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1. Introduction

1.1. Motivation and Outline

Creativity and innovation have turned into catchwords within the last century. Due to digital developments and the increasing interest in the development of new and innovative products, investigations about creating novelty, problem-solving and creativity have expanded in different research disciplines. Investigations concerning problem-solving and creativity can therefore be seen in the fields of business, art, education and sciences (Runco & Albert, 2010).

Within this master's thesis I am going to immerse in this broad, interdisciplinary field of research, mainly examining ideation during creative work. Creativity is involved in many, of not all, different working tasks. Nevertheless, it is ~~assumed~~ that creative work done by creative professionals such as designers, photographers, architects, artists, writers etc. should be investigated separately. This assumption formed during a small research project, in which Aha! experiences were investigated by interviewing different professionals to find out more ~~about~~ their idea finding processes. During the interviews, I realized that every work is creative to some extent, but creativity in the work of creative professionals has a different significance. In most cases, this results from their ability to access to ~~their~~ own creative processes, being able to reflect and analyze their creativity processes elaborately.

In this master's thesis, the focus is on creative Aha! experiences that are occurring during creative idea finding processes. This research focus includes the assumption that creative Aha! experiences are always occurring during processes of creative thinking or creative problem-solving (e.g. Cross, 1984; Dorst, 2003; Ward, 2011).

Both foci will lead to an examination of current research about Aha! experiences as well as to a description of some of the currently most investigated stances of creativity research.

Apart from conceptual investigations, I will also present a qualitative research project, in which I am interviewing creative professionals about their work with a phenomenological interview procedure called Elicitation Interview Technique (Petitmengin, 2006). This is used to further understand the process of creative Aha! experiences.

Before explaining the research questions and goals, I would like to mention that the reading period for the conceptual part of the thesis showed that there are various different ways of spelling the term “aha experience” (e.g. Metcalfe & Wiebe, 1987; Ohlsson, 1992; Gick & Lockhart, 1995; Gruber, 1995; Reber, Schwarz & Winkielman, 2004; Topolinski & Reber, 2010; Danek, 2014). Due to the fact that there is no universally agreed upon way of spelling, I decided to stick to one writing option that is prosed by Danek et al. (2013), namely “Aha! experience”.

1.2. Research Question and Goal

Due to the fact that Aha! experiences have mainly been investigated in problem-solving research (e.g. Metcalfe & Wiebe, 1987; Ohlsson, 1992; Gick & Lockhart, 1995; Gruber, 1995; Reber, Schwarz & Winkielman, 2004; Topolinski & Reber, 2010; Danek, 2013), the term *creative Aha! Experiences* will be introduced for this master’s thesis because the aim is to investigate *Aha! experiences that occur during creative processes*. Therefore, it is assumed that creative Aha! experiences are emerging during creative processes such as creative idea finding or innovation finding (e.g. Cross, 1984; Dorst, 2003; Ward, 2011).

Although there is an interdisciplinary body of literature about how creative ideas, and therefore creative Aha! experiences, are possibly triggered (Rothenberg, 1979; Finke, 1990; Finke, Ward, & Smith, 1992; Ward, 1994; Mumford, Baughman, Maher, Constanza & Supinski, 1997; Wilkenfeld & Ward, 2001; Ward, Patterson & Sifonis, 2004; Ward & Wickes, 2009; Ward & Kolomyts, 2010), there is hardly any phenomenological research about the experience of creative Aha! moments.

For this reason, I am examining and explaining creative Aha! experiences phenomenologically, investigating the following research questions:

1. *What are creative Aha! experiences?*
2. *What is the process of creative Aha! experiences?*
 - 1.a *How do creative Aha! experiences develop?*
 - 1.b *How are creative Aha! experiences experienced?*

The goal of this master’s thesis is to develop a model about the process of creative Aha! experiences. For that reason the dynamics and experience of creative Aha!

experiences will be investigated and explaining, trying to find out which processes and circumstances enable and facilitate them.

1.3. The Focus of the Thesis: Creative Aha! Experiences

The issue of how new ideas are generated has a long history in philosophy and science. Investigations about creating novelty are going back to ancient philosophy, more precisely to the philosophical dialogues of Plato. In Plato's famous Dialogue with Meno, Plato is paraphrasing Meno's paradoxical assertion as follows: "I know, Meno, what you mean; but see what a tiresome dispute you are introducing. You argue that a man cannot inquire either about that which he knows, or about that which he does not know; for if he knows, he has no need to inquire; and if not, he cannot; for he does not know the very subject about which he is to inquire." (in Jowett, 1937).

In outlining Meno's statement, Plato is referring to the philosophical view that all new knowledge is a recollection of already existing facts that already have been previously learned, in Plato's considerations, possibly also in past lives. In that sense Plato argues that any kind of novelty is based on products or thoughts that are already existing in the present. Thoughts and ideas are remembered and then shifted and rearranged in different ways, which in some circumstances leads to new products and ideas (Bowers, Farvolden & Mermigis, 1995).

Since Plato's early deliberations, a vast body of literature has emerged, investigating ideas and knowledge finding procedures from different perspectives. Although a large number of studies have turned the topic of insight and Aha! experiences over and over, it is remarkable that the generation of new ideas is still seen as a rearrangement of already existing knowledge in the majority of research (e.g. Basala, 1988; Crouch, 1992; Finke, 1990; Friedel et al., 1986; Lubart & Sternberg, 1995; Marsh, Landau & Hicks, 1996; Marsh, Ward & Landau, 1999; Mumford et al., 1997; Scott, Lonergan & Mumford, 2005; Sifonis et al., 1997; Smith, Ward & Schumacher, 1993; Rothenberg 1979; Ward, 1994; 1995; Ward, Patterson & Sifonis, 2004; Ward, 2008; Ward & Wickes, 2009; Ward & Kolomyts, 2010; Wilkenfeld & Ward, 2001).

Nevertheless, investigations about creating novelty have expanded in various ways. During years of investigating the phenomenon, an extensive research field about insight and problem-solving has developed. Within this line of research, Aha!

experiences have been investigated as a part or indicator of insight moments that occur during problem-solving (e.g. Metcalfe & Wiebe, 1987; Ohlsson, 1992; Gick & Lockhart, 1995; Gruber, 1995; Reber, Schwarz & Winkielman, 2004; Topolinski & Reber, 2010; Danek, 2013). In order to describe the actual stance of research about Aha! experiences, I refer to the investigations about Aha! experiences that occur during problem-solving.

Besides describing the actual research stance of Aha! experiences, the thesis also approaches the research field of creativity, due to the fact that it is not about Aha! experiences during problem-solving, but about *creative* Aha! experiences. As already mentioned, I assume that creative Aha! experiences are coming from creative ideas and thoughts and therefore from creative cognition. Accepting this assumption, it is necessary to also look in the research of creative cognition (e.g. Finke et al., 1992; Ward et al. 1999) when trying to understand creative Aha! experiences fully. Within this thesis, largely recognized models of the interdisciplinary Creative Cognition Approach (Finke et al., 1992; Ward et al. 1999) will be described, backing them up with a short excursion into the research field of neurobiology.

