. In other words; The approaches can be perceived as different kinds of energy drinks, which all have a positive effect. The energy drinks works as they are. However, There are one or more ingredients that give the energy effect. It is most interesting if this ingredient can be found. The hypothesis of this project is that the core essence of creativity is the discipline of thinking.

Understanding the mechanisms behind the approaches will make creativity independent of the specific approaches that exist today. Hereby it will be possible for common people and normal companies to understand and make use of effective creative processes.

The problem formulation for this project is:
How and why is the discipline of thinking central to the idea generation in a creative process?

The point of departure is to understand the field of creativity, and therefore the first sub question to direct the project is:
What is creativity with focus on the creative process?

The base for understanding and discussing the discipline of thinking will be on the approaches of creativity, therefore the second sub question is:
How do the approaches of creativity practice the discipline of thinking?

The last sub question will discuss how the discipline of thinking is involved in the idea generation of the creative process, therefore the last sub question is:
Why does the discipline of thinking affect the creative process in idea generation?

It is intended that this project identify the relation between creative processes and the discipline of thinking especially with focus on the idea generation. The project will not discuss whether the discipline of thinking is the only element of importance ("magic

ingredient") of creative processes. Therefore it is important to take into account that there might be more elements of importance, which are not covered in this project.

1.3 Terminology of five dimensions for analysis

An analysis of the approaches is essential for this project in order to understand and identify how the discipline of thinking is practiced in the approaches. The approaches are lacking academic structure, as they are primarily used for commercialisation. This makes a need for a systematically analysis of the approaches. Given this condition, the project has developed a structure relevant to the problem of the project. Mance has developed a structure for creative analysis. Pelletier has made a similar structure. However, these structures for analysis are limited to a structural analysis of the approaches, while this project need to cover all the dimensions of an approach in order to identify how the discipline of thinking is practices in any part of this approach. The approaches for creative processes are analysed on five dimensions in the analysis. This structure has been created especially with inspiration from Gonzales[7]. These dimensions are the dimension of the philosophy, dimension of the theory, dimension of the model, the dimension of the techniques as well as the dimension of the use of the approach. Using these five dimensions provides a holistic view of the approaches, as well as given understanding of the specifics of the use and techniques of the approaches. In total the five dimensions makes it possible to identify the practicing of the discipline of thinking both on the abstract level and on the specific level.

The philosophy and the theory provide the holistic understanding of the approaches:

The *philosophy* provides the background behind the approach as well as the rationale of it. It is the set of thoughts that the approach is based on. Hereby the beliefs, the assumptions and the motivations of the approach will become visible for gaining an overview of the approach.

The *theory* provides the connection between the model, the techniques and the philosophy. It will create the understanding necessary to see why the model and techniques are the way they are. This is essential for getting the "whole" picture of the approach. It explains the know-why!

The model, the techniques and the use provide a practical understanding of the specific of the approaches.

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[7] Gonzales (2001)

The *model* provides an understanding of how to use the theory on a specific problem or in a specific situation. It is the architecture of the theory. The ingredients of the model will explain the components necessary to the process as well as the stages that are needed to go through. It is an explanation of the "way of doing it". This explains the know-how!

The *techniques* are for use as part of the model, however are separated out in the explanation, because they function independently also. While the model is the engine of the approach, the techniques are the fuel for it to run.

The *use* is an understanding of the practical use of the approach. It explains the need for special requirements, under which circumstances it works, and how roles should be divided and maintained. It also discusses elements as training, learning and procedures.

1.4 The three approaches chosen

There are more than 250 creative approaches in the field of creativity.[8] However, most of them are overlapping and some are not being continuously developed. Only a minor part of the creative approaches are designed for use in creative processes. This project focuses on a representative selection of the approaches that are usable in creative processes. Three approaches are selected, which in sum are representative for the majority and the most important creative approaches. The choice of the three approaches for the analysis of this project is based on discussions and presentations of relevance.[9,10,11,12,13] The most important criteria for the selection of the approaches was the representative function, so that the project gain relevance for the entire field of creativity. Of relevance to the selection where also the following points:

- The author of this project has extensive knowledge of the Lateral Thinking approach. During one semester of study at the "Institute for the Design and Development of Thinking" in Malta, it is possible to add specialised knowledge of this approach to the project. The Lateral Thinking gives an approach that is not focused around a specific model. It is rather a way of thinking that is optimal for creative processes, but it does contain both a model and techniques for

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[8] Silverstein et al (2001)
[9] Hansen (2006)
[10] Dingli (2005)
[11] Schweizer (2006)
[12] Schweizer (2006-B)
[13] Gruszczynski (2006)

supporting this thinking. Therefore it is a highly cognitive approach. The Lateral Thinking approach also provides a huge amount of literature on creative processes, which is rare in the field of creativity. The Lateral Thinking approach is found to be one of the most utilised approaches amongst practitioners and educators.[14] Also it has been found as the foundation for most other approaches for creative processes.[15] This is important to this project as it hereby has a high representative status of the majority of the approaches.

- The TRIZ approach is chosen because it is very distinct in its structure and philosophy. It does not have a foundation of a psychological background, but instead have a foundation on a patent system. TRIZ has been considered as the most effective approach for creative processes[16,17,18]. However, it is also the most complex approach and therefore is limited in diffusion around the world.[19] The TRIZ originate from Russia (1940'es) and has only been introduced to the western world in relation to the fall of the Soviet Union, which makes it very young in compared to e.g. the Lateral Thinking in these countries.[20] This approach adds to the project by its distinctive nature and the creative structuring that is close to the extreme.

- The Creative Platform is the approach practiced at the Creative Lab at Aalborg University. It has been chosen primarily for two reasons: representativity and practical experience. This approach is developed from a mix of various approaches reaching from CPS, Synectics, Tantra Yoga to more artistic approaches.[21] Therefore this approach adds to this project with a huge variety of elements from a lot of different approaches, thus representing a majority of creative approaches. It combines a model of "freeing" the mind and a model of idea generation into the creative process.[22] This also makes this approach unique in relation to both TRIZ and Lateral Thinking. Therefore it also adds a new perspective into the project. The author of the project has had extensive practical

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[14] Gonzales (2001)
[15] Schweizer (2006)
[16] Zlotin & Zusman (1999)
[17] Zlotin & Zusman (2000)
[18] Darrell Mann (2001)
[19] Schweizer (2006-B)
[20] Silverstein et al (2001)
[21] Hansen (2006)
[22] Hansen (2006-B)

experience in the educational part of this approach as well as taking the role as a facilitator in creative processes using the Creative Platform. This practical experience to the understanding of the mechanisms behind the models and techniques. Therefore the involvement of this approach adds more than just an approach. It also provides deeper understanding of creative processes in general. The involvement of the Creative Platform in the analysis of this project is especially interesting, as this approach has a very limited academic foundation. Today only little literature exists and only limited research has been conducted on this approach. Therefore this project might be part of the academic foundation for the rationale of this approach.

The combination of the approaches chosen for this project make up a sum that is representative to the field of creativity with focus on creative processes as well as adds interesting and comprehensive elements to the analysis.
The three approaches chosen are essential to the project directly because the discipline of thinking have been identified in all of then. This identification shows differentiation in the use of the discipline of thinking in each of the approaches. Therefore it is possible to discuss the discipline of thinking in more academic terms, since more perspectives can be taken into account.

1.5 Structure of this project

The first part of the project (this part) gives the rationale for the project, an introduction to the project as well as the methodology for the research conducted in relation to this project.
The second part of this project gives an overview of the field of creativity. This will primarily be done through a discussion of the various definitions as well as misconceptions of creativity. The discussion will have focus on creative processes
The third part of this project goes into detail about the three approaches under study. Each approach will be discussed in the structure of the 5 dimensions. These dimensions will be the philosophical background behind the approach, the overall model in the approach, the theory that connects the philosophy with the model, and the techniques that make the foundation for the creative process as well as the use of the approach. This part will identify how the three approaches practice the discipline of thinking.

The forth part of this project develops the discipline of thinking from the three approaches. It also discusses the affects of the discipline of thinking to the generation of ideas in a creative process. This part will make relations to the three approaches.

The fifth part will conclude on the findings in this project, while the sixth part will reflect on the findings of the project.

1.6 Research Design

Grounded Theory has been chosen as the main research design for this project. However, for some parts of the research, elements of other methodologies have been incorporated. The Grounded Theory has been chosen primarily due to the purpose of developing new understanding of creative processes in particular about the idea generation.[23] This methodology is especially relevant for the development of new theory or new understanding.

The Grounded Theory belongs to the group of designs under social constructivism.[24] The fact that it allows for the existence of multiple realities gives room for finding hidden and conflicting triggers that otherwise might have been perceived as nonsense. One of the more interesting, but also dangerous elements of the Grounded Theory is that the researcher has huge influence on the field under study.[25] The involvement makes it possible to understand what otherwise might have been foregone. However, this has to be done cautiously, as the research should not reflect the knowledge of the researcher, but rather show what is "out there".

The Grounded Theory refers to theory that is developed inductively from a corpus of data.[26] This is that the theory is developed from a set of data. An analysis of the data constructs the theory. The inductive approach for the Grounded Theory is to create nomotetic understanding.

Grounded Theory has a case-oriented perspective. A case-oriented perspective tends to assume that variables interact in complex ways. Therefore the focus is on the understanding of the variables in the case. The Grounded Theory has a comparative

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[23] Glaser (1994)
[24] Glaser (1994)
[25] Glaser (1994)
[26] Borgatti (2001)

orientation. Cases that have a similar outcome are examined to see which conditions they all have in common, thereby revealing necessary causes.[27]

The Grounded Theory approach consists of a set of steps that is thought to guarantee a good theory. Strauss finds "that the quality of a theory can be evaluated by the process by which a theory is constructed."[28] This makes the process essential to the validity of the research.

The core method of Grounded Theory is coding of a textual database. The focus is on the discovering of something new in the context of either something old or something new. The coding consists of three methods: open coding, axial coding and selective coding. In relation to the coding is the making of memos and notes. This is especially important for the process of coding for interviews and involvement. The involvement is central for gaining information for the analysis in Grounded Theory. It is especially two kinds of involvement that are used in Grounded Theory: observation and participation, however, other kinds can also be used. The important thing is to be close the subject under study.

The Grounded Theory is using a combination of a concrete level and an abstract level for creating understanding. The concrete level in Grounded Theory consists of subjectivism, relational structures and the phenomenal meaning, while the abstract level consists of concepts, theories and models.[29]

The Grounded Theory is not a problem-oriented methodology.[30] This is due to its highly explorative nature. However, it can be turned into a problem-oriented methodology by making a strong focus area (limitation of the project).

1.6.1 Ontology

This project uses both the concrete and the abstract level for creating understanding. Grounded. The methodology bases its research on subjective data for the data of the three approaches. This subjectivism is necessary due to limitations in the literature on the approaches. Very limited literature exists for the Creative Platform. The literature that does exist is from the same persons. In fact, most of the knowledge about the Creative Platform is embodied in the few people who use this approach at the creative

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[27] Borgatti (2001)
[28] Borgatti (2001)
[29] Glaser (1994)
[30] Glaser (1994)

lab at AAU, thus making any data collection very subjective. For the TRIZ, quite a lot of literature do exist, however, most of it is bad interpretation of the original Russian literature on TRIZ. The literature, which is accessible and useable, is biased by the strong commercialisation that holds and develops the TRIZ as a service. Due to the complexity as well as the commercialisation possibilities of the TRIZ approach, almost everyone who work on it are doing it from a commercial point of view, thus making it very subjective. For the Lateral Thinking there do exist a lot of literature. However, due to a strict and strong supervised copyright of the models and techniques of Lateral Thinking, the literature of importance are from one author only – De Bono, thus making it subjective.

The problem with subjectivism in this project is related to the mechanisms of the approaches. It is expected that the sources are valid for the description of the approaches, as these are the sources closest to the origin of the approaches as possible. However, for the understanding of the effects and the outcome of the approaches exists the issue of validity. How can we know that the information is true? The issue is twofold. Firstly, the perception is individual. Edelman draws this point out clearly when he claims that the collection of individual and subjective experiences, feelings and sensations associated with awareness are unique to each individual.[31] In consequence it can be asserted that no two individuals will experience the external world in exactly the same way, thus making it difficult to use the perception of one individual for creating objective academic research. In other words; how the creator of the approach understands the effects and the outcome of his/her approach can be individual and might be understood differently by others. Secondly, the knowledge about the effects and outcome can be incomplete. This is not a critique to the authors of the approaches, but rather a standard issue for all information. It is found that "everything we think we know is a guess, and every thought process is a theory in progress. No knowledge is absolute."[32] Therefore subjective information can be questioned for its validity especially for information about the understanding of effects and outcome.

As mentioned before, the Grounded Theory has focus on the relational structures. For the research of this project the relational structures are important. The problem formulation involves identifying the relationship that exists between the three approaches in order to identify the trans-approach theme – the hypothesis of the project

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[31] Edelman (1992)
[32] www.humantruth.info

is that this theme is the discipline of thinking. In fact, the project has a case-oriented perspective, analysing more cases for gaining understanding of creative processes.

The last element of the concrete level of the Grounded Theory methodology is the focus on the phenomenal meaning. This focus is relevant to this project as the problem of the research is to understand the phenomenal meaning of this trans-approach theme.

For the themes to be identified and understood the project will be working on an abstract level, as it is the rationale of the Grounded Theory methodology. The final product of this project will be a set of abstract models, theories and concepts making up the discipline of thinking.

This project starts out as a research without a problem formulation. At first it was a fully explorative research with no other specific purposes. As a consequence of this explorative research, the problem formulation was developed. This is very much in line with how the Grounded Theory is structured. To fully understand the methodology of this project it has to be perceived as a two-step process: the first step with only explorative activity and the second step that occurred after the development of the problem formulation. The first step was primarily about gaining understanding of the use of creative approaches in creative processes. The second step was more about gaining understanding of the relationship between creative processes and the discipline of thinking.

The explorative process in the first part of this project is highly inductive. The project was at this point rather focused on handling the incoming data for making sense of these (especially data coming from observation, participation and facilitating). Therefore the project started out partly with an inductive approach to the research. The explorative process identified the discipline of thinking as a potential explanation of the activities of creative processes. From this point the project changed into a more deductive approach. The hypothesis was now that the discipline of thinking is the key to understand and manage a creative process. Therefore data was collected and analysed to find out if this hypothesis was true. The creation of a hypothesis is not in line with the methodology of the Grounded Theory. It has a negative effect, as any preunderstanding limits the possibility of understanding. The inductive approach is part of the Grounded Theory methodology.[33]

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[33] Glaser (1994)

This project is adding to the nomotetic understanding of creative processes, thus making universal theory. It is nomotetic, as the outcome of the project is representative to the majority of the creative approaches and not only to one or a few of them.

The project accepts dispacing in the research conducted. The reason for this is that the three approaches and the people standing behind them are disagreeing on a number of matters regarding creative processes. This project is not about comparing, contrasting or finding the best creative approach. Instead it accepts the conflicting understanding and practice in the creative processes, as well as uses these for gaining a better understanding of the discipline of thinking. Dispacing is at the core of Grounded Theory methodology.[34]

1.6.2 Data

The data collection has been performed of both primary and secondary data.

The collection of primary data has been based on qualitative methods, as it allow for a deeper and more comprehensive understanding, however, both the Actor and the Grounded Theory methodology are used for doing this. The collection of primary data started out with observing activity. This was observation of creative processes conducted with the use of Lateral Thinking at the institute for the design and development of thinking as well as the use of the Creative Platform at the creative lab at AAU. Together with this I also participated in a number of creative processes both using the Lateral Thinking and the Creative Platform. Finally I have performed a number of creative processes as the role of a facilitator of the process. As a facilitator I have used the Lateral Thinking, the Creative Platform and the TRIZ.