1.4. Structure of the Thesis

In order to understand the structure of my thesis, I created the mentioned below figure, which shows how the different parts of my thesis are connected.

This thesis is divided into two main parts. The first part is about the conceptual research period and the second part is about the qualitative research I did for the thesis.

The first part is about conceptually and theoretical investigating Aha! experiences and creativity. Within this part, I will refer to investigations about Aha! experiences and different problem formulations. Although the thesis is located in the field of creativity, it is first going into the research of problem-solving because the literature of Aha! experiences is mainly derived from research about insight problem-solving (e.g. Metcalfe & Wiebe, 1987; Ohlsson, 1992; Gick & Lockhart, 1995; Gruber, 1995; Reber, Schwarz & Winkielman, 2004; Topolinski & Reber, 2010; Danek, 2013). With reference to these investigations, the actual status of research about Aha! experiences is described. Furthermore, the phenomenological research about Aha! experiences (Metcalfe & Wiebe, 1987; Ohlsson, 1992; Gick & Lockhart, 1995;

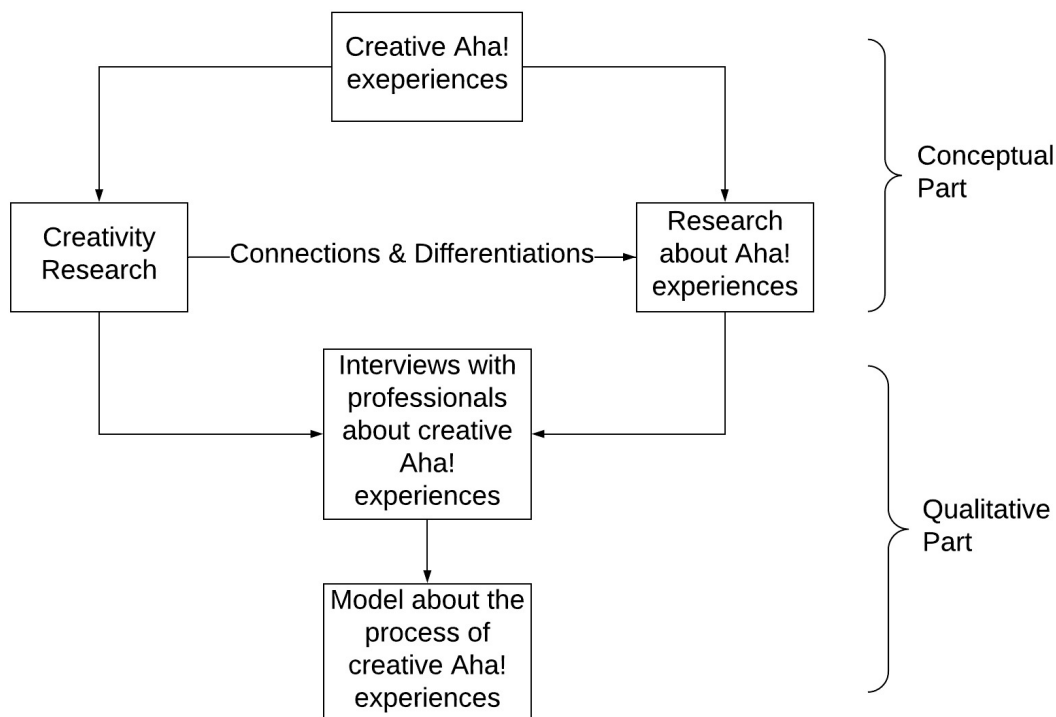


Figure 1. Structure of the thesis.

Gruber, 1995; Reber, Schwarz & Winkielman, 2004; Topolinski & Reber, 2010; Danek, 2013) in problem-solving as well as current research about different problem formulations (e.g. Cross, 1984; Dorst, 2003; Meijers, 2000; Roozenburg & Eekels, 1995; Simon 1973;1978) is explained. The phenomenological research is examined because the interviews will also focus on this perspective of creative Aha! experiences.

Due to the assumption that creative Aha! experiences are a result of creative cognition (Cross, 1984; Dorst, 2003; Ward, 2011), some of the currently most investigated theories in creativity research will be described in the third chapter of the thesis. Within this chapter, I will on the hand refer to the neurobiological foundations of creativity (e.g. Borgen & Bogen, 1969, 1988; Carlsson, 1990; Jausovec, 2000; Kaufman et al., 2010; Mashal et al., 2007; Martindale, 1977, 1989) and on the hand describe the Creative Cognition Approach (Finke et al., 1992; Ward et al. 1999).

In the second part of the master's thesis, the qualitative research about creative Aha! experiences will be examined. Besides explaining the *Elicitation Interview*

Technique (Petitmengin, 2006) that was used for the qualitative research, I will explain the results that emerged out of the interview data. The second part of the thesis will end with a chapter about the discussion of the qualitative research results with actual research findings that have either been already described in theoretical part of the thesis, or will be added in the discussion chapter itself.

1.5. Research Methods

The first part of the thesis is about conceptual research, which includes a chapter about theoretical approaches of Aha! experiences as well as chapter about different theories and models of creativity research. Within these two chapters, different research stances will be presented.

For the qualitative research that will be described in the second part of the thesis, the *Elicitation Interview Technique* will be used. This technique was mainly shaped and conducted by Pierre Vermersch (1999) and then further developed by Claire Petitmengin (e.g. 2006; 2007; 2013).

The technique is designed to enable the interviewer to get access to the cognitive processes of the interviewee (Petitmengin, 2006). The method will be described in detail in the second part of the thesis, nevertheless, I am giving a short introduction in the following.

Petitmengin (2006) explains that in the first step of an elicitation interview, the interviewer tries to make the interviewee remember one certain cognitive experience. Which kind of cognitive experience should be chosen is, in most cases, dependent on the interviewers research question. If the participant has successfully chosen one experience, the interviewer tries to bring the participants cognitively back to the experienced situation through posing selected questions. If this step is successful, the interviewee is able to retrospectively explain the cognitive experience in depth. In order to unfold pre-reflective thoughts, emotions and other cognitive processes, the interviewer has to pose certain questions to the participant repeatedly. The interviewer has to consider different guidelines and principles when using the technique in order to make the interviewee talk about cognitive processes that were happening during the experience.

For the master's thesis, elicitation interviews with designers, artists, photographers, writers and architects are conducted in order to find out about their experiences of creative Aha! moments. All interviews are following a certain

interview guidance that has the goal to gather information and data about creative Aha! experiences. Before the commencement of the actual interview, every participant receives a short briefing that is based on my interview guidance and explains what kind of Aha! experience is required for the interview. Furthermore, the interview briefing contains information about the interview procedure itself and therefore enables the participants to get a feeling for the technique.

The purpose of the interviews is to find out an empirical, phenomenological perspective of creative Aha! experiences. This phenomenological perspective should enrich the third person research about Aha! experiences and creativity that will be presented in the second and third part of the thesis. All results will be discussed in the last chapter.