In the role as an observer and as a participant, I have used phenomenology to create understanding. This is part of the Grounded Theory and the Actor methodology, and allows the researcher to "go to the things themselves"[35]. The rationale for this is that preunderstanding limits the understanding of the mechanisms of the three approaches. The phenomenology has especially been used in the interviews conducted before the development of the problem formulation of the project. This is in the role of being an observer, participant and facilitator, but also in the interaction with Sandra Dingli, Timothy Schweizer and part of the interaction with Søren Hansen. The rest of the interaction with Søren Hansen as well as my interaction with Olav Sørensen dealt with

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[34] Glaser (1994)
[35] Glaser (1994)

the abstraction of the essence of the phenomena, according to the principles of the Grounded Theory methodology.[36] This interaction with Søren Hansen after the development of the problem has characters of the Actor methodology. It is similar to an open interview, as it has been vaguely structured and continuing over several months. The interaction has been based on the Actor method: social dialectic. Before the meeting one or both of us did a subjectivisation. During the meeting we both performed an externalisation expressing our individual understandings and beliefs, and following an objectivisation took place. After the meetings we individually did an internalisation trying to connect the new understanding to the understanding we had beforehand. This internalisation is the base for an extensive part of this project. The interaction with Søren Hansen was primarily about gaining a deeper understanding of the creative process and its elements. One of the more important actors related to this project is the supervisor, Olav Sørensen. The interaction with Olav Sørensen has similarity to the interaction with Søren Hansen. I, as the author of this project presented my understanding of the elements of this project, and from this Olav Sørensen presented his understanding of the same and related elements. The interaction with Olav Sørensen allowed the structure of this project to be set, and as well did this interaction help the project to perceive the creative process in a larger perspective, thus relating it to practical and theoretical perspectives.

An extensive amount of secondary data is used in this project to deal with both the subjectivity from the primary data as well as the high involvement of the author. In the collection of secondary data, a more Analytical methodology is used. This is especially true for the development of the discipline of thinking where the method is rationalistic rather than positivistic. The secondary data is based on a broad variety of different kinds of literature. While the primary data is dealing with the final explanation (the understanding of what is behind) the secondary data deals with the causal explanation (A causes B). This is to make the connection between existing theory and the discipline of thinking as well and to explain how the discipline of thinking works. However, secondary data is also used in the project to create understanding of the connection between the three approaches and the discipline of thinking. The secondary data is mostly data on the general literature on creativity, the three approaches as well as the mechanisms that make up the discipline of thinking. For the three approaches, the

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[36] Glaser (1994)

secondary data consists primarily of literature by De Bono for the Lateral Thinking approach, Hansen & Jacobsen for the Creative Platform approach and Silverstein, DeCarlo & Slocum for the TRIZ approach.

Most of the data collected is biased by subjectivity. To solve the issue of using this subjective data in the research of this project, triangulation has been used. Triangulation has been fulfilled in the project by 2 means. Firstly, the analysis is made up of three different approaches that are representative to the majority of the creative approaches that are usable for creative processes. The use of more cases (approaches) is part of the Grounded Theory and function in this project both as a triangulation tool and for gaining understanding. Secondly, the collection of data for each approach is a mix of secondary and primary data for getting a more reliable base for the research.

2. CREATIVITY AS A FIELD OF ITS OWN

2.1 Categories of Creativity

Creativity can seem as a complex field of study, which makes it difficult to maintain a comprehensive overview. This is partly true as it do contain many elements and various different views on the same matters. However, according the Rhodes, there are four overall categories within the field of creativity. These vary in the focus they have: Product, Person, Process and Press, known as the four P's of creativity.[37] The product is the outcome of the process, which is most likely one or more ideas. Therefore the focus on the product will be a study of the outcome of creativity. Focus on the person is to analyse the persons involved in creativity. These persons are responsible for the process, press, and eventually the product. The process is the set of methods, theories, and techniques that aid the idea generation in a creative process. Finally the press is the environment that creates the framework under which creativity is performed. It is important to understand that the four P's are overlapping and has huge influence on each other. This project has a focus on the creative process and the creative person, however, elements of the press and the product is also discussed.

2.2 Structured Generating of ideas

Generating ideas is often perceived as the outcome of a creative process. However, it is also important to understand that the generation of ideas is also part of the creative process itself.[38] This means that the ideas generated in the process are not all meant to be usable for the following innovative process. Many of the ideas are to be understood as building blocks for other new ideas. Therefore some ideas have the purpose of a stimulus in the process. Generate ideas for all fields of study. In fact creativity can be used for all purposes, where new ideas are needed.[39] The early views on creativity are that it is considered as an irrational, intuitive and mystified process.[40] According to these views it is not possible to conduct a scientific investigation of the process, but only on the outcome. The more modern views on creativity consider the process as something that can be analysed, explained, and understood scientifically.[41] Once this

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[37] Rhodes (1961)
[38] De Bono (1992)
[39] De Bono (1992)
[40] Reichenbach (1958)
[41] Schweizer (2006-B)

process has been scientifically codified into knowledge, it is possible to diffuse this knowledge to all parts of society to increase the level of understanding of the concept of creativity as well as improve the creative process itself. During time the term of creativity has had many meanings and definitions according to the eyes that sees. Morgan found that all the definitions had one thing in common. They were all putting a connection between novelty and creativity.[42] Therefore, a creative process must bring forward something new. Hausman found that any "appearance of genuine novelty is a sign of creative activity"[43]. This makes it even clearer. New ideas are at the core of a creative process. It is the process of coming up with new ideas. The ideas generated do not have to solve a problem. It is important to understand that any idea is a good idea, since it can be used to "build" on other new and better ideas. This makes it an evolutionary process, where the better ideas often come as a result of less good ideas. A creative process can be a specific period of time. This can e.g. take two days, two hour or two minutes.[44] The process can be separated from other activities in a more or less formal way.[45] This way it can be more structured. However, it can also be a natural part of any other activity. This way it has to be incorporated into the natural thinking of a person. For the creative process to be creative it has the purpose of having an output of new ideas. However, "new ideas" is a broad term. It can be new to the situation, new to the industry, new to the people involved, new to the world etc. The defining of "new" can be divided into two main areas of creativity: psychological creativity and historical creativity.[46,47] The psychological is the individual perspective. That a person comes up with a new idea s/he has not had before. Other people might have had this idea and may even have considered it (been working with the idea). The point here is that the idea is new to the person. The historical creativity is universal. For a new idea to belong to this category it must not have been come up before as an idea from anyone else. It must be totally new in the history.[48]

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[42] Morgan (1953)
[43] Hausman (1964)
[44] De Bono (1999)
[45] Schweizer (2006-B)
[46] Based on Boden (1990)
[47] Based on De Bono (1992)
[48] Boden (1990)

2.3 Stereotyped creativity

An important issue in the field of creativity is the multiple ways that the term has been used. Many misconceptions have been developed from this "misuse" of creativity as a field. A problem is that many people use this term to describe "strange things" or "behaviour" that is different. But that is not precise. The academic field of creativity is highly structured and has been built on science in the fields of philosophy, psychology and medicine (nerve systems in particular). In the field of creativity there are a number of different approaches, models and techniques, but most of them are based on the same or similar basics. There are a few misconceptions that this project needs to make clear. These will be discussed in the following.

2.3.1 Creative artists

First of all, it is often believed that you have to be an artist to be creative. This is a normal misconception that is also stereotyping this field in a very negative way, because many come to believe that creativity is only for such people and not for all people. An artist does not necessarily have skills in creativity and especially not necessarily skills that can be applied to other fields. It is true that artists often are motivated to be different and work with alternative perceptions. Some artists develop a style or a brand that in itself limit their creativity to be within this style/brand. Some areas of the artistic field have techniques quite similar to the field of creativity (such as improvising), and therefore it is related to some degree.[49] Everyone can learn these and other techniques, and hereby it is not limited to the field of artists.[50] To better understand this it is important to discuss if creativity can be learned or if it is something embodied in people. Some people are creative without ever taken creativity lectures or studying creativity. In some way this issue can be compared to people who compete in a race. If everybody line up and start running, then one of them will win the race. Most likely a continuous run of races will have similar outcomes. This is because some are especially gifted by nature with better conditions for running. The same is the case in the field of creativity. Some are "born" creative either from the context of their brain or from the context in which they have grown up. Therefore, a simple creative session without any models or any techniques will result in one or a few persons being highly creative and

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[49] Hansen (2006)
[50] De Bono (1999)

others very little creative. Similar to the race, it will typically be the same people that are most creative.

Going back to the race, each participant is given the same tool for use in the race. In this case the participants are given each a pair of roller-skates. Now the outcome of the race might be very different. This is because it suddenly depends on the skills of using the tools given (the roller-skates). Those who "by nature" were very good runners are not necessarily good roller-skaters. Now they have to train in using roller-skates to win the race. The more training the faster and better they become. If one of the participants chose not to use the tools, he will most likely not be able to catch up with the others. In such a race the outcome depends much more on the skills of the runners rather than on any "natural" ability. It is the very same in the field of creativity. People may have developed a creative way of thinking from their environment or birth. However, specific tools (models and techniques) can be used, which works like the roller-skaters. What is needed for using these tools is training and development of skills for using these tools.[51]

2.3.2 Rebels

Another common interpretation of creativity is that the source for it comes from the rebels of any society, because they want things different. This also gives the issue that many people consider creativity as bad, since rebels are threatening the existing order of the society. It is natural for rebels to challenge the existing order, which is a very central part of the field of creativity. Therefore rebels can be considered as creative. However, that is very far from being the source for creativity and new thinking. The problem is that rebels tend not to play the game of the current system. Therefore their main effect is to push the system into a certain direction, but they normally do not lead the system into the direction. The "conformists" are capable of leading the system if they become creative. This is very relevant to understand since the use of creative models and techniques can make any person creative.[52] It is important to understand that since we all come out of different contexts, some people might have it easier to learn and use the models and techniques. The rebels might use creative techniques naturally and not even be aware of them as techniques.

The creativity of the rebels raises an interesting question. Is mental liberation the key to creativity? Behind this lies the notion that everyone is creative, but some systems inhibit

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[51] Dingli (2005)
[52] De Bono (1992)

this creativity to unfold.[53] In such a case, it is just to remove the inhibiting elements of a system and the creativity will flow. As part of this is also an encouragement to be playful and childish. It is very hard or almost impossible to be creative in a system that inhibits creativity, therefore this can be an important element in the creative processes.[54] Companies often use brainstorming as the tool to remove the inhibitions to creativity. This is a model that for a certain period of time allows people to come with their ideas freely and not being criticised.[55] Therefore, brainstorming is often seen as the key to liberating or "freeing" people to become creative, when it seems to be needed. The problem with brainstorming though is that it only brings forth the ideas that are already there and – if successful, mix these to new versions.[56] This can be compared to cooking hash, where you take what is available and mix it together. Most people tend to like this because it consists of what people were already thinking of before the brainstorming. In other words, brainstorming rarely brings forward anything new. This is what happens when people perceive creativity as "freeing" people. You do not get new thinking, only the thinking that is already there. In many ways and in many situations this might be enough, but this is only one aspect of creativity. What is missing is the structured models and techniques that generate the new thinking on a subject. Some models of creativity have incorporated this "freeing up" while other models are structured in a way that does not make freeing up necessary. A comparison might make this clearer. Imaging a person tied up with a rope around his body and arms. This person is not able to play violin, because he cannot move his arms. If we "free him up" by cutting the rope, will he then become a good violist? Not necessarily! Cutting the rope might be a necessity for him to play, but he might be a terrible violist. He might need to learn the skills of playing violin before he will be good. It is exactly the same in creativity. Development of skills is necessary.

An issue arises from the "freeing up" and using models and techniques at the same time. It is the complexity of "freeing up" while giving constraints (models and techniques). The problem here is actually a misconception of models and techniques in the field of creativity. It is important to think of these as tools and not as constraints. In a kitchen, a pan is a tool, but not necessarily a constraint. For a band a guitar is a tool, but not

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[53] Robinson & Schroeder (2003)
[54] Schweizer (2006)
[55] Baumgartner (2005)
[56] Hansen (2006)

necessarily a constraint. It allows the band to play guitar, but does not tell what is played on the guitar or if the guitar is even used as a guitar or something else. The same is the case with models and techniques of creativity. They allow people to think different, but not in what direction and not what to think – only to think different.

2.3.3 Mess around

To mess around is the perception that creativity is not structured and people just need to be different in order to be creative.

This is a continuous issue in the field of creativity. The problem is that many people have experienced a positive outcome from "messing around" and therefore believe that this is the correct way to become creative. To "mess around" can have similar effects as the models and techniques of creativity and therefore it can also give a similar outcome.[57] However, the "messing around" is highly unstructured and therefore the outcome can be varying and the chance for success is basically random. For creativity to be structured and reliable, precise and systematic uses of the models and techniques as well as a strict track on time are required. Do not leave it to randomness, because then the outcome will also be very random.

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[57] De Bono (1999)

3.1 THE CREATIVE PLATFORM

3.1.1 Philosophy of the Creative Platform

The Creative Platform consists of a mix of various creative approaches. The basic of this approach was developed upon the experiences of an innovation camp in 2004 in Denmark.[58] This approach is about running a creative process within a short period of time especially for non-creative participants. It is an approach that can be used by all people regardless of their knowledge or interest in creativity in the long run.

The Creative Platform consists of two stages: building up the creative platform and running an idea generation.[59] The approach uses artistic methods for building up the creative platform[60]; however, the use of the approach is not limited to the artistic field. The idea generation part is designed to handle any subject or situation.

At the core of the Creative Platform is the use of diversity in knowledge and level of knowledge. It is designed for knowledge to be shared easily and for knowledge to come forward in the idea generation process.[61] Often this diversity is found as a problem in the idea generation process. How easy is it to make a zookeeper, a waste collector and an administrator of a computer system work together on creating a cleaner park environment in a city park, for example? The building up of a platform is to build an environment where the participants speak a common language and are not afraid of showing their knowledge and bring forward their ideas.[62]

The idea of the Creative Platform is to create an environment where the "rules of creativity" are followed. It is to make an environment for creativity to flourish. This is engaged by a number of activities; where the three (of the four) most important elements of the Creative Platform are built (the forth element is knowledge). These elements are "feeling safe", concentration and motivation. They are interconnected and complementary in their effect for the creative process. Once the three elements are built for the Creative Platform, the participants of the creative process will feel free to forward out their ideas and the ideas will automatically come to the mind of the participants as they are concentrated and motivated. They will experience a feeling of

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[58] Hansen (2006)
[59] Hansen (2006)
[60] Hansen & Jacobsen (2005)
[61] Hansen (2006)
[62] Hansen (2006-B)

being "present".[63] Imagine a person peeling a back of potatoes. In a situation where every potato he pick to peel, mentally is the first potato he has ever peeled, then this person is being "present". In some sense the Creative Platform is creating a flow experience[64] through social activities primarily coming from the field of theatre (improvising). The flow experience comes when a person concentrates on an activity so much that all thoughts (worries, enjoys etc) related to life/competency temporarily will be forgotten. Hereby the subject under concentration will have the full attention of the mind in a "now moment".

Once the platform is build, the Creative Platform will use techniques to continuously break the patterns of thinking. This is performed by changing the situation, the perception or similar. As the authors of the Creative Platform like to term it: "it is about creating a platform that takes us away from the everyday sump"[65]. The everyday sump is filled with routines, rules, fear and prejudice and hostile attitudes that control our thinking into safe directions of thinking. The safe directions are those that we have tried or seen before. However, these directions are not creative, because they are what we normally think or do. Getting away from this sump, will set our thinking free of the safe directions, and allow us to think different.

3.1.2 The Theory of the Creative Platform

The Creative Platform has extensive focus on emancipating the participants from all boundaries that exist in the sump.[66] This process aims to expand the natural allowed area of thinking as shown in figure 3.1.A Boundary in Area of Thinking. The area of thinking is limited by emotional boundaries, experiential boundaries, intellectual boundaries and belief boundaries.[67] The emotional boundary is the natural fear in a person for saying something, trying something or for doing something that is not traditionally accepted as "normal".[68] It is to have feelings that make you afraid of being the odd one. The experiential boundary is the path dependency of thinking that derives from our past experiences, education, environment, routines, habits and similar.[69] Our

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[63] Hansen (2006)
[64] Csikszentmihalyi (1996)
[65] Hansen (2006-B)
[66] Based on Hansen (2006)
[67] Based on Hansen (2006)
[68] Hansen (2006)
[69] Based on Hansen (2006)

experiences are actually giving limits to our thinking unless we can put ourselves out of this path dependency.[70] The boundary of belief is that people do not believe in all their ideas and do not trust all their thinking. It often happens that you get an idea and then "put it away", just because you do not believe in it. The more you believe in any new ideas, the larger is the change for finding totally new ideas for solution. Often the "crazy" ideas are the ones that later turn out to be the right ones. The last boundary is

Figure 3.1.A Boundary in Area of Thinking
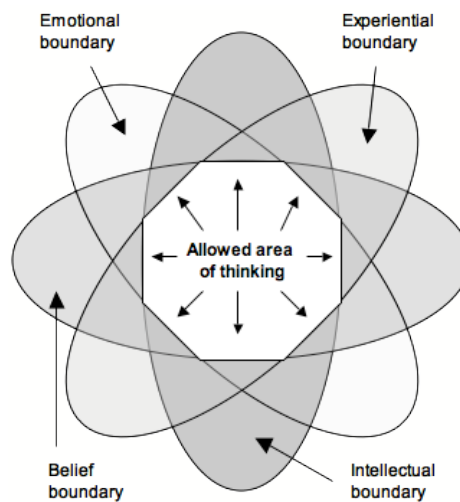
Source: Own work (2006)

the intellectual boundary. This can be an issue especially in more complex subjects where diversified intellect is needed. However, a much more important thing is to make the participants allow all their knowledge to come through. Perkins finds that extensive knowledge about the subject helps in the idea generation process.[71] The point is that people are afraid that their knowledge is not good enough.[72] Ironical this is highly intensified if one of the participants has shown that he is "the intelligent guy" and nobody should think they are smarter than him.

The emotional and the belief boundary are both dealt with in the Creative Platform by performing exercises that makes people expand their emotional boundary – they kind of "let go", while they at the same time start to believe in anything they say and do. The experiential boundary is dealt with, also through some of these exercises that make people stop thinking about "what is" and start thinking about "what might be". In other words, they are forced into situations, where they cannot think about anything but what

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[70] Hansen (2006)
[71] Perkins (1994)
[72] Hansen (2006)

they are told to think about. Hereby, the boundary of experience will disappear. The intellectual boundary is dealt with on the Creative Platform in a different manner. Often specialists are put into the creative process.[73] E.g., it is possible to put in a professor in the field of Mould, into a creative process about indoor climate or a farmer into a creative process about improving parks in the centre of larger cities. The intellectual boundary can also be limited by minimising the building up of "thrones". The thrones consist of the personal ego, which anyone would like to show or tell to other people. This can be specialised knowledge or personal experiences. By allowing participants of a creative process to build their throne, the idea-generation will be negatively affected. Therefore it is important to avoid this for limiting the intellectual boundary.

The ideas coming from the allowed thinking area might be able to solve a problem. However, the ideas lying outside this thinking area are often better and more radical. The point of "freeing" is to increase the allowed area of thinking for getting more ideas and more radical ideas for solution finding.[74] The Creative Platform uses a set of rules for increasing the allowed area of thinking. This is called the "Emma Gad" for creative processes.[75] The "Emma Gad" consist of the following rules: accept anything in a creative process, make other look good, make many mistakes – and make use of them, No breaks are allowed, it is allowed mentally to take a pause - but only shortly.

3.1.3 The model of the Creative Platform

The model provides an environment ideal for a creative process.[76] For this environment to be built it requires four elements to be put in place. These are "feeling safe", concentration, motivation and knowledge (and experience).[77]

The element of "feeling safe" is to remove any fear that might prevent a creative process to run perfectly.[78] This is the fear of feeling foolish, the fear of failing, the fear of wasting time, the fear of getting fired or the fear of being strange. The facilitator takes away responsibility from the participants. Hereby the participants will be "feeling safe". Everything that happens in the Creative Platform is to be of the responsibility of

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[73] Hansen (2006)
[74] Hansen (2006)
[75] Hansen & Jacobsen (2005)
[76] Hansen (2006-B)
[77] Hansen & Jacobsen (2005)
[78] Hansen & Jacobsen (2005)

the facilitator. The "feeling safe" creates accept for new ideas that are not normally accepted in the sump.

The element of concentration is to make the participants being absorbed into the subject or situation at hand.[79] The participant must be so concentrated about the ideas coming up, that nothing else is allowed in the thinking. This state of mind is created through precise and strict planning and running of the creative process itself. There must not be any risk for the participants to start thinking about other subjects or situations than the ones important to the idea generation. To extend the concentration of the participants, they are relieved from all thinking about planning, reflection and running of the process. In other words, the responsibility is taken away from the participants.

Figure 3.1.B Model of the Creative Platform
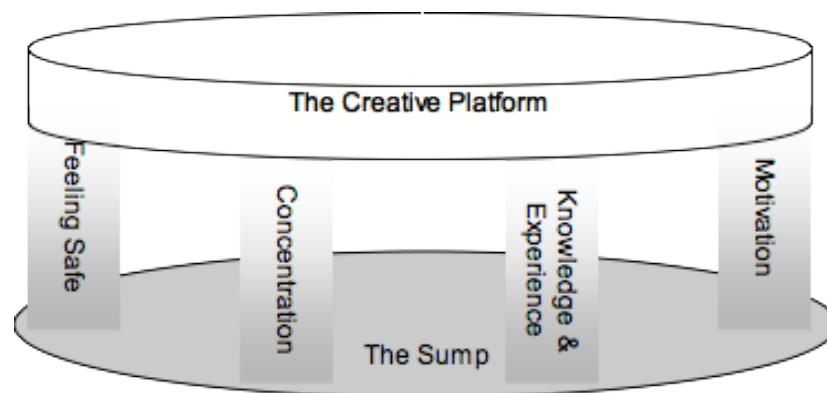
Source: based on Jacobsen & Rebsdorf (2003)

The element of motivation is closely related to the element of concentration.[80] The motivation is the force and energy for the creative process. The participants must be motivated in order to take part of the idea generation part. The motivation will automatically be stimulated, as the concentration gets stronger. However, the participants will be trained in accepting all incoming stimuli and ideas as positive, which creates mutual motivation in a creative group process.

The knowledge is a resource in a creative process.[81] New ideas cannot be generated without knowledge at all. The Creative Platform focuses on having the right knowledge in the creative process. This can be put together according to the subject or situation at hand. If the subject is to create a better office climate, a farmer and a spider expert

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[79] Hansen & Jacobsen (2005)
[80] Hansen & Jacobsen (2005)
[81] Hansen & Jacobsen (2005)

might have knowledge relevant to this and therefore have to take part of the creative process. The knowledge has to be shared and combined. The Creative Platform is performing this sharing/combining task by using the technique of improvisation. The spontaneity in the technique will allow any relevant knowledge to come forward in the process.

Once the Creative Platform is established, this approach uses a variety of techniques for changing the perspective and break thinking patterns.

3.1.4 The Techniques of the Creative Platform

The techniques for the creative platform can be divided into two groups; Energisers and Offers.[82,83] This part will only analyse the most important techniques, as many are overlapping and some rarely are used.

Energisers are techniques for learning and using the "Emma Gad" practically in a creative process. These techniques are meant to stimulate the brain with energy, while building up the creative platform. They consist of physical and verbal activities that create the social structure between people for "feeling safe", concentration and motivation to exist. The activities are primarily inspired from areas such as sport theatre, music and teambuilding.[84]

Offers are cognitive stimuli that change perception and break patterns of thinking.[85] These techniques are meant to lead the direction of thinking of the participants. This makes it possible to "search more places" for ideas. A participant having only one direction of thinking will have a very limited diversity and variety in the outcome of ideas. By using the Offers, while the participants accept them, the participant will have more directions of thinking during a creative process. The Offers are a mix of techniques inspired from many other approaches. Some of the Offers come from the human psychological field while others come from the cognitive; however, the point of all of them is to direct the thinking.

3.1.5 The use of the creative platform

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[82] Based on Hansen & Jacobsen (2005)
[83] Based on Hansen (2006)
[84] Hansen (2006)
[85] Based on Hansen (2006)

The use of Energisers makes this approach ideal for longer creative processes.[86] This is because they create energy for the participants to go on, while they keep the concentration at a very high level. The participants are not allowed to take mentally breaks for longer periods of time. Therefore a creative process using the Creative Platform can last for up till 16 hours.[87]

The Creativity Platform needs a facilitator in all the processes that are carried out. This facilitator must be particular strong in the theory and practical use of the method and the techniques. Developing a Creative Platform takes a lot of planning and require of the facilitator to be concentrated. Therefore the entire structure and flow of the session must come from the facilitator and not from the participants. The participants however, need to be motivated for doing the creative session.

The techniques are not taught to the participants and therefore do not change these people into becoming more creative in general. No pre-training of the participants is needed. Everyone can participate in the creative session and diversity in the knowledge of the participants will only strengthen the idea generation process.[88] This makes the Creative Platform ideal for group process, while it is less ideal for individual processes.

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[86] Hansen (2006)
[87] Hansen (2006-B)
[88] Based on Hansen (2006)

3.2 TEORUYA RESHENIYA IZOBRETATELSKIKH ZADATCH (TRIZ)

3.2.1 The Philosophy of TRIZ

The "creator" behind this approach on creativity is the Russian born Genrich S. Altshuller.[89] He was educated as a mechanical engineer and worked as a patent expert in the 1940's, where he started to get curios about creating a standard method for inventive problem solving. His education, work and his curiosity led him to develop a method for inventive problem solving that is quite unique in its structure. His insight into the patents made him perceive creativity as "re-thinking" rather than "new thinking". He states: "Someone, somewhere has already solved your problem"[90]. The rationale of it he found when he was looking at inventions across industries and subjects and found that the "same" problems are being solved over and over again. By "same" is meant the same problem on an abstract level of thinking. Altshuller founded 40 principles that can be termed as the foundation for all inventive solutions for problems. [91] By defining and using these principles in inventive problem solving it is possible to find solutions quickly and more efficiently. From here he developed the problem solving method of TRIZ.[92]

For many reasons, the TRIZ is unique as a creative model. One of the more basic differences is that it from origin was not meant to be dependent on psychological tools, while the other approaches are all highly dependent on such tools to work effectively.[93] Another one is that TRIZ uses a body of inventive knowledge ("old" solutions) as part of the solution space.[94] In fact, the TRIZ is today based on an analysis of more than 2,500,000 patents (originally Altshuller used around 200,000 patents).[95] This is rarely seen in the field of creativity, where the normal perception is to develop new ideas, instead of using "old" solutions.[96] The last major difference in TRIZ from most other

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[89] Silverstein et al (2001)
[90] Schweizer (2006-B)
[91] Silverstein et al (2001)
[92] Schweizer (2006-B)
[93] www.xtab.se
[94] Schweizer (2006)
[95] Schweizer (2006-B)
[96] Dingli (2005)

creative models is its philosophical foundation. While most creative models consider "what might be" as the way of thinking for a creative process, the TRIZ consider "what is" as the right way.[97] This is especially seen in the methodology of the model. While most problem solving methods are designed to find what is referred to as a Pareto 'optimal' solution – "one that cannot be improved with respect to any one objective without worsening some other objective"[98], TRIZ is designed to solve the contradictions without any trade-off. An example of a contradiction can be the strength versus weight of a metal plate. In order to increase the strength of the metal plate the weight will get heavier. Such a contradiction is optimal for being solved by using TRIZ. The point is then; NOT to find an optimal trade-off between the weight of the metal and the strength of the metal plate, but to find a solution where it is actually possible to increase the strength of the metal plate while not increasing the weight of the metal plate – to solve the contradiction. An example for solving this contradiction in TRIZ is by performing segmentation or change from uniform to composite material.[99]

3.2.2 The Theory of TRIZ

The theory of TRIZ is based on using old solutions for coming up with new ideas for a current problem.[100] Therefore the change of perception in this approach is not by random, but highly structured. The perceptional change is by purpose directed to one or a few ways of thinking. These directions are based on the analysis of the patents. To solve a current problem the perception is direction towards a direction that helped solving the same problem somewhere else. In other words, what basically happens is that you "give" TRIZ the problem and it "give" you back the way of thinking that have solved a similar problem in another context.[101] This is done, by converting the problem at hand into an abstract contradiction.[102] The contradiction consists of a factor that needs improvement and another factor that is negatively affected by the improvement of the first factor. A matrix then shows the direction of thinking that has solved this kind of contradiction somewhere else. The creative process can then start based on the direction(s) given by the matrix.

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[97] Dingli (2005)
[98] Steuer (1986)
[99] Based on the 40 principles matrix in Silverstein et al (2001)
[100] Hansen (2006)
[101] Hansen (2006)
[102] Silverstein et al (2001)

It is important to understand that abstraction is essential to the theory of TRIZ. Solving a problem on a specific level of thinking is against the principles of TRIZ. Therefore the aspect of thinking is highly important to this approach. If we would only be working on the specific level, the traditional way of solving a problem is to do trial and error. Therefore the trial and error would be the technique for finding the specific solution to the specific problem.[103] This would allow us to go from a specific problem directly to a specific solution. At first sight this might seem like a better option, since we hereby do not need to do the tasks of abstractions and specialisation. For a person who has not learned the skills of abstraction and specialisation the obvious way would be to try out trial and error in order to solve any problem. However, if we compare this technique with the science of mathematic, then trial and error would be similar to the use of "adding up" for solving a multiplying task. Look at the two different ways of solving the same specific problem below:

Specific: $4 + 4 + 4 + 4 + 4 + 4 + 4 + 4 + 4 + 4 + 4 + 4 + 4 + 4 + 4 + 4 + 4 + 4 + 4 + 4 + 4 = 84$

Abstract: $4 \times 21 = 84$

Knowing the technique on the abstract level makes this method much faster and easier. Figure 3.2.A Trial and Error vs. TRIZ, shows how the difference in thinking is between

Figure 3.2.A Trial and Error vs. TRIZ
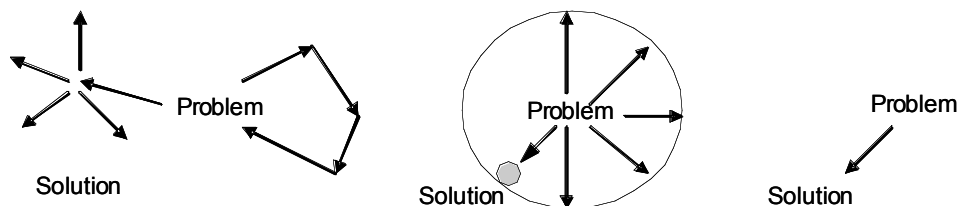
Source: based on Schweizer (2006-B)

trial and error on the one side and using TRIZ on the other side. The image to the left is showing how the thinking works by using brainstorming sessions and likewise. The thinking takes a direction depending on the first ideas that come up, and only changes direction rarely.[104] The direction might lead towards a solution and might not. The image in the middle shows a more structured way of thinking, where the direction of the thinking is changed many times to make sure that as many directions are looked at as

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[103] Schweizer (2006-B)
[104] Schweizer (2006)

possible. It could be e.g. using the Lateral Thinking for doing problem solving.[105] If this one is worked through, then a solution will be found at some point, as the direction of thinking will change until the right one is found. According to Schweizer, these two images show the trial and error method.[106] The image to the right shows a highly structured way of finding a solution. This is by using TRIZ. It is done by defining the problem on an abstract level and hereby finding the "right" way of thinking to find a solution.

From this it is possible to understand the use of an abstract level for solving a specific problem. When the idea of how to solve the specific problem is visible on the abstract level it is possible to go back to the specific level to solve the specific problem. Using trial and error might also have solved the problem, but in a much more random way and it might have taken much longer time.[107] These two examples show the principles of the Theory of TRIZ.

A real life example can illustrate the explanation of the TRIZ theory. The cores of green peppers are removed in a certain way. It is by forcing air into the centre of the pepper by gradually increasing the pressure. When the pressure is suddenly released, the stem and seeds are blown out. This way of cleaning peppers was invented in 1945 and patented. If we try to abstract the solution for cleaning peppers it will be something similar to this: "Raise pressure slowly and then suddenly release it". Going to the next abstraction level the principle could be termed: "Store up energy and suddenly release it" or "Store up a resource for later use". Looking at the history the same principle has been used to the following problems: Removing shells form sunflower seeds, shelling cedar nuts, cleaning filters, unpacking parts wrapped in protective project, splitting diamonds along micro-cracks, producing sugar powder from sugar crystals as well as explosive project depulping.[108]

3.2.3 The Model of TRIZ

The model provides a structure of the thinking where the randomness of creativity is kept to a very low degree.[109] The first step is to define the specific problem. Then the

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[105] Schweizer (2006-B)
[106] Schweizer (2006-B)
[107] Schweizer (2006-B)
[108] Schweizer (2006-B)
[109] Silverstein et al (2001)

problem is converted into a contradiction through a process of abstraction.[110] What happens is that the problem solver will be distanced from the natural way of thinking: "I must find a specific solution to this problem". In this thinking the human brain will only browse through the solutions we have already "in our mind" for solving this specific problem. On the abstract level the specific techniques of TRIZ will be used for directing the thinking and bring about ideas for solution.[111] The distancing (abstraction) allows the brain to browse through all the solutions we have to "similar problems" or problems that share some characteristics with the specific problem itself. When one or more ideas have been found, a generic solution is made on the abstract level. The final step is to convert this abstract solution into a specific solution.[112] The divergent thinking is only performed on the abstract level, while convergent thinking is performed on the specific level.