I. Theoretical Investigations

2. Approaching Aha! Experiences Theoretically

According to the legend about the physicist, astronomer and mathematician Archimedes, he was shouting “Eureka“, meaning “I have found it!“, when he discovered that the displacement of water can be used for calculating density (as cited in Sternberg & Davidson, 1995).

Since then, the expression “Eureka“ or the word “Aha“, have been used in order to express one’s experience of insight. Aha! experiences of different kinds occur constantly in human cognition, such as in situations of language comprehension, memory retrieval, creativity, problem-solving and many more (Sternberg & Davidson, 1995).

Current investigations (e.g. Gick & Lockhart, 1995; Danek et al., 2013) mostly agree on the assumption that insightful solutions always come with an Aha! experience. These insightful solutions can be provoked by different problem-solving scenarios, that make the solver have an Aha! moment when finding a solution for the problem at stake (e.g. Chu & MacGregor, 2011). This results in the fact that most of current investigations about Aha! experiences are found in the research field of *insightful problem-solving* (e.g. Chu & MacGregor, 2011; Danek et al., 2013; Gick & Lockhart, 1995; Gruber, 1995; Metcalfe & Wiebe, 1987; Reber, Schwarz & Winkielman, 2004; Topolinski & Reber, 2010).

For the sake of describing the current stance of research about Aha! experiences, some stances of insight research are described in the first part of the this chapter. Referring to the phenomenon of insight also includes describing concrete insight problem-solving scenarios that are scientifically used for provoking Aha! experiences (e.g. “The Matchstick Arithmetic Problems“, “The 9-dot Problem“, “The Cheap Necklace Problem“ etc.).

This leads to the next subchapter, explaining the status quo of research about the phenomenology of Aha! experiences. All phenomenological studies about Aha! experiences currently available are part of insight problem-solving research (Gick & Lockhart, 1995; Gruber, 1995; Metcalfe & Wiebe, 1987; Reber, Schwarz & Winkielman, 2004; Topolinski & Reber, 2010).

Furthermore, I am presenting different problem-solving scenarios, which are different from traditional insight problem-solving cases. This includes the assumption that the cognitive process of problem-solving is used in various different ways, dependent on the problem case at stake (Chu & MacGregor, 2011). Within the course of this chapter, it is argued that not only traditional insight problem-solving scenarios evoke Aha! experiences, but also problem cases that are more open in terms of structure (e.g. referred to as “ill-defined problems” or “design problems”). These problem cases do need a certain extent of creativity in order to be solved (e.g. Dorst, 2003; Treffinger, Isaksen & Stead-Dorval, 2008; Ward, 2011).

2.1. Insight

The phenomenon of insight is shortly presented because of its interconnection to Aha! experiences. In order to give a diligent overview about the current research about Aha! experiences, it is necessary to explain some stances of the fields insight and problem-solving.

The concept of insight was initially introduced by the Gestalt psychologists, referring to investigations of insight problem-solving (Köhler, 1969; Wertheimer, 1959). Gestalt psychologists Köhler (1969) and Wertheimer (1959) argued that insight problem solving is characterized by two criteria. First, prior experiences aren't considered as a crucial factor in solving the problem at stake. In that sense they pointed out that the processes of transferring past solutions to new problems could lead to deficient solutions. Second, Gestalt psychologists (Köhler, 1969; Wertheimer, 1959) claimed that the reconstruction of a problem in a different way is the key component to finding the right solution. The process of restructuring the problem was understood as changing the perspective towards the problem in a way that is different from the initial interpretation.

Within current investigations, insight is mostly understood as a sudden and unexpected phenomenon that occurs in situations of problem-solving (e.g. Zander, Öllinger & Kirsten, 2016).

In that sense, Smith (1995) explains that insight moments appear when a new solution for a specific problem is finally discovered. Nevertheless, this new, innovative solution can be a result of reconnecting already existing knowledge. Jung-Beeman et al. (2004) are claiming that this insight is mostly occurring in

situations where new connections among already existing knowledge are realized. Information that is stored in long term memory is re-grouped and re-arranged until an appropriate solution is emerging out of it. In that sense, researchers (Jung-Beeman et al., 2004; Ohlsson, 1992) argue that new knowledge is always arising out of already established information.

Researchers (e.g. Gick & Lockhart, 1995; Danek et al., 2013) do not agree if there are any conditions or circumstances that need to be fulfilled in order to be sure that an insight experience has occurred. This uncertainty mainly depends on the fact that there are no physiological markers that indicate the moment of an insight experience. Due to the absence of behavioral markers, scientific analysis can only build on the subjective reports of insight experience. In that sense, Danek et al. (2013) are claiming that the clearest marker of an insight moment is the reported Aha! experience itself.

In the following, there will be a short overview about the research field of insight, starting with intuition and insight. Insight and intuition are strongly interconnected phenomena, which will be described in the course of this chapter. Investigations about their connections and differences with the Remote Associate Test (Mednick, 1967) also show their interconnectedness with creativity.

Furthermore, I will introduce the field of insight problem-solving, stating three concrete insight problem solving scenarios that are often used in current research (Chu & MacGregor, 2011). These cases will be introduced because they provoke solutions that coming an insight moment and therefore also with an Aha! experience (Chu & MacGregor, 2011).

In the last subchapter, current phenomenological research of Aha! experiences will be described. This is be a part of the chapter "Insight" because all phenomenological studies about Aha! experiences are about insightful Aha! experiences that occur during problem-solving (Gick & Lockhart, 1995; Gruber, 1995; Metcalfe & Wiebe, 1987; Reber, Schwarz & Winkielman, 2004; Topolinski & Reber, 2010).

2.1.1. Intuition and Insight

Besides investigations from the field of insight problem-solving, another line of research about insight emerged out of the extensive number of studies about

intuition (e.g. Dane & Pratt, 2007; Kahneman, 2003; Tversky & Kahneman, 1974; Zhang, Lei and Li, 2016).

Epstein (2010) states that the emergence and function of intuition is extensively investigated, hence it is one of the phenomena in cognitive science that has a vast number of different definitions.

Kruglanski and Gigerenzer (2011) explain that generally it can be said that intuitive judgments are understood as easily and quickly coming to the judger's mind. They seem to pop into the mind without any conscious deliberations. Therefore it can be said that intuition captures a fast decision-making process.

Zhang, Lei and Li (2016) explain that the phenomena of intuition and insight are sharing a lot of common facets and are strongly interconnected with each other. They mostly occur in the same situations, where the final outcome is not clear right from the beginning onwards. Despite their strong interconnectedness, it is important to point out that intuition and insight cannot be seen as the same phenomenon. Due to their strong interconnectedness, one of the most influential cognitive tests, the Remote Associate Test (Mednick, 1967), developed. The Remote Associate Test (RAT) is used for studies about insight and intuition, also investigating the differences of these phenomena. Additionally, the test is ~~abused~~ used for investigations about creativity.

It is not clear how the process of intuition should be assessed which leads to different opinions about the usefulness of this construct. Some researchers (eg Tversky & Kahneman, 1974) argue that intuition could be nothing more than a useless construct that leads to a high frequency of wrong decisions. This concept of intuition is mostly denoted as the heuristics-and-biases approach.