Figure 3.2.B Model of TRIZ
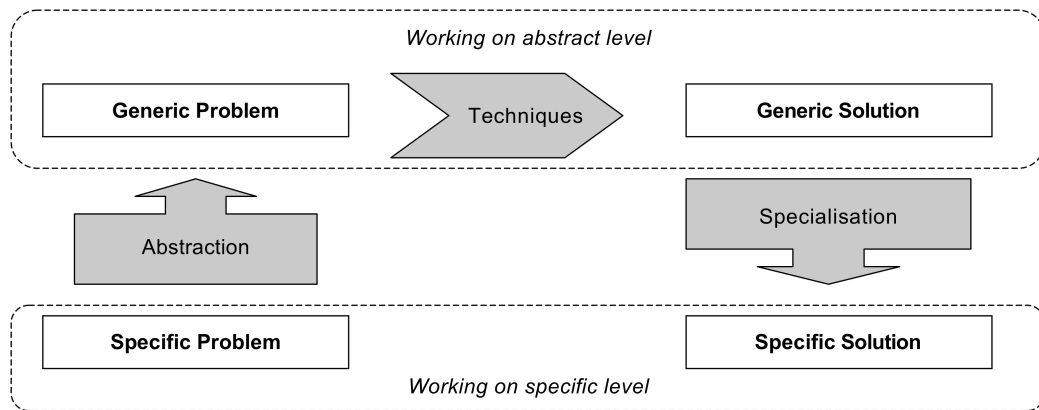
Source: based on Silverstein et al (2001)

3.2.4 The Techniques of TRIZ

This part will only analyse the most important techniques, as many are overlapping and some rarely are used.

Ideality[113] is a technique that has similarities with the wishful thinking technique from the Lateral Thinking. However, what characterizes Ideality is its structured way of approaching the "wishful thinking". In the technique is a process of identifying all the *useful* functions and all the *harmful* functions surrounding a product, service, process

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[110] Silverstein et al (2001)
[111] Silverstein et al (2001)
[112] Silverstein et al (2001)
[113] Silverstein et al (2001)

or any other subject at hand.[114] Part of this process is also to do an identification of all existing resources available in the surroundings. The ideal system performs a required function without actually existing and this function is often performed using existing resources. The point of defining Ideality is that it breaks psychological inertia on a subject matter. Therefore this is one of the more psychological techniques of TRIZ. Contradictions[115]: The point of this technique is NOT to avoid contradictions, but rather the opposite. Find contradictions, or define any problem into a contradiction. The point is then to resolve the contradictions without any compromise.[116] The technique is at the very core of the TRIZ and also the one most widely used for problem solving on the abstract level. The contradiction is "*an improvement in one system characteristic (parameter) results in the deterioration of another*"**[117]**. There are two different kinds of contradictions: technical and physical. An example of a technical contradiction is the acceleration of a car vs. economical performance of the car. The contradiction is that the typical trend is to want faster cars that use less gas. A typical solution is to find a reasonable trade-off between the two. However, the contradiction technique is to find a solution that makes the both possible at the same time. For solving the contradictions without trade-off, there have been developed 40 principles. These 40 principles are based on an analysis of 2,500,000 patents. The principles are to be found in a matrix as explained earlier in the Theory of TRIZ. Another way of solving the contradictions is by using 76 standards solutions that solve the most common problems in technical contradiction problem solving.[118] These standards are also based on the analysis of the patents.

The physical contradiction is related to the technical, but very different in the way it is solved. An example of a physical contradiction is that concrete pills for a foundation have to be pointed for pushing them into the ground, while they have to be flat for gaining stability once they are in place in the ground. This is a contradiction because we need one thing, but we also need the opposite. The TRIZ have 4 main principles for solving physical contradictions. The principles seek to eliminate the physical contradiction by separating the two contradictory requirements. The four principles are:

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[114] Schweizer (2006-B)
[115] Silverstein et al (2001)
[116] Schweizer (2006-B)
[117] Silverstein et al (2001)
[118] Silverstein et al (2001)

separation in space, separation in time, separation between the parts and the whole and separation upon condition.[119] Basically these are directions of thinking for finding ideas.

3.2.5 The use of TRIZ

The method of TRIZ is more complex than most other creative approaches. The method and the techniques require fully understanding before they can be taken into use. Their complexity both makes them difficult to learn and to use. Therefore a facilitator seems to be essential for running creative process. Running without a facilitator will leave too much to randomness, if the participants do not fully understand the TRIZ. Software has been developed for making it easier to perform an individual or a group session without a facilitator[120]. It leads the participant (s) through the steps necessary in TRIZ. The software actually takes the function of the facilitator.

Whether the process is performed in a group or individual is not important to the TRIZ. The number of people using TRIZ for a particular problem can be related to the outcome of usable ideas. The more people – the more usable ideas. However, whether they run the session individually or in a group have no significant difference.[121]

It is useful in groups, since the diversity in a group makes it easier to come up with more ideas and ideas of more variety. However, it is just as useful for individual use, since the model and the ancillary techniques are designed for individual use. In fact, the inventor of Lateral Thinking, De Bono, find that individual creative processes often are more effective in terms of quantity per person than group processes. From this Edward de Bono suggests that a creative session can consist of both an individual and a group session.

An interesting and very unique use of creativity is only possible with the use of TRIZ. By using the matrix or the 76 Standards before a creative process it is possible to find the direction of thinking before starting the idea generation process.[122] Hereby it is possible to put the participants together according to how they might be relevant to the process. This can be based on their knowledge. If the matrix shows a particular direction of thinking it is possible to find participant with knowledge that suit this

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[119] Schweizer (2006-B)
[120] www.creax.com
[121] Schweizer (2006-B)
[122] Hansen (2006)

direction. This possibility for defining the direction of thinking might also make diversity of knowledge in groups of less importance.

3.3 LATERAL THINKING

3.3.1 Philosophy of Lateral Thinking

Lateral Thinking is "*a way of solving problems by unconventional or apparently illogical means rather than using a traditionally logical approach*"[123].

What characterises the Lateral Thinking is very much separation of the thinking into divergent and convergent thinking[124]. De Bono describes this himself as the difference between lateral thinking and logical thinking.[125] De Bono developed the term lateral thinking and it is the foundation of all his work. The best way to understand the mechanism of this separation is by analysing one of the Lateral Thinking thinking tools called the "Six Thinking Hats"[126]. In this method the thinking is separated into 6 areas: red, green, black, yellow, white and blue. The red hat is to give emotional response to a subject. The green hat is to generate alternatives or ideas. The black hat is to view a subject (situation, idea etc.) from a logical negative side. The yellow hat is to view a subject from a logical positive side. The white hat is to only look at facts, information and data. The blue hat is kind of a facilitator viewpoint. It is to think about thinking.[127] When e.g. doing yellow hat thinking it is not allowed to do any other areas of thinking. This kind of separation of the thinking is the case, no matter if it done individual or in a group. The method of the six thinking hats is actually based on the theme of parallel thinking[128], however it has the same rationale as the separation of the thinking in the Lateral Thinking, and is therefore a good illustration of how separation of divergent thinking and convergent thinking is at the essence of Lateral Thinking. It is to do only one kind of thinking at a time.

The rationale behind the separation is first of all to maximise the sensitivity of the thinking about a particular area or field.[129] The point is that a continuous thinking about a specific area is actually a stimulus for the thinking of the area itself. In other words, if a person gets only positive input about a subject (e.g. from group members or from own thinking) then the mechanism of the mind will make the thinking directed in that area of

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[123] Encarta (1999)
[124] Hudson (1967)
[125] De Bono (1992)
[126] De Bono (1985)
[127] De Bono (1985)
[128] De Bono (1994)
[129] De Bono (1968)

thinking.[130] It generates a spiral effect, where the sole thinking about an area makes it easier to think about that area, with a continuous upward effect.[131] Positive input affects the thinking to think in positive ways, while negative input does it to think negative and creative input does it to think creative. This is often seen in creative processes, where ideas are brick stones for other new ideas.

The basic philosophy of the Lateral Thinking is that generative thinking is more important than constructive (critical) thinking. According to de Bono, there are three basic aspects of thinking: what is, what may be and what can be.[132] He believe that western societies are obsessed with "what is", and fail to see the importance of "what may be" and "what can be" in shaping our future. In other words; if "what is" is the dominant way of thinking, then a process, product or structure has to be proven wrong in order to be challenged. If "what may be" is the dominant way of thinking, then continues development becomes natural in all situations.

De Bono's background is in medicine and psychology and his philosophy is based on research on the mind as a self-organising system.[133] This is also known as patterning system, where the mind make patterns of thinking according to what we do and what we experience. Hereby the thinking is structured in routine patterns. The mind does not have to consider all options for every action. Instead it automatically chooses the routine option for the respective action. According to the theory of self-organising information systems, this happens automatically in the mind. The philosophy of Lateral Thinking is then to break these routine patterns for a certain period of time.[134] This is what the models and techniques are designed to perform. This is because De Bono believes that breaking these routine patterns is the key to see the non-routine option – and hereby the key to creativity. In the Creative Platform the state of mind of being "present" was very central. In Lateral Thinking this is also part of the philosophy. However, here the way to reach the state of mind of being "present" is through cognitive techniques.[135] The focus on separation of thinking creates an up-going spiral effect as explained in the part about Lateral Thinking. This is actually similar to a flow

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[130] De Bono (1968)
[131] De Bono (1968)
[132] De Bono (1992)
[133] De Bono (1968)
[134] De Bono (1992)
[135] Hansen (2006)

experience, because repeatedly thinking in a specific area will focus the mind so much, that all other things will temporarily disappear from the mind.[136]

3.3.2 The theory of Lateral Thinking

The Lateral Thinking is concerned about change of perception in thinking. To try harder to think in one direction might not lead to an idea for a solution. It might be that there is no valid idea in that direction of thinking. Therefore it does not matter how efficient a person is about thinking in that direction, if he has to find the right idea in another direction. De Bono puts it like this: "you cannot dig a hole in a different place by digging the same hole deeper"[137]. If you need new ideas on a subject, a change of perception is often needed. The problem is that "we do not see the world as it is but as we perceive it"[138]. The perception is a limitation of the world. It is a smaller picture only taking bits of the world in it. Continues change of perception on a specific situation or subject will give more of the smaller pictures. Together these pictures can make a comprehensive view of the situation or subject. Hereby it becomes possible to see the solutions that were before limited away from the one perception.

The main principles of the Lateral Thinking are Provocation and Movement.[139] The Provocation allows our mind to get out of the established direction of thinking. Basically, this is done by forcing the mind onto a new direction of thinking. The Provocation provides the opportunity to move laterally and generate connections that have nothing to do with experience.[140] This is because it rearranges the information in the mind to create new patterns. The Movement makes sure that the mind uses this new direction of thinking and moves along it.[141] On the new direction of thinking it is possible to find ideas that were not possible on the "old" direction. Movement is to hold back judgement; it is to avoid comparing new ideas to "old" directions of thinking. It is to work with "what might become of this?" and avoid "will this work or not?" However, Movement is more than the absence of judgement. The important element of it is concerned about how and where the thinking can move forward.

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[136] Hansen (2006)
[137] De Bono (2001)
[138] De Bono (1992)
[139] Dingli (2005)
[140] De Bono (1968)
[141] De Bono (1992)
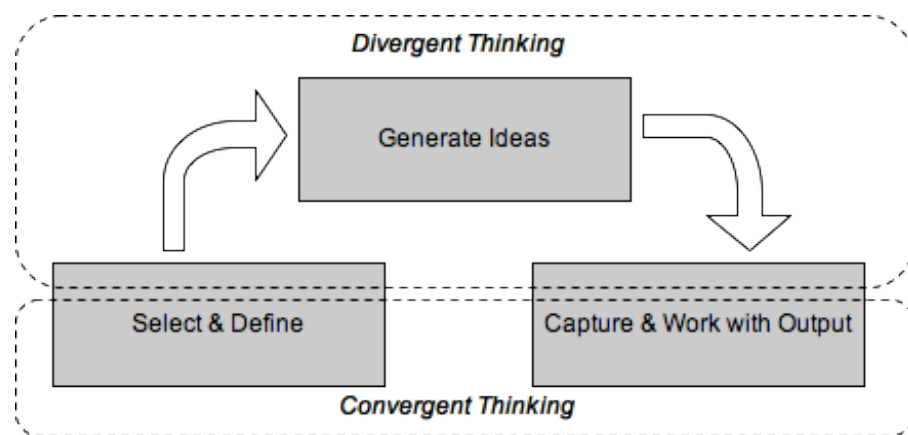
3.3.3 The model of Lateral Thinking

The Select & Define is to create a general Area Focus or a Purpose Focus.[142]

The divergent thinking starts in this part as this model create alternative ideas for focus. It is kind of an idea generation process at this stage to cover all the areas or purposes of focus possible. Different focuses bring forward different ideas. According to the Lateral Thinking, the focus is one of the most important elements of a creative process.[143] This stage ends by defining a clear and usable focus.

The stage of Generating Ideas is the actual idea generation process, which is highly structured by a number of different techniques like Alternative Generation, Challenge, Random Entry and Provocation.[144]

To Capture & Work with Output is partly a divergent and partly a convergent process. It contains two sub stages; harvesting and treatment.[145] The harvesting is a structuring of ideas parallel to a continuous produce of ideas in a structured manner. The treatment is to build up the ideas and adapt them into the real world situation. The treatment is a pure convergent process.

Figure 3.3.A Model of Lateral Thinking

Source: based on de Bono (1992)

3.3.4 The techniques of Lateral Thinking

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[142] De Bono (1999)
[143] De Bono (1992)
[144] De Bono (1999)
[145] De Bono (1999)

This part will only analyse the most important techniques, as many are overlapping and some rarely are used.

Focus is a technique for obtaining the first part of the creative session. It contains a divergent part, where ideas for alternative focuses are developed. The technique has two different kinds of focus; the general-area-type that has a broad focus, and the purpose-type, which looks at narrowing the focus.[146]

Challenge is a technique to change the basic way of thinking in a person.[147] It challenges everything existing, even what seem to be perfect. Challenge is not to criticise the existing, but to look for alternatives without having a triggering problem. It does this by blocking the current path of thinking or escaping the current path of thinking. It also challenges the rationale that lies behind the existing – like the reason for doing something a specific way.

Alternative Generation forces one to seek out alternatives even though the next step in a process seems to be logical and available.[148] The technique extracts the concepts behind existing alternatives and then uses this concept to generate more alternatives.

Provocation is a technique for moving the pattern of thinking on "new roads".[149] De Bono, find that Provocation makes a person look at things not as they are, but as they might be. Basically, Provocation changes the perception and hereby makes one see the situation or subject in a different way. The most important Provocations are: random entry, escape, reversal, exaggeration, distortion and wishful thinking.[150]

Movement is to be used in combination with Provocation. It allows the thinking to move forward in a direction of thinking regardless of if it seems to have value or potential.[151] It removes any kind of judgement from the mind, by forcing the mind onto the direction of thinking that is established by Provocation. The most important Movements are moment-to-moment, extract principles/concepts/features, positive aspects and circumstance dependent.[152]

3.3.5 Use of Lateral Thinking

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[146] De Bono (1999)
[147] De Bono (1999)
[148] De Bono (1999)
[149] De Bono (1999)
[150] De Bono (1999)
[151] De Bono (1999)
[152] De Bono (1999)

The method of Lateral Thinking can be used in several situations. It is useful in groups, since the diversity in a group makes it easier to come up with more ideas and ideas of more variety. However, it is just as useful for individual use, since the model and the ancillary techniques are designed for individual use.[153] In fact, the inventor of Lateral Thinking, Edward de Bono, find that individual creative processes often are more effective in terms of quantity per person than group processes. From this Edward de Bono suggests that a creative session can consist of both an individual and a group session.[154]

The Lateral Thinking can be used in multiple ways. First of all, non-creative people can use it. There is no need for learning the techniques, models or the theory before starting a session. However, using the Lateral Thinking like this requires like a need for a facilitator. The facilitator needs to know the techniques, models, theory and the use of the Lateral Thinking.