In contrast, other scientific analysis (e.g. Gigerenzer & Todd, 1999) promote the fast-and-frugal-heuristic approach, which regards intuition as a positive and useful human function. Within this concept intuition is understood as a fast form of analytic reasoning, which enables humans to make quick decisions when there is no time for extensive analytical reasoning.

Furthermore, it can be said that intuition is often defined in terms of what it is not. In that sense many researchers (e.g. Epstein, 2010) argue that intuition is a form of information processing that is different from analytic reasoning. Hence, Myers(2002) explains that intuition should be seen as the ability to get fast knowledge and insight without analytical reasons.

Researchers (Dane & Pratt, 2007; Tversky & Kahneman, 1974) explain that unconscious knowledge processes are playing a fundamental role during intuitive decision-making processes. During such procedures, unconsciously activated information is evoking an intuitive judgment procedure, which mostly results in yes/no decisions.

Zhang, Lei and Li (2016) propose that intuitive judgments are different from deliberative judgments in terms of their content. In that sense, intuitive judgements are primarily concerned with the question of whether there is a solution or not, in contrast to insight processes, where the content of the decision is mostly seen as the determining factor. In other words, insight concerns what the solution is all about, whereas intuition only reveals if there is a solution available.

Kahneman (2003) explains that further criteria, which often decide which kind of decision making-process is chosen in a certain situation, are time and availability of information. Intuitive decisions are often made quickly because of a limited amount of time or missing information.

Insight moments on the other hand, are occurring in situations where individuals are *experiencing complex situations*, in which they don't know how to proceed. For that reason they are making a great effort in order to find a solution for the problem at stake (Ohlsson 1984; Knoblich et al., 1999).

As already mentioned above, the differences between intuition and insight have often been investigated by a scientific analysis method called the Remote Associate Test (Mednick, 1967). Over the years, the RAT was used for investigating a number of cognitive processes, such as creativity, insight, problem-solving, memory and intuition (Mednick, 1962; Bolte & Goschke, 2005; Topolinski & Strack, 2008, Smith et al., 2013). The original form of the RAT by Mednick and Mednick (1967) consists of 30 items. Each item is a word triad which is made up of three words that are building an associative cluster. The goal of the test is for participants to spot the remote associate, which is a fourth word that is connected to the triad. It is argued that the Remote Associate Test is not only investigating the difference of intuition and insight processes, but also pointing at a connection of intuition and creativity. One example of the RAT by Zhang, Lei and Li (2016) would be the triad "night - wrist - stop", which has the solution word "watch".

Bolte and Goschke (2005) explain that within RAT analyses about intuitive judgments, participants were forced to find the solution word within a limited time

(1 or 2 seconds) in order to avoid analytical reasoning. On the contrary, there were also other RAT testings concerning insight or creativity that left participants with more time in order to enable them more time for reflections.

2.1.2. Insight Problem-Solving Scenarios

Insight problem-solving is a widely investigated topic in Cognitive Science (Chu & MacGregor, 2011). Chu and MacGregor (2011) explain that experiments examining problem-solving are mostly working with so-called *insight problem scenarios*, which should evoke insight moments, and therefore also Aha! experiences, when having solved them. It is important to point out that individual experiences of insight are idiosyncratic, meaning that they are dependent on one's personal experience. In other words, an insight experience scenario for one person, might be an everyday scenario for another person. For example, a person can have an insight experience when finally being able to put a given set of furniture in a room without blocking the door, whereas this might be an everyday step-by-step procedure for someone else.

As already mentioned above, insight and problem-solving have been interconnected in research since its first investigations of Gestalt psychology (Köhler, 1969; Wertheimer, 1959). One of the most influential and still accepted theories about problem-solving was established by Newell and Simon (1976). Newell and Simon's theory, which is based on protocol studies, states that the solver is confronted with the start condition of the problem and tries to find a way to reach the goal state.

Newell and Simon (1967) explain that the problem-solver's understanding of the problem-solving scenario and its desired changes that should ideally lead to a solution, can be summarized within a mental space that is referred to as a *problem space*. The problem space, described as a graph-like structure, encompasses possible actions within the problem scenario as well as problem relevant environmental factors. Within the graph, the nodes, called knowledge states, are standing for all possible situations a problem-solver is including in his or her deliberations. The arcs or operators that are connecting the nodes, are illustrating the problem solvers actions, that are changing the problem scenario. Problem-solving is therefore understood as the process of searching a chain of operators that is continuously going from the current to goal state.

In the following, I am shortly introducing three famous insight problems-solving scenarios that have been extensively investigated (Chu & MacGregor, 2011). In my thesis I am assuming that that insight moments are accompanied by Aha! experiences (Chu & MacGregor, 2011; Danek et al., 2013; Gick & Lockhart, 1995; Gruber, 1995; Metcalfe & Wiebe, 1987; Reber, Schwarz & Winkielman, 2004; Topolinski & Reber, 2010). Therefore I am referring to problem cases that are known to be solved with insight moments, and therefore also with an Aha! experience (Chu & MacGregor, 2011). Which of those problem solving scenarios are used for problem solving investigations is dependent on the paradigm researchers are investigating (Chu & MacGregor, 2011).

The Matchstick Arithmetic Problems

The Matchstick Arithmetic Problems have played an important role in experiments concerning the Representational Change Theory (RCT) (e.g. Ohlsson, 1992; Sternberg & Davidson, 1995; Knoblich et al., 1999). The Matchstick Arithmetic Problem instructs participants to move one of the matchsticks in order to make an equation true.

Reseachers (e.g. Ohlsson, 1992; Sternberg & Davidson, 1995; Knoblich et al., 1999) that are advocating the RCT are claiming that the deficient, initial representation of the problem is changing during the process of problem-solving until the final solution is “found“. Due to this model, an insight Aha! experience is occurring as a product of *representational change*. Testing the hypothesis of the RCT model, experiments were investigating the factors of constraint relaxation and chunk decomposition while participants were trying to solve the Matchstick Arithmetic Problems (Knoblich & Öllinger, 2006).

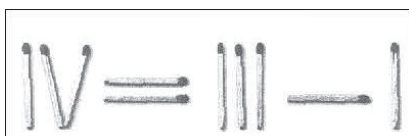


Figure 2. A Matchstick Arithmetic Problem. Reprinted from “Human Performance on Insight Problem Solving: A Review” by Y. Chu and J. N. MacGregor, 2011, *The Journal of Problem Solving*, 3(2), 122.

Knoblich and Öllinger (2006) explain that the factor constraint relaxation refers to the process of releasing unnecessary, constraining information about the problem

formulation. Concerning this problem, constraint relaxation is happening when the participant is realizing that he or she is not only able to move the matchsticks in the form of roman numerals, but also in a way to make them operators (+,-,=). After constraint relaxation has occurred, the participant is usually realizing the solution quickly. Chunk decomposition is referring to the process when the participant is changing the representations of the problem in his or her mind. That means that perceptual chunks, in this case for example roman numerals, are changed and recombined into different, ideally more productive, representations. Experiments showed that problem-solvers generally don't think of changing the matchsticks that are operators because they seem to be unchangeable. If the problem is solved, which means that the initial representations of the participants are changed, constraint relaxation and chunk decomposition are happening unconsciously.

The 9-dot Problem

Another problem formulation that has often been used for investigations about insight problem-solving is the famous 9-dot problem. The 9-dot problem requires the participants to connect all 9 dots with 4 straight lines without lifting the pen once from the paper during the connecting process (as cited in Chu & MacGregor, 2011).



Figure 3. The 9-dot problem. Reprinted from "Human Performance on Insight Problem Solving: A Review" by Y. Chu and J. N. MacGregor, 2011, *The Journal of Problem Solving*, 3(2), 123.

The 9-dot problem was mainly used for investigating an insight problem-solving approach called the Criterion for Satisfactory Progress Theory (CPS), which states that the problem solver is continuously comparing the current state of problem solving with the goal state (Chu, Dewald, & Chronicle, 2007). The CPS theory assumes that if the solution approach which the problem solver is continuously comparing fails, another approach is tested until the final solution is found (MacGregor, Ormerod & Chronicle, 2001).

The Cheap Necklace Problem

The third famous insight problem-solving scenario is the Cheap Necklace Problem (CNP). The CNP has also been investigated within the Criterion for Satisfactory Progress theory (Chu, Dewald, & Chronicle, 2007). Within the CNP problem scenario, the participant is left with the task to form one complete necklace out of four complete chains that contain 3 links each. Some of the links have to be opened or closed in order to connect all twelve links. The participant has 15 cents available for the whole process, costing 2 cents to open a link and 3 cents to put it back together (as cited in Chu & MacGregor, 2011).

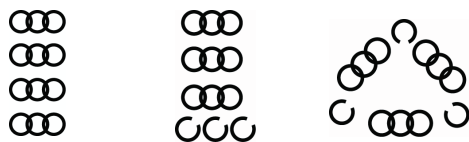


Figure 4. The Cheap Necklace Problem (CNP) in its initial state and in the solution state. Reprinted from "Human Performance on Insight Problem Solving: A Review" by Y. Chu and J. N. MacGregor, 2011, *The Journal of Problem Solving*, 3(2), 124.

Besides the aforementioned insight problems, there are of course many more scenarios in similar styles that provoke insight Aha! experiences. Although insight experiments have mainly been working with such scenarios, all of the existing formulations are limited. Firstly, it is not clear if those problems absolutely require insight experiences or, if they can also be solved without an insight experience (Weisberg, 1996).

Secondly, Fleck and Weisberg (2004) point out that there is not any knowledge of possible relationships between the problems. That means that it is not entirely clear if there are certain subsets of insight problems or if they are all unique. Information about possible relationships between insight problems would be important because it would provide information about the comparability of the scenarios.

Lastly, MacGregor & Cunningham (2008) state that the insight problems that are available now are very limited in number. Additionally, mostly all of them are quite different in content, materials, level of difficulty as well as in their presentation to the problem-solver.

Despite all of these arguments, the introduced problem scenarios show problems that typically provoke insight moments and therefore also insight Aha! experiences. These kind of insight Aha! experiences have also been investigated from a phenomenological standpoint (Gick & Lockhart, 1995; Gruber, 1995; Metcalfe & Wiebe, 1987; Reber, Schwarz & Winkielman, 2004; Topolinski & Reber, 2010), which will be described in the next subchapter.

2.1.3. The Phenomenology of Insight Aha! Experiences

In the following the phenomenological research about Aha! experiences will be described. As already mentioned above, all phenomenological investigations about Aha! experiences have been done in the field of insight problem-solving (Gick & Lockhart, 1995; Gruber, 1995; Metcalfe & Wiebe, 1987; Reber, Schwarz & Winkielman, 2004; Topolinski & Reber, 2010).

Chu and MacGregor (2011) state that before a problem-solver is finally reaching an insightful solution with an Aha! experience, he or she was already experiencing a process of inner change. In most cases problem-solvers are feeling stuck in the situation of problem-solving, looking at the problem scenario without getting back and forth. People are turning the problems over and over, but they are not able to find the solution yet. At this point the problem solvers feel frustrated, not being able to get the solution. They usually stop searching for the solution shortly, because their thoughts are now circling around possible impasses and they don't know which other solution approaches they should try. If the problem-solver is going on with the process, at some point he or she usually realizes the right solution approach for the problem. After a few rounds of trials where the solution approach is put upside-down, the final solution is found with an Aha! experience. If the problem-solver is not able to leave the stage of possible impasses behind, he or she might also stop during the problem-solving process, focusing on other matters.

Segal (2004) explains that this often results in a period of incubation, which means that there are no mental efforts towards the problem. Incubation is referring to a time span in an insight problem-solving process that is basically a break from actively engaging in solving the problem. Within the stage of incubation, the problem-solver is doing no activity at all. That means that he or she is neither

addressing the problem, nor distracting him- or herself with something else. Literally nothing is happening during the break.

Segal (2004) further states that the incubation time in-between serves as a time span that leads to a change from the influence of the wrong assumptions towards the problem that have been created during the preceding-problem solving process. The incubation break enables the problem-solver to apply new, organizing assumptions when returning back to the problem scenario. Research showed, that taking a break improves the problem-solvers performance in the solving the problem, which again could lead to an insightful solution accompanied by an Aha! experience. Interestingly, it is not important how long this incubation break lasts, as long as it is part of the solving process.

According to research (e.g. Metcalfe & Wiebe, 1987; Metcalfe & Wiebe, 1987; Gick & Lockhart, 1995; Gruber, 1995), the main characteristics that accompany every Aha! experience in insight problem-solving are *suddenness*, *surprise*, *ease*, *positive affect* as well as *truth* and *confidence*.

In the following these factors are explained in more detail, following up with a short excursion into the topic of *processing fluency* (Reber, Schwarz and Winkielman, 2004; Topolinski & Reber, 2010).

(i) Suddenness

Metcalfe and Wiebe's investigations (1987) showed that insightful solutions are experienced suddenly. They compared warmth ratings during solution processes of numerical insight- and of numerical non-insight problems. Participants were asked to rate their progress in solving a problem by describing their "*feeling of warmth*" concerning the distance to the actual solution. The experiments showed that the warmth ratings stayed overall stable when participants were exposed to an insight problem until the actual Aha! experience occurs. The moment when participants experience the Aha! moment, the ratings rise drastically. Metcalfe and Wiebe (1987) concluded from this finding that the abrupt experienced change of warmth is a reflection of the suddenness in which Aha! experiences occur.

(ii) Surprise

Among others, Gick and Lockhart (1995) point out that Aha! experiences occur surprisingly as well as suddenly, *popping into the mind* without expecting them.

They explain their hypotheses in stating that the moment of insight comes mainly with a shift of representations. This means that the surprising effect of an Aha! moment arises from a difference between representations, meaning that ~~in~~ the representation is different from the representation that will solve the problem. It is not proven that insight problem-solving is dependent on a shift in representations or if this phenomenon can be explained otherwise. Nevertheless the factor of surprise is generally agreed upon.