Secondly, the Lateral Thinking can be taught to the participant of the creative session beforehand. Such a session can use a facilitator or not. Using a facilitator might make the process more structured, however, a session can be just as productive without a facilitator. This way, the participants need to learn the models, the techniques, the theory and the use of Lateral Thinking.

Thirdly, Lateral Thinking can be perceived as a mechanism for changing the culture of a person, an organisation or a group. In other words; there is no need for a specific session, a separation from other activities or similar. It can be used any time at any situation. For this, Lateral Thinking is considered more as a philosophical approach than a model approach, but it contains both. However, it cannot be termed as a creative problem solving approach like it is the case for CPS, Synectics and to a certain degree also TRIZ.[155] Instead it is a way of thinking. Through the embodiment of its model and its various techniques, the mindset of the people who use it changes to a more generative approach instead of the traditional selective approach. In other words, Lateral Thinking changes the worldview of the people who use it from "what is" to "what might be" or "what can be".

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[153] De Bono (1999)
[154] De Bono (1992)
[155] Schweizer (2006)

3.4 DISCIPLINE OF THINKING IN THE THREE APPROACHES

This part of the chapter is a sum up of how the discipline of thinking is practiced in 3 approaches according to their 5 dimensions. The table below shows an overview of how the approaches use the discipline of thinking structured by the 5 dimensions used for the analysis.

	Creative Platform	**TRIZ**	**Lateral Thinking**
Philosophy	State of no patterns Three pillars: "Feeling safe", Concentration and Motivation Knowledge Management	Not based on psychological tools, but uses it widely for directing thinking	Separation of thinking: lateral and logical Self-organising system (break these routine patterns) Long-term change of thinking
Theory	Limiting the boundary in Area of Thinking: Emotional, Experiential, Intellectual and Belief	Focused directions of thinking (one or a few)	Change perception Break patterns
Model	Out of the Sump	Abstraction (creating contradiction) Specialisation (creating specific solution)	Lateral Thinking Logical Thinking
Techniques	Energisers and Offers	Ideality 40 Principles 76 Standards Four main principles	Focus Provocation Movement Challenge
Use	Facilitator	Facilitator	Facilitator & Own

The philosophical dimension of the three approaches is all highly related to the discipline of thinking. The creative platform is to create a state of mind with no patterns. This is what is termed as being "present" This is to control the thinking into a certain state, where memory and knowledge is not affecting the thinking in any way. It is to set the mind free. Therefore it is about "removing" pattern thinking form the thinking of the person. – To put the person in a situation, where it will be impossible to use old thinking, routines, tradition, and "what we have done before" as part of the thinking. However, setting the mind free requires a strict structure in the control of the thinking. This is done through the building up of the three pillars: Feeling safe, Concentration and Motivation. These are all made to change the thinking of the participants in the creative process. This approach also controls the foundation on which the thinking can be made. This is the knowledge management that determines what knowledge will be available to make ideas of in a creative process.

The philosophy of the TRIZ is not based on psychology. Therefore it does not have a base in the cognitive theory. However, even though the base comes from an analysis of patents, the purpose of the tools is to direct the thinking into specific directions. Actually the TRIZ has a very strong steering of the direction of thinking in one or a few direction(s).

The Lateral Thinking philosophy is 100 % based on psychological basement. It is that the mind consists of a self-organising system, which automatically creates patterns in the thinking. The Lateral Thinking is to break with this self-organising system. The core of this approach is to separate the thinking. The lateral thinking is the divergent generation of new ideas. This approach leads to a long-term change in the thinking through structured affection of the thinking itself. In short the philosophy of the Lateral Thinking is to change direction of thinking as much as possible to "look more places" for ideas.

The discipline of thinking is also reflected in the theory of the 3 approaches. The Creative Platform is dealing with the boundary in the area of thinking. This is to direct the thinking out of the emotional, experiential, intellectual and belief boundaries, and hereby setting the mind (free). It will "allow" the participants to think what they would normally never do. The theory of TRIZ is about that it is possible to direct the thinking

into the right direction or right directions already at the start of the creative process. The right direction is defined by historical experiences – on existing solutions. It is chosen from what has solved a similar problem in a different situation. The solution is to found where it has been found before. The Lateral Thinking theory is to perform a continuous change of perception and to break patterns of thinking. This is done through the use of stimuli. The thinking is affected by the stimuli to change the direction of thinking by breaking the pattern thinking as well as changing the thinking completely through perceptional changes.

In the three models of the creative approaches it is also possibly to identify strong relations to the discipline of thinking. The Creative Platform model is to get out of the sump of routine thinking. This is to avoid any logical and analytical driven thinking. It defines how the thinking must be separated from the "rules" of thinking that exists in any system. Once this "out of the sump" has been done the idea generation can take place – not before. The model of TRIZ is to perform 2 modes of thinking. The first mode is abstract. The specific problem goes through a process of abstraction, which makes it possible to identify similar problems elsewhere. In the abstract mode techniques are used to find solutions among historical experiences. The second mode comes through a process of specialisation. Here the abstract solutions that have been found will be put through a specialisation process to create the specific solution to the specific problem. Both steps are a discipline of thinking. Lateral thinking models when to use logical thinking and when to use lateral thinking in a creative process. It is a separation of the thinking both for the focus of the problem, for the idea generation and for the treatment of the ideas. It gives a 3-step model of how to solve a problem through thinking.

The techniques are the tools for controlling the thinking and therefore belong to the discipline of thinking. On the Creative Platform the techniques are the energisers and the offers. The energisers are setting the mind into a state of no patters and therefore kind of make a reset of the thinking. This is to put the participant(s) onto the platform – out of the sump. Once the person is mentally on the platform, the offers are changing the directions of thinking. In the TRIZ approach the ideality technique forces the mind to think only in terms of useful and harmful functions, eventually focusing on the thinking about the harmful functions. The 40 principles and the 76 Standards are guides for finding the correct direction of thinking, while the four main principles are four directions of thinking that hold most of the ideas for solutions that exists. For the

Lateral Thinking techniques the focus and provocation are both changing the perception and breaking patterns of thinking. The movement makes the thinking "concentrated" and the challenge technique makes a long-term change in the thinking itself.

In terms of the use of the approaches it is also highly connected to the discipline of thinking. All of the approaches have the possibility of having a facilitator for controlling the thinking during the creative process. It is also possible to do individual processes controlling one's own thinking, however, the Lateral Thinking is the easiest to use in individual processes.

A main difference between the three approaches is that the creative platform is trying to "remove" the patterns in the mind before a creative process, while the others accept any existing patterns but chose to change them either very deliberately or by random.

The three approaches analysed in this project are highly dependent on the discipline of thinking. In fact it seems like that the underlying base of creative models is to control the thinking of the participants of a creative session. This is the case whether it is a group session or if it is an individual session. The discipline of thinking is created by various means, but all have the same purpose to direct the thinking into certain directions of thinking.

4. THE DISCIPLINE OF THINKING

4.1 The Study of Thinking

The study of thinking in relation to creativity is rarely conducted at traditional universities; however, the study of thinking reaches far back in time. It is often perceived as being founded as a study in the Golden Age of ancient Greece, where studies was conducted to understand inquiry and dialogue.[156] Others perceive the seeds of the study of thinking as being in the Age of Enlightenment.[157] Here the studies were conducted to understand rationality and progress. Today most studies in thinking are conducted to understand critical and creative thinking.[158] According to Beyth-Marom, rational thinking skills are skills for making good choices[159] Therefore creative thinking skills are skills in making good ideas or skills in making many ideas. Whether it is the one or the other is difficult to determine and is being discussed thoroughly in the academic field of creativity. According to Silverstein et al, most of the creative approaches might be good at generating ideas as such, but are destructive to the innovative process in general.[160] The rationale for this can be described in terms of mathematics. Imagine that you have the following: DP = I / S, where DP is the difficulty of the problem resolution, I is the number of ideas, and S is the possible number of ideas that can lead to a solution. In such a situation the optimal point for success will be to get the DP as close to 1 as possible. By reaching 1 means that the ideas found are all valid for finding a usable solution. The higher DP will become the more ideas are found that are not usable for a solution. Silverstein et al find that any increase in the DP equals a similar increase in the difficulty of problem solving.[161] The higher DP the more thinking, hypothesizing, and experimenting is needed to be done before finding a usable solution. Therefore it seems like having creative thinking skills is about making good ideas. By having a low DP makes it possible to have a more direct way to a solution. The discipline of thinking allows for a DP as close to 1 as possible. This is seen e.g. in the TRIZ approach, where the direction of thinking is defined even before the creative process.

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[156] Presseisen (1986)
[157] Presseisen (1986)
[158] Presseisen (1986)
[159] Beyth-Marom, et al. (1987)
[160] Silverstein et al (2001)
[161] Silverstein et al (2001)

Looking at the issue like a metaphor of finding gold in a field can explain the phenomena from a different point of view. Gold in the field is rare and might be isolated. This way it seems like that the Lateral Thinking approach of finding gold might be best. You dig a lot of smaller holes all over the field. The TRIZ make a rational hunch of where the gold is placed, based on knowledge of previous gold-hunts. If the TRIZ have a bad hunch, you will never find gold, since you are only digging the same hole deeper and deeper. The Lateral Thinking goes into a lot of different holes to look for the gold. From this point of view, having creative thinking skills is about making many ideas. However, if the gold is absent across the entire field, then no one direction is obviously best, and the lateral thinking is only giving more confusion than results.[162]

The creative thinking is a skill and several research suggest that thinking capabilities can be improved through instruction and practice.[163,164,165] This fact stresses the importance of thinking in a creative process even more. As it is possible to train the mind in thinking skills, it is possible to gain more control of the creative process and thus becoming more advanced in the task of creativity. This was partly touched in the Lateral Thinking approach, that proclaim to make a long-term change in the thinking. In other words: the fact that you can control the quality of a creative process through the discipline of thinking feeds of a lot of interesting effects.

4.2 The involvement of the mind

Most people recognise that the mind has a major importance in a creative process. De Bono explains according to neurology the mechanism of the mind and how this is important especially to a creative process.[166] Other studies suggest many other elements that connect the mind to creativity. Feist finds that "It is not unbridled psychoticism that is most strongly associated with creativity, but psychoticism tempered by high ego strength or ego control. Paradoxically, creative people appear to be simultaneously very labile and mutable and yet can be rather controlled and stable"[167]. Therefore creativity and the state of the mind like the "self-image" of a person have influence on creativity.

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[162] Perkins (1994)
[163] De Bono (1992)
[164] Ristow (1988)
[165] Presseisen (1986)
[166] De Bono (1968)
[167] Feist (1999)

However, Fiest does not stand-alone with his view on the connection between the mind and creativity. Many other have found similar connections.[168,169,170,171,172] For example did Barron found that "the creative genius may be at once naïve and knowledgeable, being at home equally to primitive symbolism and rigorous logic. He is both more primitive and more cultured, more destructive and more constructive, occasionally crazier yet adamantly saner than the average person"[173]. On another account there have been found evidence of a connection between creativity and variability in physiological measures of arousal. Bowers & Keeling find that "high creativity has been found to be correlated with variability in heart rate"[174]. Since the brain controls the heart rate, there seems to be a close connection to the mind. This can be backed up by the fact high creativity gives spontaneous galvanic skin response and EEG alpha amplitude.[175,176] In sum there seem to be a strong connection between the mind that the tasks of creativity, which lead to the strong importance of thinking in the creative process.

4.3 Perceptional Change

One of the more important areas of creativity that has been found from this study is the structuring and systematisation of the perceptional change. Perception is "the process of using the senses to acquire information about the surrounding environment or situation"[177]. Therefore the purpose of changing perceptions is to discern what might escape or what is not discerned or under normal circumstances. The perception can be changed thinking techniques, but there is limited control of "to what" the perception will change. This means that it is possible to change the perception of one self or others on command, but not possible to change it to a specific road. It is important to understand that it is possible to control when to change perception, and control the direction of thinking, but direction and road is not the same. The direction of thinking is controllable, but the roads are partly controlled by the conscious thinking and partly by

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[168] Barron (1963)
[169] Eysenck (1995)
[170] Fodor (1995)
[171] Richards et al (1988)
[172] Russ (1993)
[173] Barron (1963)
[174] Bowers & Keeling (1971)
[175] Martindale (1977)
[176] Martindale and Hasenfus (1978)
[177] Encarta (1999)

the unconscious thinking. As the unconscious thinking is out of direct control, the perceptional change can seem a bit random, however this is also the strength of perceptional change. With total control of the thinking, the outcome of a creative process will be ideas selected already beforehand by a facilitator or the participant him/herself. Hereby the novelty will be left out. With the unconsciousness part involved in the control of the thinking, it is possible to get perceptions that are not thought of before, eventually coming up with new solutions, ideas, products or likewise.

## Figure 4.A Change of Perception
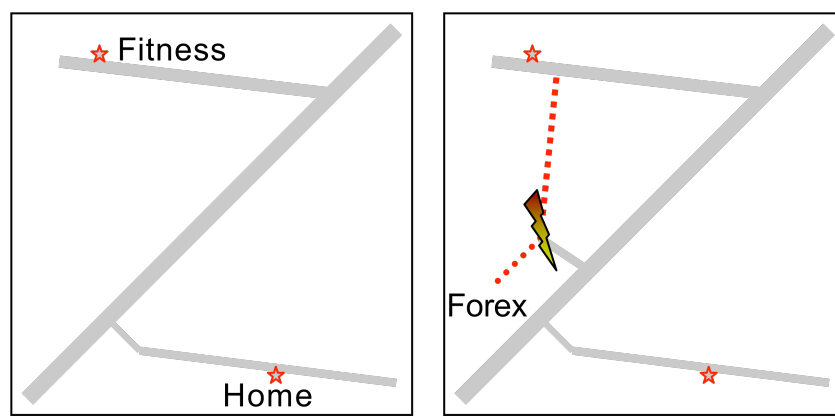
Source: Own work

An example explains the change of perception. In figure 4.A Change of Perception, is shown two images of the same streets in the centre of Aalborg city. When I moved to the city of Aalborg, I lived in the place called "Home" on the image to the left. My fitness centre is the one called "Fitness". Every time I went from Home to Fitness, I took what seemed to be the easiest way for me. This is the one shown in the same image as the only road to go between the two places. It was my perception that this was the optimal solution to go from "Home" to "Fitness" and vice versa. One day after a game of squash I needed to go to a company called Forex (shown in the image to the right as "Forex"). I asked in the reception at "Fitness" and was guided to go along a particular road (shown as the red cut line in the image to the right). When I got to the place marked by the lightning I could see the big road in the middle, which changed my perception on "how to go from Home to Fitness". Suddenly I could see that there is an easier and faster way from "Home" to "Fitness" and back. Some might say that I could have found out the same by trying out different roads or asking for the way. It does not matter: all of them offer a change in perception.

The "trip to Forex" was a stimuli that changed my perception on "how to go from home to my fitness centre". It is a very simple example, but it clearly shows how change of perception can lead to new thinking on a subject.

4.4 Network Activation

The rationale behind the perceptional change can be explained by the theory of network activation[178]. It explains the storage of memories by putting them into a network in the mind.[179] All the memories are connected in a huge network. If one memory is activated, it activates the memories, which it is networked to.[180] Imagine a person getting a stimulus of a Fish. What thinking will be activated by this stimulus? Relevant thinking that might be activated is water, cooking, nice weather and worm. The networking in the mind will then activate more areas. E.g. the thinking of water will activate those it is networked to, like beer, milk or bad weather. The activation of the thinking of the bad weather will active thinking about nice weather, (umbrellas, holiday or hot chocolate etc). The cooking will activate thinking about cleaning, which activates thinking about

Figure 4.B Network Activation
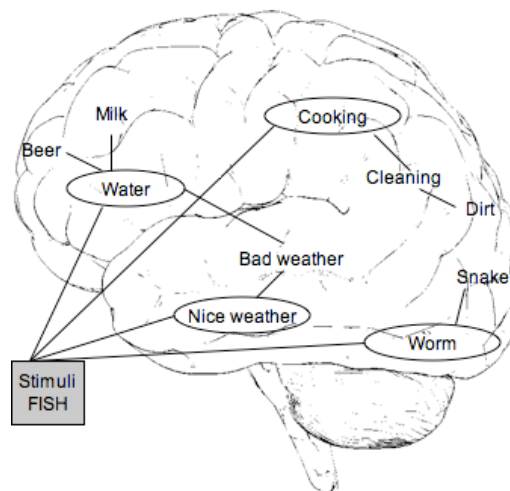
Source: Own work

dirt, while the worm activates thinking about snakes. The network activation is illustrated in figure 4.B Network Activation.

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[178] Gabora (2000)
[179] Gabora (2000)
[180] Gabora (2000)

The activation of thinking as memories do not happen by random. It is happening according to the setup of the network in the specific mind, and this differs from one person to another. That is why two people rarely come up with the same ideas. But it also explains why some people often come up with the same ideas. Students that has been studying the same for e.g. 5 years might find the same solution to a specific problem because their mindset are arranged alike due to their similar studies. The memories that are closest connected to the stimuli in the mind are activated most and the degree of activation is falling according to the distance from the most activated one.[181] However, the choice of thought the person makes, decides what is to be activated.[182] E.g. if the person chose to follow the direction of thinking of water, then thinking of beer is activated and as well is milk and bad weather. Therefore the thinking of milk derives from the stimulus of fish. The person could also chose to take another direction of thinking that might be cooking, which activates the cleaning that will activate dirt. Hereby the stimulus of fish activates the memory of dirt.

This network activation system allows the mind to "move" very far from the stimuli to find an idea for solution. Therefore, even if it is possible to change the direction of thinking by stimuli, it can be difficult to control the roads of thinking. The choice of direction is what De Bono term as Movement – the decision on what move to make / what direction to take.[183] What is out of control is the network activation that happens as a result of the choices made by Movement. According to research by Satzinger it is possible to control the direction of thinking to a very high degree. He finds that "individuals tend to generate ideas that match the paradigm-relatedness of ideas provided to them as stimulation"[184]. This means that the thinking is directly related to the stimulation.

Gabora argues, "Once the subject (person, red) has run out of the more usual associations (e.g. 'chair' in response to 'table'), unusual ones (e.g. 'elbow' in response to 'table') come to mind"[185]. From this it can be argued that the longer a creative session is the more novelty will be found in the ideas developed. This is also backed up by the Danish Technological Institute, which often spends 8 to 16 hours for a creative session

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[181] Gabora (2000)
[182] Gabora (2000)
[183] De Bono (1992)
[184] Satzinger et al (Not Yet Published)
[185] Gabora (2000)

for radical idea generation.[186] In the Lateral Thinking approach exists a tool that makes use of the network activation. It is called the concept triangle[187], and it systematically searches the mind network bit by bit. It takes one minor area of connections at a time and makes the thinking focus on only one of the areas of connection, then go on to the next and so on. The concept triangle is shown in figure 4.C The Concept Triangle. First it identifies the most visible memories in the network. Secondly, it activates these

Figure 4.C The Concept Triangle
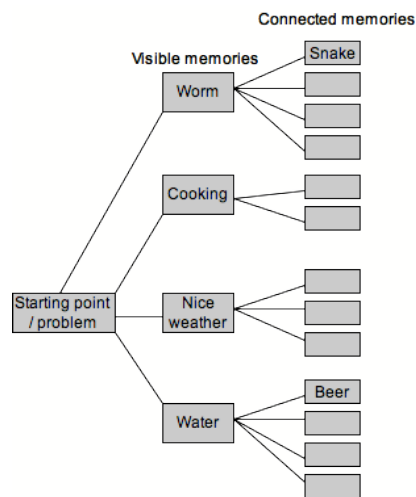
Source: Based on de Bono (1999)

memories one by one. The ideas appear in the respective areas of connections in the network, when it is activated. Basically it is possible to structure the thinking in a creative process to do exactly the same. To go through the mind network, activate one area of connection for idea generation. When satisfied with this area, then activate another area and so on, just like the concept triangle does. Hereby a creative process will be very structured through the use of the discipline of thinking.

4.5 Pattern Thinking

Davis finds that *"The challenge to anyone wishing to increase his or her creativeness is to understand, expect, and be ready to cope with barriers to creativity from the environment or from inside oneself"[188]*. The barriers from inside oneself are to be understood as the patterns of thinking created in the mind. To know the barriers to creativity makes it possible to direct the thinking, thus avoiding these barriers

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[186] Hansen (2006)
[187] De Bono (1999)
[188] Davis (1999)

eventually allow for creative thinking. Therefore Davis is making a call for a discipline of thinking to cope with these barriers. The thinking is naturally controlled by the patterns in the mind. The theory of cognition explains the pattern thinking as blocks.[189] One of the blocks is habituation[190], which is closely related to the boundaries explained in the part about the theory of the Creative Platform. This is strongly engrained behaviour that prevents new perceptions to arise, just like it is the case for pattern thinking. Routine behaviour and routine thinking create the block. Another block is the mental set[191]. This is that one perceives a subject/situation in a specific way without considering new relationships, applications, or uses. This block is created and maintained by a strong belief in logical (rational) thinking, which is what De Bono explains as the "what is" perspective.[192] The snap judgment block is quite similar and is based on the resistance to change.[193] This is that one ignores or not considers new ways of doing as a possibility.

The mind functions as a self-organising information system, where the patterns of thinking are created from the stimuli that a person gets as well as the thinking a person makes.[194] It is important to understand that it is the thinking a person makes, and not the thinking a person has. This is because it is possible to control the thinking by choosing the directions of thinking and by choosing the stimuli to receive. This is the rationale behind the discipline of thinking. The patterns of thinking can be explained by the effects of rain falling on a landscape.[195]
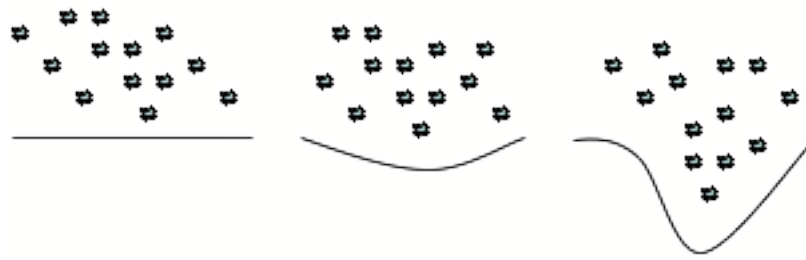
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[189] Adams (1980)
[190] Adams (1980)
[191] Adams (1980)
[192] De Bono (1992)
[193] Adams (1980)
[194] De Bono (1992)
[195] De Bono (1968)

Figure 4.D Valleys of Thinking

Source: Own work

Figure 4.D Valleys of Thinking shows how this is happening. The image to the left shows a landscape where it has just started to rain for the first time, but the rain has not yet hit the ground. The rain is stimuli; while the ground is the mind on which the thinking can flow. Therefore no patterns have yet been created. This can be understood as the mind of a newborn baby. The image in the centre shows the landscape where some rain has fallen and has started to create smaller valleys where the water flows. The rain continues to fall. A valley attracts more rain, and the rain creates deeper valleys thus reinforcing the existence of the valleys. In the image to the right the rain has created deeper valleys. The thinking is flowing on the landscape and thus directed by the valleys created by the stimuli and the thinking. Therefore these valleys are patterns of thinking, Stimuli, like an education, a job or a relationship creates deep valleys that control the thinking to a very large degree. Herby the past and present stimuli determine the thinking. Whenever we see something new or get a new stimulus of any kind, this is channelled through the valleys and organised according to the previous stimuli that has come beforehand. According to the pattern thinking, the connections are made from the valleys. When the rain enters a specific valley, the new rain connects to what is in that valley beforehand and what will come to that valley in the future. The valleys are connected through smaller valleys. Which valleys the rain will fall into, is determined by the relatedness of the new stimuli and the knowledge that exists in the valley. New knowledge tends to connect to similar knowledge.[196] We perceive new situations and new stimuli with a blocked mindset, since we only understand it according to past experience

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[196] Mullen et al (1991)

Figure 4.E Pattern Thinking
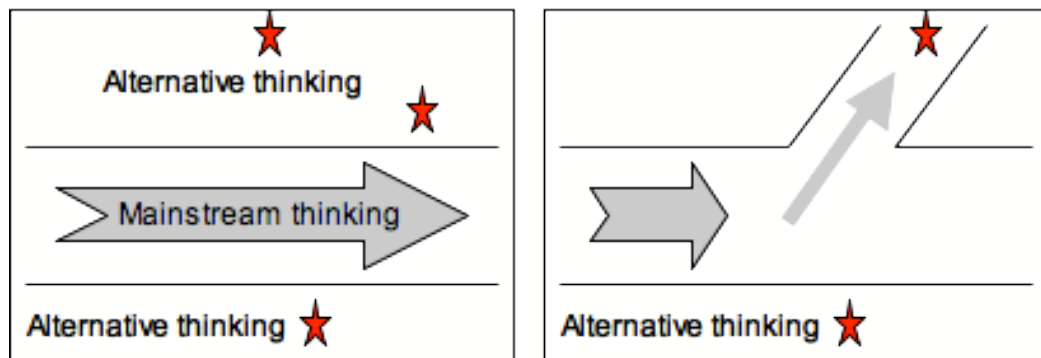
Source: Based on de Bono (1999)

The pattern theory explains why children are often perceived as creative. They have not yet formed the patterns in their mind that make them think "logical". Therefore they perceive things different than adults, who have widely developed patterns in their mind. Through the discipline of thinking it is possible to remove these patterns for a period of time. The Creative Platform terms this as being "Present". This is a state if mind, where the patterns are temporary away.

Figure 4.E Pattern Thinking, shows how patterns have effect on the thinking. The image to the left shows the mainstream thinking, which is created by the patterns in the mind. The patterns exist like barriers around (shown as above and below the mainstream thinking) the (mainstream) thinking and therefore prevent from going into new thinking. The image to the right shows how thinking can be controlled by the discipline of thinking. The mainstream thinking is natural, but creative techniques can lead the thinking into new directions that would normally have been barricaded. Therefore it is possible to make new thinking through the discipline of thinking and hereby develop ideas that would not be possible/visible otherwise.

Pattern thinking is generally a good thing for most thinking. It allows people to perform routine thinking at a speed, which would never be possible without this way of thinking. Imagine deciding what to wear in the morning after the shower. Probably you have about 10 trousers, 15 pair of socks, 15 pair of underwear and 25 sweaters/tops. This gives you exactly **_56.250_** alternative combinations to choose from. If it takes just one minute to test every combination it would take you more than **_39_** days to try out all of them. Most people do not have this kind of time every morning to try out what to wear. That is why pattern thinking is helpful to speed up the routine processes. The pattern thinking puts things together that you normally use as a suit, and show you these

alternatives when you skim through your clothes. The pattern thinking is built up from personal experiences, the environment and similar.

However, when new thinking is needed about a subject, then the pattern thinking is actually a huge constraint, as it limits the thinking to "what we are use to do" or "what we have been told to do" "or what seems close to what we normally do". Therefore there is a need for breaking these constraints or break this pattern thinking, whenever, new thinking is needed. For systematically to break pattern thinking, there have been developed models and techniques that show new directions for thinking and lead the thinking on new roads.[197]

One of the main issues in the pattern thinking is that the mind makes a functional fixation[198]. Functional fixation is that we interpret objects according to their conventional functions. As a consequence of this "we fail to see their potential novel functions" [199]. The problem is that once a conceptualisation of an object has taken place it is very difficult to change it again. It is like working with melted iron. While it is fluid we can work with it, changing the shape and so on. When we have decided the shape, we let it cool down. Once it has cooled down it is very difficult to change it again. The same is it with functional fixation. Here an interpretation of e.g. how to use a belt will normally be fixed in most minds to use it for holding up jeans, by putting it horizontally around the stomach. The fixation can be so strong that any other use of a belt than this would sound strange and will be rejected instantly in the mind. However, breaking the fixation it might be possible to perform the same task by putting it on vertical from between the legs and over the shoulders. Or it can perform other tasks like working as a carry strip: that you put it through the holes of a supermarket bag and put the belt over the one shoulder. Hereby it will not be the hands carrying the bag, but instead it will be the shoulder.

If one try to find a solution to a given problem the thinking takes on a path right from the start. This path is created from the past. It can e.g. be directed from what a person has just experienced minutes, hours or days before, or it can be from previous successful experiences or from general knowledge. Without control, the thinking continues along this path of thinking until a solution is found, eventually finding out that there maybe are no solutions in that direction. Even unsuccessful attempts to find a

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[197] Hansen (2006)
[198] Horowitz (2000)
[199] Hakkarainen (2001)

solution still activate the wrong associative patterns. That is why knowledge is far from enough for performing a creative process. The discipline of thinking is just as essential for finding new ideas for solution.

4.6 Change of Thinking

A subject of high importance for creativity is shortly touched in the Lateral Thinking approach under the Challenge technique.[200] This is the subject of long-term change of thinking. It seems to be possible to learn the discipline of thinking and use it in everyday life for creative thinking on the job, hobby, in the family or similar. This kind of learning will actually be a change of the thinking in general.[201]

This subject is related to a huge issue. It can be discussed whether creative thinking skills cancels out rational thinking skills. They are inconsistent in their very nature. If this is the case then, then any increase in the creative thinking skills will affect the rational thinking skill correspondingly negative. This is important to discuss and do research on as most educational institutions are teaching rational thinking skills. Any teaching in creative thinking skills would then destroy the achievement for teaching in rational thinking skills, and a lot of resources will be wasted. Therefore a solution for having both skills in an organisation or a society is to do specialisation. Some people must learn the creative thinking skills and some must learn the rational thinking skills. What is important to understand here, is that knowledge and rational/creative thinking skills is not the same, and that rational/creative thinking skills are not necessarily an output of knowledge accumulation or knowledge generation. The consequence is that an organisation or a society will need "double knowledge" people. They need two of every knowledge worker; one that has rational thinking skills for administration and one that has creative thinking skills for development.

Looking from another point of view, it might be possible for the mind to handle both thinking skills at the same time. This would involve the ability to switch from one mode of thinking to another according to the thinking that is needed for a specific situation. This is what can be understood as a permanent platform for creativity that can be stepped onto and down from, according to what is needed. Lateral Thinking is through the training and practicing of the model and techniques basically creating a platform, on

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[200] De Bono (1999)
[201] Hansen (2006)

which one can step up on, whenever it is needed.[202] This means that it is possible to "walk around in the sump" in the everyday, but whenever a creative process is needed, it is possible to step up on the platform for the period it is needed. In that sense it can be understood as a kind of a methodology. Once it is learned, it can be used whenever it is needed. You can choose to be creative and you can choose to be rational, just like you can choose to be in the sump (logical thinking) and in the platform (lateral thinking). If this is the case, the problem of having "double knowledge" people will be solved. People will be able to learn the creative thinking skills as kind of a methodology as well as preserving their rational thinking skills.

Maybe the two thinking skills can be combined in some way, eventually becoming complementary in some sense. How to do this will be left as an open question in this project.