(iii) Ease

Besides from the fact that Aha! experiences occur suddenly, Metcalfe and Wiebe (1987) as well as Gick and Lockhart (1995) explain that they are also processed with ease. This refers to the fact that no matter how difficult the process of problem-solving was, the final solution is experienced with ease.

(iv) Positive Affect

Gruber (1995) explains that the experience of insight leads to a genuine positive affective response. Nevertheless, the *feeling of pleasure* should not be ~~confused~~ with a possible feeling of pride after the assessment of the idea or the solution.

(v) Truth and Confidence

Gick & Lockhart (1995) explain that after an Aha! moment was experienced, the person who had the experience is convinced by the truth of the trigger of the experience. This emerged conviction leads to a confident state of mind that facilitates further actions.

Processing fluency

Proceeding from the above stated categories, recent investigations in the field of Cognitive Science have identified *processing fluency* (e.g. Reber, Schwarz & Winkielman, 2004; Topolinski and Reber, 2010) as a pivotal factor of Aha! experiences. It is argued that processing fluency is the factor that connects all other categories of insight experiences.

Reber, Schwarz and Winkielman (2004) explain that processing fluency is described as an experienced state that facilitates the integration of all components of insight. Therefore, processing fluency is understood as the *ease with which*

information is processed in a cognitive system. Furthermore, processing fluency could influence perceptual input, inquiry of memorized information or semantic representations positively.

Topolinski and Reber (2010) suggest that Aha! moments, which are exhibiting processing fluency, are triggering positive affect as well as confidence in ~~the~~ Hence, they are proposing a unifying account in which *processing fluency acts as the glue between all other experiential features*. When an Aha! moment is experienced during a solution finding process, information concerning the problem scenario can be processed more fluently than before. The change in processing fluency results are threefold. First, the increase in fluency leads to an increase of experienced positive affect. Second, the participant's rating of judged ~~the~~ increases and third, participants are feeling much more confident about the solution. Therefore, they are arguing that processing fluency unfolds the connection between the different experiential features of Aha! experiences.

2.2. Insight and Creative Problem Solving

Concluding from the previous section, the research field of insight is extensive but not distinct. Until now, the majority of research assumes that *insightful solutions of any kind are always coming with an Aha! experience* (e.g. Gick & Lockhart, 1995; Danek et al., 2013). Some investigations are even going one step further, stating that the only clear marker for insightful solutions is the occurrence of an Aha! moment (Danek et al., 2013). On the other hand, there are also investigations that claim that insight moments do not necessarily come with Aha! experiences, rather distinguishing themselves through other factors (Klein & Jarosz, 2011).

As already stated above the majority of current literature is based on the assumption that insight solutions are always accompanied with an Aha! experience. This leads to the question of which other situations could possibly lead to insight moments (Ward, 2011)? The previous subchapter already showed that there are certain problem-solving scenarios that are especially designed to create insight experiences (e.g. "The Matchstick Arithmetic Problems", "The 9-dot Problem", "The Cheap Necklace Problem"). Ward (2011) explains that the typical insight problem-solving cases used in research are quite narrow and can only be rarely applied in real-world settings. This limitation leads to further investigations of different problem types that are occurring during real-world situations. Among

investigations of political, societal and personal problem cases, creative problem-solving scenarios have also been examined.

In the following sections, different problem types are introduced, giving an overview about approaching problem type categorizations. This will result in a description of the differences and connections of the phenomena; creativity and insight.

2.2.1. Insight- and Noninsight-Problems

A common way of characterizing problems is the distinction of *insight and noninsight problems*. Generally it can be said that solutions for insight problems are coming with an Aha! experience (e.g. Gick & Lockhart, 1995; Gruber, 1995; Metcalfe & Wiebe, 1987; Reber, Schwarz & Winkielman, 2004; Topolinski & Reber, 2010; Ward, 2011).

Ward (2011) explains that insight problems are generally considered as problem cases that require that a problem-solver is restructuring the information of the problem case in order to find the right solution. Within this process of restructuring information, the solution is found when the problem-solver is having a moment of realization about the problem.

Ohlsson (1992) proposes that insight problems are encompassing three different categories of restructuring. First, he identified *elaboration*, which describes a restructuring process that mainly entails adding up information to the original problem case. Second, he states the process *re-encoding*, which means that the problem elements are reinterpreted. Finally, Ohlsson (1992) explains that constraint relaxation often leads to a solution, because unnecessary information about the problem scenario at stake is dropped.

Metcalfe and Wiebe (1987) explain that algebra or logic problems are generally considered as noninsight problems because they are solved through a tedious process, that progresses step-by-step. This difference of processing the problem was measured in the warmth ratings study by Metcalfe and Wiebe (1987), which is already mentioned above. When insight problems are solved, the warmth rating of a participant is increasing suddenly until the solution is found. In contrast, when solving an noninsight problem, the warmth rating is increasing more steadily.

Ward (2011) explains that there are currently two interpretations of the knowledge about insight and noninsight problem-solving. First, it is argued that *insight*

problem solving does not require a search through the problem space in the sense of Newell and Simon, which leads to the fact that the *solution appears suddenly*. Another interpretation is that insight as well as noninsight problem-solving arises through an *incremental progress*, but this step-by-step procedure is only consciously realized in noninsight problem-solving.

The short excursion into problem-solving scenarios above offers a little sense of what insight problem-solving is targeting. The question of which classification criteria do make a problem an insight problem remains still open. Chu & MacGregor (2011) explain that due to uncertainty about insight and noninsight problem-solving processes, it is not entirely clear if there is something special about insight problems compared to other problems. If yes, researchers are not sure what it is.

Ward (2011) goes on explaining that insight problems have also been used in experiments for investigating certain aspects of *creativity*. These kinds of insight problems used for experiments, i.e. the two-string problem, are usually solved through very simple solutions that often involve a trick. Problems used for testings are usually having one right solution, which is only to a limited extent useful for investigations about creativity. This leads to the fact that creativity research is generally proposing that *investigations about creativity* should work with problem scenarios that are *not as strongly defined and more open-ended*.

2.2.2. Well-defined and Ill-defined Problems

A common distinction in problem types is between well-defined and ill-defined problems (Simon, 1973; 1978). This differentiation is especially important in the field of creativity research. *Well-defined* problems are having a defined start and goal state, as for example arithmetic problems. The starting point is generally accurately specified as well as the procedures that should be applied in order to reach the goal state. On the other hand, there are *ill-defined* problems, which have neither a defined starting point, nor a clear goal.

Ward (2011) explains that examples would be scenarios such as what to do with your life, how to solve world poverty or how to create art that will have a long-lasting effect on culture. Besides from the fact that start and goal state cannot be defined clearly, it is also completely open as to which procedures one could use in order to work towards a solution. Ill-defined problems are often used in order to

define and investigate problems for creativity research. Writing a poem, designing a website or creating a piece of art are generally understood as ill-defined problems that need creativity to be solved. In addition, it is emphasized that creativity could also be usefully applied in situations that are more defined than the previous ones. Nevertheless, it is often stated that creativity cannot be applied to typical well-defined problems because the start and the goal state are defined, which hampers creative thought. On the other hand, ill-defined problems with their open problem spaces are thought to encourage divergent thinking, which is mostly understood as a marker for creativity.