4.7 Stimuli

The focus on stimuli in thinking is relevant because thinking tools have shown to be effective from the natural use of them. Several studies have shown that stimuli control the thinking.[203,204,205] Gabora states an interesting comment on thinking, which can be highly related to the field of creativity:

" *There is a saying 'You never step into the same stream twice', and this applies to streams of thought as well as streams of water. At a high enough level of resolution, it is not the exact same memory or concept conjured up time and again; your understanding of it is always coloured by, and reinterpreted in the context of, events that have taken place since the last time you thought of it, and your current goals or desires. For example, right now I am recalling how, last night as I was working on this, my cat Inkling jumped up and fell asleep on my lap. Tomorrow I may retrieve the 'same' memory. But today it is coloured by today's mood, today's events; tomorrow it will be experienced slightly differently. The qualia patterns are not identical. In fact, what is 'retrieved' may be never have been explicitly stored. Next month I might wrongly 'remember' it as having been my other cat, Glimmer, perhaps because I will blend this memory with a memory of Glimmer walking on my keyboard. The mind does not pull*

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[202] Based on Schweizer (2006)
[203] Andersen (1983)
[204] Andersen (1987)
[205] Andersen (1992)

items from memory like mitts from a box, but creatively weaves external stimuli with memories and concepts relevant to the current motivational state. Thus it is more accurate to think of the process as reconstruction rather than retrieval. [206] *"*

Gabora finds is that the stimuli for the thinking that happens all the time, is essential to how we perceive subjects and situations. In other words; stimuli affects the thinking of a subject to a very high degree. The thinking made by a person is constructed partly by the present direction of the thinking and partly by the stimuli. The stimuli explained above happen automatically all the time as we live our lives, thus directing our thinking beyond our control. That is why we can experience this "sudden" feeling. It could be that after a few days of thinking about a problem suddenly the person see a solution. This "sudden" is not by random. It is due to the stimuli that have occurred in the meantime from starting thinking about the problem until the solution is found. . If the same person would have had other stimuli in this "meantime" it is likely that it would have been another solution that he would find. It is clear that there is a strong connection between stimuli and thinking. This is the foundation that makes up the rationale for a creative process; the fact that stimuli are a direct cause (main part of the cause) for the thinking. Therefore the main activity of the creative process is to control and structure the stimuli "presented" to the participants in the process. The causal explanation of stimuli and thinking is the reason for using the discipline of thinking for performing the idea generation of creative processes. There are different ways of creating these stimuli for creative processes. The Lateral Thinking uses highly cognitive techniques to create the stimuli. An example is the Random Input[207]. where the stimuli is random and therefore puts the thinking onto a random direction. In the mind *the concept of 'depth' is stored in memory locations that stored other concepts ranging from 'deep water pool' to 'deeply emotional book'. Similarly, the concept of 'container' does not just activate concepts like 'cup', bag', and so forth; it derives its very existence from them. Likewise, once 'cup' has been identified as an instance of 'container', it is forever more affected, however subtly, by experiences that activate 'container'*[208]. Hereby certain words seem to make the mind associate/change the thinking and thus are stimuli in themselves. If a person gets a stimulus like a shipping container s/he start thinking about a dinking cup. That is why a technique like Random input is so effective

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[206] Gabora (2000)
[207] De Bono (1999)
[208] Gabora (2000)

even though it is very simple. This gives a lot of opportunities in the control of the thinking in a creative process. For the TRIZ the stimuli can be one or more of the 40 principles for inventive problem solving, which are by far not random. On the Creative Platform a very different stimuli can be the change of setting. By moving all participants from the office to a stable a change of perception is created. Interaction between people is stimulation itself. The impact of interaction is widely recognised. Sharing of ideas allows the participants of a creative session to explore a larger space of the idea base. This is because interaction (such as sharing of ideas) is stimuli. The interaction will be further discussed in the part about co-thinking.

4.8 Co-thinking

Many theorists have discussed the rationale of both individual thinking and co-thinking (group sessions).[209,210,211,212] De Bono is fond of individual sessions followed by a group session. His rationale for this is that individuals are more productive – the quantity of ideas is much higher.[213] This tendency De Bono found strong evidence for throughout the creative processes he ahs performed as a facilitator. Hakkarainen explain the co-thinking from a different perspective: "one person's half-baked suggestion resonates in the mind of another and suddenly takes a definite shape"[214]. This is to build on other people's ideas. The idea generation process is an evolutionary process. The idea can be very simple at first, but develop into a more complex and useful idea through the interaction between people. According to the discipline of thinking one idea (as a stimuli) can generate one kind of ideas in the mind of one person, but due to the differences in the pattern of the thinking between people, this very same idea (as a stimuli) might generate different ideas in the mind of another person. Rumerhart et al find co-thinking as a "double up" – that person can compensate each other in understanding and solution-finding, and therefore be able to understand and solve problems that appear incomprehensible to the individual.[215] The co-thinking can also be explained by distributed cognition. Here the thinking is perceived as a resource. This

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[209] De Bono (1992)
[210] Hakkarainen (2001)
[211] Rumerhart et al (1986)
[212] Norman (1993)
[213] De Bono (1992)
[214] Hakkarainen (2001)
[215] Rumerhart et al (1986)

resource is shared socially in order to extend the individual thinking resource.[216] In other words a person can make use of the thinking resources of other people in one owns thinking. It is found that "individual and distributed cognition are in interaction, co-evolve and reciprocally affect each other"[217]. From the general literature it seems as if co-thinking has a positive effect in the idea generation process.

Figure 4.F Individual vs. Group
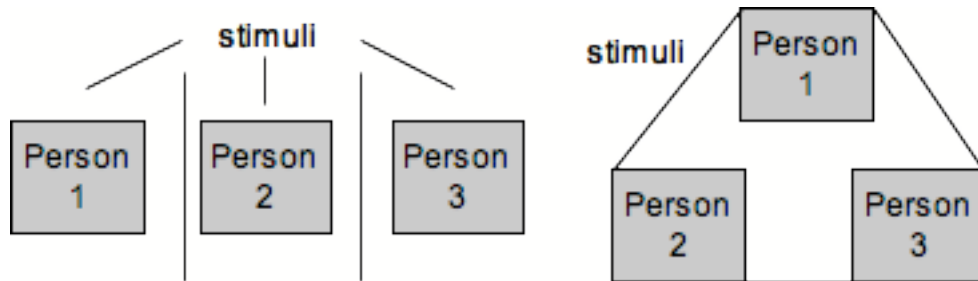
Source: Own work

The discipline of thinking finds that the ideas in a creative process are developed through control of the thinking. This affects the issue of individual versus group sessions in a creative process. A group session will have no difference in the quality or the quantity of ideas from individual processes, if the stimuli of the creative processes are the same. What determine the output are only the knowledge and the discipline of the thinking. Once the knowledge is selected and the discipline of thinking is set in place, then the output is theoretically fixed. Whether you put the persons together or place them individually will have no difference on the output. Figure 4.F Individual vs. Group, illustrates the difference between group sessions and individual sessions. The knowledge is the resource, from which the ideas can be developed. The discipline of thinking controls the process of developing the ideas by browsing through the knowledge base (the different valleys/patterns of thinking). The image to the left shows a creative process where the participants are separated and do not have any interaction. The discipline of thinking is controlled either by themselves or by one or more facilitators. This is also the case in the image to the right, where the participants are not separated thus having interaction. However, the difference is that the participants with interaction have the possibility of affecting the discipline of thinking. This can e.g. be

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[216] Norman (1993)
[217] Hakkarainen (2001)

done through stimuli like sharing the ideas.[218] Therefore there seem to be a difference in the output of the two different approaches to creative sessions. However, giving the theory of the discipline of thinking, it is possible to control the discipline of thinking oneself or by a facilitator. Therefore the group effect can be copied and performed throughout the use of the discipline of thinking. The sharing of ideas can also be done in individual processes by the use of Group Memory.[219] Basically the idea of a group in a creative process, seem to be irrelevant according to the discipline of thinking. Support for this is found in the literature on Group Memory[220]. Tools such as brainstorming have been used for idea development in many organisations. The reason for their primitive, but nevertheless usefulness in idea development, is due to the often mix of knowledge "around the table" (divergence in knowledge of the participants of the session) as well as the indirect, but unstructured control of thinking through idea sharing. In a sense group process can actually have a negative effect on a creative process for radical idea development. This is because research have shown that "external stimuli in the form of an idea will evoke the production of closely related ideas"[221,222,223]. If an individual receives stimuli as an idea from another group member, s/he is likely to develop ideas of the same type. This is prohibiting the development of radical new ideas. However, looking on the other hand the group members most likely has different patterns of thinking. What one person develops of ideas from one stimulus might be very different from what another person develops of ideas from the same stimulus according to the discipline of thinking. Therefore the group might have a positive effect on a creative process for incremental idea development.

4.9 Psychology

The terminology of the discipline of thinking is chosen for getting a more precise title for the context. The field of cognition can explain parts of the discipline of thinking and therefore psychology is very important. The connection is primarily seen in how the discipline of thinking uses elements from the cognition. Ward argues *"to advance the scientific understanding of creativity by adapting the concepts, theories, methods, and*

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[218] Satzinger et al (Not yet published)
[219] Satzinger et al (Not yet published)
[220] Satzinger et al (Not yet published)
[221] Dennis et al (1996)
[222] Maier (1970)
[223] Osborn (1953)

frameworks of mainstream cognitive psychology to the rigorous study and precise characterization of the fundamental cognitive operations that produce creative and non-creative thought.''[224] However, the discipline of thinking is misunderstood if one try to explain it as cognition. Cognition is the study of biology, culture and experiences. Therefore the link to the discipline of thinking is very strong, since this especially focuses on the outcome of these elements. However, they differ on one major part. Cognition is to study of the connection between the behaviour and the mind. It is predicting, describing, and understanding in trying to modify the behaviour of people.[225] The discipline of thinking focuses on the connections, which are established within the mind itself. While the purpose of the discipline of thinking is to control the thinking of a person, the purpose of cognition is to control the behaviour of a person.[226] Cognition has focus on the specific mind and uses an individual perspective. The discipline of thinking is about how the general mind works and not about the individual mind.

4.10 Knowledge

The Creative Platform stresses the importance of knowledge in the creative process. However, is there really a need for knowledge in the creative process itself or is it only important in the innovation process? The point is that in the creative process, the abstraction level in the thinking is very high and therefore it is possible to browse through knowledge that seems irrelevant to find a relevant idea for a solution. Therefore knowledge is important to the creative process. Knowledge is part of the discipline of thinking for two very distinct reasons.

First of all, it is possible to control the direction of thinking in the creative process by controlling the content of knowledge present in the process itself. This is to identify the patterns of thinking necessary and then find the people, who have the patters of thinking as natural thinking (a dentist think as a dentist). Hereby, to a large extent, it is possible to control the output of ideas. If a dentist is participating in a creative process about developing new cell phones, the ideas will be based on the principles, and methods from what the dentist have knowledge about (the dentist industry). The knowledge actually determines the overall foundation from which the ideas can arise. This makes knowledge very central to a creative process as it is also discussed in the section about

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[224] Ward et al (1999)
[225] Encarta (1999)
[226] Gruszczynski (2006)

Network Activation. As it is possible to control the output of a creative process by knowledge management, it is possible to put a question mark to whether it is really creativity or not. The rationale for this is that if the output is controlled, what kind of "new" will then become of the process? Since it is already decided beforehand, can there be any "new" output in the creative process? The knowledge management only determines the directions of thinking that are available to the creative process. It does not decide the output itself, but rather the principles and methods that the ideas can be based on. Therefore it seems like there can come "new" out of a creative process. Having control with the content of knowledge in a creative process is better than having no control of it at all. Leaving the content of knowledge in a creative process to randomness, then the output will also be random, which could lead to a failure. To understand the connection between knowledge and creativity it is possible to perceive the mind as a library. The books in the library are the knowledge of the person. It is possible to reach any of these books and use them for idea development. However, normally the books are divided into sections depending on the content of the books. It could be that there is a section about relationships, one about cooking, one about gardening and especially one or more sections about ones profession. If a person is a carpenter, there will be a section about processing and working with wood. If this person wants to develop new ideas for his carpenter job, he will tend to go to his library and look through the section about the principles and methods of a carpenter job. The irony is that here he will only find what he has already seen, heard about or tried himself as a carpenter. Connecting knowledge to the discipline of thinking it becomes possible to search through the other sections in the library to find new ideas for his job as a carpenter. Therefore the creative process is about directing the thinking away from the library section about the principles and methods in his job as a carpenter.

The second very important reason for knowledge being important in a creative process is that it can have the effect of a barrier to new thinking in the idea generation. At first it might seem irrational to think of knowledge as a barrier to new thinking. After all, knowledge has to be present for new thinking to appear. However, by looking a bit closer to the element of knowledge in a creative process, it might seem more rational. It is not a question if there should be knowledge present or not. The issue is that some kind of knowledge might inhibit the development of ideas in a creative process. Knowledge determines the patterns of thinking of a person, as it is explained in the part about pattern of thinking. This part showed how the patterns are like valleys in the

landscape created by the stimuli from outside and the thinking itself. The problem is that if the library in the mind contains 60 % books about the principles and methods as the job of a carpenter, then the thinking will primarily be about this. When a businessman enters an airplane, he will automatically count the number of seats and multiply this with the average price for a seat. This is because his mind is filled with valleys of economics, and his patterns of thinking will concentrate about the profitability of the flight. An engineer will not think much about the economy, but rather about the construction of the airplane.[227] He might wonder how the wings are attached to the body of the plane. The patterns of thinking are controlled by the knowledge, because the knowledge is created through stimuli. The thinking can be moved from these patterns of thinking by using creative techniques, as shown in Figure 4.G Knowledge & Pattern Thinking. However, the image also shows that the thinking "falls back" to the pattern again after using the technique. This is due to the structure of the thinking. Very fast the thinking will hit one of the valleys and continue along this pattern of thinking again. Hereby it seems like it is very difficult to change the thinking

Figure 4.G Knowledge & Pattern Thinking
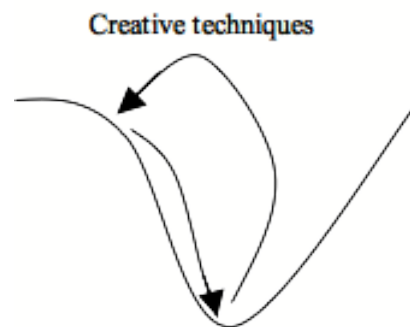
Source: Own work

very much from the major valleys in the mind. Break the patterns of thinking might be of limited effect, if the thinking will return to the valleys. Looking at the broader picture, basically the creative techniques can only move the thinking from one valley to another. Runco and Chand state *"Individuals who rely on details from past experience – even persons who have been innovative in the past – preclude original behaviour. It is another kind of functional fixedness, whereby someone is stuck with one perspective and has difficulty finding new alternative"*[228]. Here they term knowledge as past experience and find that it is preventing thinking "new". Smith et al say that *"although*

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[227] Hansen (2006)
[228] Runco and Chand (1995)

prior experiences can provide the expertise needed to fully explore and develop ideas into creative products, it may be that such experience limits creative thinking when ideas are originally being generated"[229]. According to Smith et al, the expertise is limiting the idea generation. It is therefore important to avoid valleys that consist of the same thinking as a specific problem at hand is about. In other words; a person with extensive knowledge about current technology for cell phones will be very bad for a creative process on cell phones. This is because he automatically will lead his thinking towards the existing principles and methods, and will have difficulty in thinking about other than this due to his valleys – due to his knowledge about these. This means that his knowledge about cell phones is a barrier to generation of "new" ideas in a creative process.

The incorporation of management of knowledge into the discipline of thinking can have extensive consequences for the output. As the TRIZ puts a lot of focus on, the transfer of knowledge from one industry to another is a huge part of creativity. This transfer consists of techniques, principles and methods that exist in one industry/company and have relevance to another industry/company. This link is most likely not visible in rational thinking. However, using lateral thinking the link can be made and the transfer can be put in action.

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[229] Smith et al. (1993)

5. CONCLUSION

5.1 What is creativity with focus on the creative process?

> *Creativity is the bringing into existence of something new. In the creative process it is to develop new ideas.*

The field of creativity can be divided into four sub-categories, which create four focus areas. These are the person, the product, the process and the press. While they cover each their independent element, their overlapping nature makes them cover the entire field of creativity as a whole. This project has its focus on the process. Generating ideas is a core essence of this process, both as the outcome and as part of the process itself. The ideas essential to the process can be anything from traditional to fantasy; however, the ideas for the outcome must contain something new.

Human creativity is universal. Everyone can be creative if they learn how to, either by purpose or by random. To be creative is a professional function comparable to the sale or the purchase functions in a company or the caring function in a kindergarten. Therefore training and education is essential for the development of skills in creativity. Mental liberation and encouragement to be creative is a part of a creative process that often cannot be left out. This alone, though, will only bring forward the ideas that already exist in a system. For a continuous creative incremental development of an organisation, product or process this is good. However, for direct problem solving and for more radical development more is needed. As creative processes often deals with the solving of a technical, physical or human problem, mental liberation and encouragement is not enough. There is a need for methods and techniques of creativity.

Creativity is based on scientifically and practical investigations. The core of the understanding of a creative process is that it can be learned and is a highly structured function. In other words, a creative process is to create a framework where new thinking is led forward. This process can either be formalised be separating it from other tasks and operations, or it can be incorporated into these tasks and operations by changing the natural thinking of the persons involved.

5.2 How do the important approaches of creativity practice the discipline of thinking?

> *The appraoches practice the discipline of thinking by affecting the thinking in creative process. This is done by limiting the boundaries of thinking as well as directing or changing the direction of thinking.*

The 3 approaches practice the discipline of thinking in several ways and for many reasons. Even though they are not all based on a psychological foundation, the 3 approaches are having the purpose of affecting the thinking by one means or another. Philosophically, the discipline of thinking ranges from "setting the mind free" (creative platform), "directing the thinking" (TRIZ), to "continuously changing the direction of thinking" (Lateral Thinking). One of the approaches even goes as far as controlling the base of knowledge available for thinking in the creative process.

Theoretically, the discipline of thinking is to stretch the boundary of thinking for the emotional, experiential, intellectual and belief boundaries to set the mind free. For the TRIZ the direction of thinking is controlled according to the historical experiences, which has proven to solve similar problems. Lateral thinking make use of structured randomness to change and direct the thinking.

The models of the 3 approaches shows how to solve a problem through the use of thinking. The creative platform is to separate the thinking from traditional rules of thinking in the specific system. It is to break free from the boundaries of thinking before starting the idea generation. TRIZ has two changes in the mode of thinking. The first is an abstraction in the thinking about the specific problem. Once it is abstract the idea generation can take place. The second is a specialisation of the ideas that are found on the abstract level. The specialisation will make the relation between the specific problem and the ideas found for solution. Lateral Thinking divides the process of solving a problem into 3 stages as well as separating the thinking on the specific stages into logical and lateral thinking.

5.3 Why does the discipline of thinking affect the creative process in idea generation? The discipline of thinking affects the creative process through the use of perceptional change and by breaking pattern thinking. The most imporatnt tool for the idea generation is the use of stimuli.

The connection between a creative process and the working of the mind is very strong both in terms of neurology, psychology and the characteristics of a creative person, thus making it relevant to discuss it as the discipline of thinking.

One of the major elements of the discipline of thinking is perceptional change. Perceiving a situation or a subject is a limitation of the "whole". Therefore a change of perception offers a possibility to see different parts of the "whole". Therefore perceptional change gives the possibility in a creative process to develop ideas that

would normally not appear by only having one perception on the subject or the situation.

The discipline of thinking is valid for the perceptional change due to the network activation system of the mind. It is possible to activate specific networks in the mind through stimuli, thus making it possible to change perception systematically.

Another of the major elements of the discipline of thinking is to break pattern thinking. Pattern thinking is like a barrier of the thinking to follow what is normal thinking. It blocks for any abnormal thinking. This pattern thinking is perfect for most activities in life, but not for a creative process. Here it is directly destructive. The discipline of thinking offers the possibility to "move" the thinking away from these valleys for a temporary period.

In the long term the discipline of thinking has a major effect on the creative process, as it makes it possible to change the thinking of a person permanently. This is due to the possibility to learn the skill of creativity through practice and training. However, there might be an issue regarding whether creative thinking skills affect the rational thinking skills negatively and vice verse.

The most important element of a creative process is stimuli. It is the foundation of the discipline of thinking in the creative process. A structuring and systemisation of the stimuli makes it possible to control and direct the thinking of the participant(s) of a creative process.

Co-thinking or group thinking is basically only interaction between individuals., according to the discipline of thinking. The interaction is stimuli. Therefore the co-thinking is effective only in terms of the stimuli that happen between the participants. However, the interesting point of these stimuli is that these cannot be controlled and therefore are random. There seem to be a tendency that co-thinking is positive for incremental idea development while individual thinking is positive for radical idea development.

An interesting connection between creative processes and the discipline of thinking is found in the study of knowledge. The project found that it is possible to control the direction of thinking in a creative process by controlling the content of knowledge present in the process itself. This gives relevance to knowledge management in a creative process for creating a foundation on which the thinking can happen. It has also been found that expertise knowledge can have an effect as a barrier to new thinking in the creative process.

5.4 How and why is the discipline of thinking central to the idea generation in a creative process?

> *The main part of a creative process is the discipline of thinking as the idea generation is to do a systematic search for principles and methods in the knowledge present in the creative process.*

The main question of this project asks how and why the discipline of thinking is central to the idea generation of a creative process. However, from the research conducted for finding the answer for this project another point of view might give more sense. It seems like it is more relevant to ask: how and why the idea generation of a creative process is part of the discipline of thinking. What has been found is that the main activity of a creative process is thinking. All other activities than thinking are performed to prepare, activate or control the thinking itself during the creative process.

> **This is because the ideas are to be found in the knowledge (memory, experience etc) of the participant(s) of the creative process. The ideas are found throughout a structured process of activating the knowledge and search for principles and methods to develop ideas for problem solution.**

According to this project the definition for a creative process will be something similar to: "the activity of thinking for bringing into existence one or more new ideas". Hereby it is possible to perform any activity related (e.g. stimuli) to the thinking in the process. This definition of creativity could activate an outcry throughout the different parts of the creative field. Many scholars might argue that there is more than the discipline of thinking involved in the idea generation of a creative process. Most likely they will manage to explain the activities of a creative process from another viewpoint than the discipline of thinking. As well will it most likely be possible to explain exactly the same activities from the viewpoint of the discipline of thinking. Therefore it would be interesting to conduct further research on this issue!

This project has structured the 3 approaches for creative processes: Creative Platform, Lateral Thinking and TRIZ. As well has it created a rational explanation of the activities of a creative process from the point of view of the discipline of thinking, thus taken out the magic and mysterious elements of creativity. Hopefully it will have a positive effect on the academic and practical field of creativity and especially the creative processes performed for any subject or situation.

6. REFLECTIONS

This part of the project will discuss some of the themes that have been found interesting to this project, but have not been relevant to the problem of the project. They will be discussed shortly as they should only give relevant new perspectives to this project.

6.1 Innovation Process

The discipline of thinking finds that a creative process is focused around the activity of thinking, while any other activity performed is done in order to control, prepare or activate the thinking. If a creative process is the development of ideas as it is found in this project, it can be limited to the art of thinking. From this it seems like a creative process is to solve a problem through the art of thinking, while an academic process is to solve the problem through research, and a practical process is to solve it through trial and error. Hereby it would have an obvious position in an innovation process. A creative process would mainly be the first step of the innovation process, however, it would also be used less formal during the other steps. The second step would be the academic research for investigating viability, duability and possibility. The last step of the innovation process is the practical. Here the idea will be tested as a solution in real life. The creative process hereby leaves out any academic and practical activity, thus making it an independent process. It is also possible to relate the creative process to the scientific research. This project is a good example of the use of the discipline of thinking in a scientific research. The project has searched the section of the library that contain information about thinking in order to explain the phenomenon of a creative process.

6.2 Fresh Minds

The discipline of thinking finds that the new ideas come from the "sections in the library" that are not directly related to the problem at hand, as described in part 4.10 about Knowledge. For example is the section about mobile phone technology almost irrelevant for the idea generation process for new technology for mobile phones. This could seem to be in conflict with traditional innovation theories that focus on involving the user[230] or the specialised employee[231] (like involving the shop assistant in the

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[230] Hippel (1975)
[231] Lundvall (1988)

development of new products or new marketing plans). The rationale for the traditional theories is that the user and the specialised employee have extensive practical-knowledge (real life experience) about the problem at hand. The practical knowledge adds new perspectives to the theoretical knowledge that is normally used for most kind of development. This gives sense and is more related to the discipline of thinking than it might seem like at first sight. The change of perception is one of the core elements of the discipline of thinking as it was found in part 4.3 about perceptional change. The involvement of any other person than the theoretical knowledge workers is actually a structured change of perception, if it is used in the right way. Therefore a technique in the discipline of thinking could be exactly this involvement of other people. Even though the rationale is not exactly the same, the technique is. According to part 4.4 about network activation, this technique will only bring forth small incremental development as it is searching a section of the library that is closely related to the problem at hand.

Related to this discussion is the general term of "fresh minds" or "fresh eyes", which can be explained as breaking pattern thinking (see part 4.5 about pattern thinking). Organisations often experience high creative activity when they do job-rotations or get a new employee into the organisation. This is often explained by the organisation as getting something "fresh". This is also used on specific tasks or projects. If a person has worked on a project for a long time without any progress, it is normally found that it helps to put another (fresh) person on the project. This "fresh" can also be explained by the discipline of thinking as the exchange of one library with another (a new person on the project) or an extension of an existing library with new section (a new person into the organisation), thus making it part of knowledge management (see part 4.10 about knowledge).

6.3 Creative Organisation

This project has taken its focus on the discipline of thinking in order to explain the creative process. Basically it finds that the discipline of thinking is the all-important part of the process (see part 5.4). It will be interesting to put it to a challenge if other scholars can disprove the importance of the discipline of thinking. This, however, could turn into a never-ending academic discussion without any final result. However, it would have important spin-off effect from the research in terms of further understanding of the creative process.

An interesting issue is whether innovation is better left without a creative process. Is a formalised creative process really needed in an innovation process?

An alternative to the creative process would be to create a creative organisation. This is that the employees will be naturally creative on the job in all their tasks all day. It would of course require an effective innovation system, where the creativity is channelled through the organisation to the relevant destinations. However, if effective, the ideas developed in a creative organisation might be able to replace the creative process in the innovation process. In order to do so it would require a development of creative thinking skills amongst the employees, which leads us back to the issue: if creative thinking skills have a negative effect on the logical thinking skills as discussed in part 4.6 about change of thinking. If so, the organisation might experience a decrease in the functions where the logical thinking is essential. Hereby the organisation would only have changed from being good at one function to being good at another function, while both functions are essential in a modern organisation. If creative thinking skills do not affect the logical thinking skills negatively, the situation would be different. Then it will be possible to perform all functions effectively including the idea generation without a creative process.

A creative process is a formalisation of the idea development activity. Therefore it is not only effective due to the use of creative models and techniques. It is also an allowance for the participant(s) to be creative. For an organisation to copy this allowance into the creative organisation, it is necessary to create a creative climate. One of the outcomes of continuously running creative processes in an organisation is actually a long-term creative climate. However, a creative climate can also be implemented in a more formalised way. For more information on a creative climate for an effective innovation process see Robinson & Schroeder (2003)[232]. For some kind of creativity it seems like a creative organisation might be able to replace creative processes. However, especially for radical idea generation a creative process seems more effective, as it can be derived from part 4.6 about change of thinking. Also in a situation where idea generation is urgent (e.g. problems that need a relatively fast solution) a creative process seem more effective, since a creative organisation is not focused on a specific problem in its idea generation like it is the case for creative processes.

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[232] Robinson &Schroeder (2003)

Another important factor to distinguish between creative processes and a creative organisation is related to the receptiveness towards new ideas in an organisation. This is often a major problem for an innovation process: that good ideas are developed, but meet no receptivity from the relevant parts of the organisation. In a creative organisation the employees might be very good at generating ideas, but for no reason if the ideas are meet with resistance. The problem often lies with the lack of legitimacy in the new ideas due to the unstructured process of the idea generation and the due to the abstract form of the new ideas. The formalisation of a creative process increases the legitimacy of new ideas and therefore has a positive effect on the receptivity of an organisation.

It is important to understand that having both a creative climate and run creative processes is possible for an organisation. The complementarity of the two modes of creativity might create a synergy effect of high value in terms of better creativity. However, it is expensive and might overlap on several tasks.

6.4 Social Creativity

Some companies perform creative sessions for other firms as a consultancy. Many of these do not use the academic approaches for the running of their processes. A company called "Klods Hans for viderekomne" (Klods Hans) seems not to be making use of the discipline of thinking. The creative process is to teach and practice the participant(s) in three different subjects: the body, the attitude and the language.[233] It is to develop a creative body, creative attitude and a creative language.[234] The "creative body" understands the effects it has on its surrounding and the person itself. According to Klods Hans the moving and the actions of the body have direct effects on both the person in the body and the people around this person. Therefore it is important to make movement and actions with the body that correspond with a creative process. The "creative attitude" is to accept any incoming stimuli as an offer for new ideas as well as to accept any idea as a potential idea. The point is to be positive towards anything new in the creative process. The "creative language" is what is creating the reality to the surroundings and to the person himself/herself. The ideas are visualised primarily verbally and therefore the verbal use is essential for the understanding and for the

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[233] Klods Hans (2006)
[234] Klods Hans (2006)

"aroma" of the ideas. Also similar to the "creative body", the "creative language" has an effect on the people around and the person him/herself.

The approach of Klods Hans is, in many terms, different from the discipline of thinking. The main difference from the discipline of thinking to Klods Hans is the systematisation of stimuli in comparison to the use of random stimuli. The main tool of the discipline of thinking is to systemise and control the stimuli in the creative process (see part 4.7 about stimuli). For Klods Hans there is no control and no systematisation of the stimuli. Instead Klods Hans focuses on making the participants use any stimuli, thus making the stimuli random, but the use of them very structured. In other words, the discipline of thinking has its focus on controlling the stream of stimuli, while the Klods Hans has its focus on controlling the use of stimuli.

The elements of the body, language and attitude are all used in the Creative Platform; however, they are far from the essential part of the idea generation. Rather these elements are the brick stones for building up the platform (see part 3.1 about the Creative Platform). In the idea generation itself, these elements are only having a less central position. The purpose of using these elements in the discipline of thinking is to prepare the mind for the idea generation process (see part 3.4). However, for Klods Hans it is to make the participant(s) accept their ideas and communicate their ideas to their surroundings. These elements are not considered of importance in the Lateral Thinking or the TRIZ approach. In fact, the Klods Hans approach has more similarity to the more long-term view of a creative organisation, as this especially is about communication and attitude.

6.5 Left vs. Right Brain

The biology has given some interesting views on creativity during time, which has not been dealt with regarding the discipline of thinking. Sperry found that the brain is structured into areas of thinking right from the birth of a person.[235] This structure is fixed and does not change over time. The most interesting result of this finding is that the two sides of the brain – the left brain vs. the right brain, can be independently consciously. He also found that each side of the brain are developed differently and therefore have different abilities. The left cerebral hemisphere is logical and verbal, while the right cerebral hemisphere is imaginative and emotional. Herrman used the

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[235] Sperry (1980)

research of Sperry to understand the different areas of the brain and their abilities.[236] He found that the brain is divided into four areas of the cerebral and limbic system consisting of: a theoretical area, an innovative area, an organisational area and a humanitarian area.[237] The interesting area for creativity is the innovative area. This area is characterised by high abilities in holistic, intuitive and integrative thinking. According to these theories, it is possible to make a focused development of a specific area e.g. the innovative area. Hereby it will be possible to develop the innovative area for the person to become more creative. However, it also makes it possible to identify the creative persons from the structure of their brain.

The left vs. right brain theory brings on a different perspective to creativity. According to the discipline of thinking, the knowledge (experience and memory) is an essential part of the understanding of creativity as explained in part 4.4 about Network Activation. It also finds that there are certain issue related to the knowledge present for a creative process (see part 4.10 about knowledge). The left vs. right brain theory does not find the knowledge relevant for creativity. Instead it is the ability to think creative that matters, and this ability is defined by the development of the innovative area of the brain. The discipline of thinking contain methods and techniques for making people creative for a temporary period of time (see part 3.1, 3.2 and 3.3), while the left vs. right brain theory understand the creative ability only as something long-term. In general, though, it seems like the discipline of thinking and the left vs. right brain theory has many supplementary statements for creativity. They agree that creativity can be learned through practice and training. While the discipline of thinking understands the practice and training as a development of a skill like the skill of playing tennis or cooking (see part 4.6 about change of thinking), the left vs. right brain theory find the practice and training as a development of a particular part of the brain. The function of the mind regarding the practice and training is very different, but has the same outcome in terms of effect. This difference in the understanding of the brain has a huge effect on the understanding of the long-term creativity. If the left vs. right brain theory is right, then the creative thinking skills do not negatively affecting the logical thinking skills as they are separated into two different parts of the mind. Hereby this theory supports the notion that it might be better to create creative people rather than run creative processes. The left vs. right brain theory was put under huge question marks when Fink and

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[236] Herrman (1996)
[237] Herrman (1996)

Marshall in 1997 found interesting results from their study of the neural activity. The new add to this left vs. right brain theory is that it is more a matter of the activity between the two sides of the brain rather than it is a matter of the activity in the specific sides of the brain.[238] Hereby the theory seem to match even more the discipline of thinking, as it finds the entire brain taking part of the creative thinking (see part 4.2 about the involvement of the mind).

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