However, Ward (2011) states that this differentiation should be discarded because creativity is about rethinking a situation and therefore about *defining a problem space in new way*. Accepting this hypothesis would imply that creative acts would have the power to change an ill-defined problem into a well-defined one.

2.2.3. Creative Problem Solving

Another approach in defining insight problem-solving and creativity is the so called Creative Problem Solving (CPS) theory, which targets at determining the ideal ways of representing problems, before actually solving them (Osborn, 1953).

Treffinger, Isaksen and Stead-Dorval (2006) explains that the Creative Problem Solving theory, which strongly developed within the last years, consists of three main stages, starting with the problem defining stage. This initial phase is again divided into three substages, starting with *a) stage finding, mess finding, or constructing opportunities*. The next substage is considered as *b) fact finding or exploring data, defining what is already known about the problem and what isn't*, finally followed by the last stage *c) problem finding or framing*. During the whole first phase, it might happen that an ill-defined problem becomes a rather well-defined one. In the second phase, the problem-solver goes through a process of idea finding or idea generation that might result in possible solutions. The final stage, which is about the preparation for an action, is again divided in two substages. The first substage is about the development of a solution. Problem-solvers choose and refine a certain solution out of a many possible ones. In the final step, people are trying to find ways in order to raise the acceptance for the chosen solution among others.

Treffinger, Isaksen & Stead-Dorval (2006) go on to explain that within ~~ts~~ approach, creativity and creative insight are considered as something predictable. For this reason the CPS is often applied in cooperative settings, where there is a strong need to produce something. However, within this approach it is not entirely clear where the actual moment of creative insight is happening, or if it is happening at all. It could be argued that the found solution is rather a result of intense reflections than a product that arose out of an Aha! experience.

2.2.4. Design Problems

Within the research fields of problem-solving and creativity, a line of investigations about *design problems* has evolved over the last 30 years. The resulting design methodology describes design problems usually as *ill-structured* or *wicked problems* (e.g. Cross, 1984; Dorst, 2003; Roozenburg & Eekels, 1995; Meijers, 2000), which goes *in the direction of well-defined and ill-defined problem-solving* (Simon, 1973; 1978).

In that sense, design problems are usually described as indetermined problems, which means that design problems are so called open problems (Dorst, 2003). This indetermination unfolds in two different ways: First, a description of a problem space is never complete when it comes to possible needs, requirements and intentions of the problem (Roozenburg & Eekels, 1995). Second, 'needs, requirements and intentions' of a problem space belong to a different conceptual field than 'structures' of the problem. (Meijers, 2000). Both indeterminations together make a large difference between the design problem the design solution. Nevertheless, designers usually overcome the difficulties step-by-step, using different design techniques (Dorst, 2003).

Dorst (2003) explains that besides the fact that design problems are *mostly indetermined*, they also *cannot be considered as completely free*. In that sense, he is defining the nature of design problems as the follows:

- 1) Design problems are partly determined by needs, requirements and intentions because the design has to fulfill a certain task or at least a certain task environment. This means that the designer has to start his or her process with a period of information gathering and analysis for possible ways of meeting this

hard facts that determine the framing of the problem space. This information can be considered as the starting point of the design process.

- 2) The major part of design problems is indeterminated and consists of the interpretation of the problems as well as the creation and selection of possible solutions. The suggested solutions and interpretations of the problems can only be created and judged by the designer him- or herself.
- 3) The design problem can also be considered as largely undetermined because the designer can find solutions for the problem that match his or her personal taste.

In that sense, Dorst (2003) states that design problems distinguish themselves through indeterminacy that is embedded in a framework of some basic rules. This situation leads to the fact that individuals have enough freedom to produce creative solutions without feeling lost in the situation. Therefore, one can argue that design problems are leading to creative Aha! experiences, when solving them autonomously.

2.2.5. Design Problems and Rational Problem Solving

As already described above, the most influential problem-solving paradigm until now was proposed by Simon in the early 1970s. This paradigm was mainly approaching rational, insight problem-solving, explaining that the procedure problem-solvers are going through from the start to the goal state. However, the question here is how undetermined design problems can possibly be that they still fit into this framework (Simon 1973;1978)?

Dorst (2003) explains that if the theory of Simon is also applicable for design processes, design problem-solving is taking place within a problem space that is structured by the task environment of the design task. The environment is therefore determining the strategies and methods that can possibly be used for the designing process.

Simon (1973;1978) himself was addressing the case of design procedures by introducing the already mentioned distinction of well-defined and ill-defined problems. Ill-defined problems are constituted in an immediate problem space, which means that the problem space is mainly put together by noticing and evoking mechanisms. The noticing and evoking mechanisms work with information

from the external environment and from long-term memory. The noticing mechanisms enable the problem-solver to pass information through, whereas the evoking mechanisms are sorting out the important information. The information gathered through these mechanisms is constantly modifying the immediate problem space.

A completely different approach to design was proposed by Donald Schön (1983) who claims that design is a process that must involve a *reflective practice*. Schön's theory emphasizes the design-component, criticizing that the rational problem-solving approach hampers the training of design professionals. Schön (1983) explains that a vital factor of designing is the process of *knowing-in-action*, which means an implicit knowledge for the actions during a creative process. Knowing-in-action processes cannot be taught explicitly, yet Schön (1983) claims that practicing reflection leads to the development of knowing-in-action habits.

Dorst (2003) states that these positions have been framed out of different paradigms, the rational problem-solving approach through positivism and the reflective practice approach through phenomenology.

Gadamer (1986) attempts to bridge a gap between these two paradigms in stating that interpretation is an operational factor during acquisition of knowledge. Interpretation is twofold because on the one hand, it is showing the interpreter what the thing that is pointing at and on the other hand, the subject is always evaluating the things through interpretation. Therefore, Gadamer (1986) was separating the two functions of interpretation in stating that there is objective as well as subjective interpretations.

Dorst (2003) explains that this twofold nature of interpretation is especially important for design problems. The designer has to choose if he or she is using objective or subjective interpretation when working on a certain task. A design project that is ordered by a client is somehow a problem-solving process, because it needs to fulfill certain standards in order to accomplish the tasks of the stakeholder. The designer has to be able to argue for his design decisions in order to justify his or her work. All possible design problem interpretations should be made explicit in order to make a discussion between the designer and the client possible. Through the process of discussing, the design process is objectified because all ideas, statements and programs are evaluated in order to get out the best possible.

Dorst (2003) goes on to explain that subjective interpretation of the design problem can become important when the problem is an ill-structured one. Structuring the problem through personal goals or subjective priorities can help to produce a good solution. Furthermore, it has to be pointed out that there is no need to reduce subjective interpretation of a design problem, because the predominant goal of a design process is to create a good design on cost and time.

Furthermore, Dorst (2003) states that in the beginning of a design procedure, designers usually spend a lot of time with the design assignment in order to make sure that they understand it properly. Through this process they find out about the constraints of the problem case, that is also showing them the extent of freedom they have during their process. The design process itself is generally understood as a subjective activity, which can be described as a reflection process. The subjective interpretation of the problem is especially important in the conceptual period, although it is often important through the whole design procedure.

2.2.6. Conclusion

Besides the extensive description of problem-solving cases, an important conclusion from this chapter is that *insight moments accompanied by Aha! experiences can emerge out of different kinds of situations*. Creative problems, like for example design problems, are generally less determined than typical insight problem-solving scenarios. Nevertheless, they do provoke Aha! experiences, like typical insight problem-solving scenarios.

The second chapter showed that creative problems are generally described as ill-defined problems because the start and the goal state are not clearly defined, in contrast to well-defined problems (e.g. Simon 1973;1978). In that sense, it is stated that creative Aha! moments are coming from multiple rounds of open, idea finding processes and evaluations, where it is not clear if there will be a final creative product (e.g. Dorst, 2003) In the case of insight problem-solving, the problem solvers are working towards a final solution that will occur certainly if they find it out (e.g. Zander, Öllinger & Kirsten, 2016).

In that sense, different kinds of Aha! experiences are caused by different problem scenarios. Therefore, I argue that creative Aha! experiences emerge out of rather open problem cases, usually to an ill-defined problem (Simon 1973;1978) or wicked problems (e.g. Cross, 1984; Dorst, 2003; Meijers, 2000; Roozenburg &

Eekels, 1995), whereas typical insight problem-solving Aha! experiences are arising from more defined problem cases, referred to as well-defined problems (Simon 1973;1978).

The first part of the chapter showed that phenomenological descriptions of insight problem-solving resulted in five qualities that appear when a person is experiencing an Aha! moment. The qualitative research that was done for this master's thesis will target at the qualities creative professionals are experiencing when they are having a creative Aha! experience. In the last chapter it will become clear if these results are similar or even the same to the ones that come from rational problem-solving.

3. Creativity

In the third chapter of the thesis there will be a short overview about some recently investigated theories from the broad field of creativity research. After describing the actual status of research about Aha! experiences, I want to refer to actual creativity research. Within this master's thesis it is assumed that creative Aha! experiences are coming from creative ideas and thoughts and therefore from creative cognition (Cross, 1984; Dorst, 2003; Ward, 2011). Accepting this assumption, it is necessary to also look in the research of creative cognition when trying to understand creative Aha! Experiences comprehensively.

The third chapter starts with a short excursion in the field of neuroscience research of creativity, shortly explaining two possible ways creativity manifests in the brain. The rest of the third chapter focuses on different theories and models of the *Creative Cognition Approach* (Finke et al., 1992; Ward et al. 1999).

3.1. Excursion into the Foundations of the Neuroscience of Creativity

Within all theories of Cognitive Science, it is assumed that cognition in all its facets is biologically grounded in the mechanisms of the brain. The disciplines of cognitive neuroscience and cognitive neurogenetics are aspiring to find out which mechanisms are underlying cognition in all manifestations, including creative processes (e.g. Kaufman et al., 2010).

Currently, there are two hypothesis attempting to explain creative cognition. First, there are investigations that imply that creativity is mainly arising from the right hemisphere of the brain, which is therefore seen as *the center of creative thinking* (e.g. Borgen & Bogen, 1969, 1988; Carlsson, 1990; Jausovec, 2000; Mashal et al., 2007). The second hypothesis explains creativity by stating that it is occurring from a reduced network inhibition in the frontal lobe (e.g. Martindale, 1977, 1989; Kaufman et al., 2010).

Both lines of research are supported by scientific evidence, although they are criticized as oversimplifying the actual neuroscientific functions (Kaufman et al., 2010). In the sections to come, I quickly describe both theories and their biological underpinnings. The Hemispheric Asymmetry hypothesis (e.g. Jausovec, 2000; Jausovec & Jausovec, 2000; Faust & Lavidor, 2003; Bhattacharya & Petsche,

2005; Petsche, 1996; Grabner, Fink & Neubauer, 2007) and the Disinhibition Hypothesis (e.g. Martindale, 1999) are the two hypothesis that are until now the most discussed ones in neuroscientific creativity research (e.g Kaufman et al., 2010).

3.1.1. Creativity as a Result of Hemispheric Asymmetry

The first theories of hemispheric differences were suggesting that different cognitive processes are originating in the different areas of the brain. The left and the right hemispheres are in that sense responsible for different cognitive abilities, which are successfully integrated through the corpus callosum (Borgen & Bogen, 1969).

The Hemispheric Asymmetry Hypothesis, which was stated the first time decades ago, suggests that creativity is a product of different neural functions within ~~the~~ right hemisphere. The right hemisphere is seen as the *predominant area of the brain for creative processes* (Carlsson, 1990).

Until now, there is extensive data supporting the Asymmetry Hypothesis, stating that the right hemisphere is concerned with global, holistic and parallel thinking processes (e.g. Jausovec, 2000; Jausovec & Jausovec, 2000; Faust & Lavidor, 2003; Bhattacharya & Petsche, 2005; Petsche, 1996; Grabner, Fink & Neubauer, 2007). On the opposite site, the left hemisphere is said to be responsible for *analytical and sequential cognition*. Based on this findings, researchers suggest that novel ideas are generated in the right hemisphere and expressed to others and oneself through the left hemisphere. In that sense the whole creativity process is explained to be a result of both hemispheres. EEG experiments showed that participants who were scoring well in divergent thinking and in creativity related tasks, were showing higher right-hemisphere facilitation and right hemisphere dominance in neuronal band synchronizations. The same individuals also had more coherence of the frontopolar and occipital areas of the brain. Both results support the right and left hemispheric asymmetry arguments.

Besides from an extensive body of EEG research, various fMRI studies also suggest that the right hemisphere is playing an important role in creative processes (Mashal et al., 2007). The Graded-Salience-Hypothesis (GSH), which has been extensively tested using fMRI experiments, states that the right hemisphere is selectively engaged in the production of novel and non-salient

meanings. Mashal et al. (2007) were developing a test in which adult participants had to judge metaphorical word pairs. For those experiments, the researchers developed four kinds of word pairs themselves. First, they were composing related words, resulting in novel, metaphorical, literal or conventional expressions. Second, they were combining unrelated words, resulting in equally unrelated word pairs. Participants then had to judge which kind of relationship exists between each word pair. Metaphorical and novel expression were representing non-salient interpretations, while literal and conventional word pairs were representing salient word pairs. The fMRI findings showed that the novel and metaphorical word pairs were evoking a significantly stronger activity in the right posterior superior temporal sulcus, in the right inferior frontal gyrus as well in the left middle frontal gyrus. Those results again are supporting the Hemispheric Asymmetry Hypothesis. Stating that only the right hemisphere is responsible for new, creative ideas would lead to an oversimplified view of creative processing. Joseph Bogen and Glenda Bogen (1988) argue that proper functioning of both sides of the brain is necessary for creative acts. They state that the combination of functional specializations of both hemispheres as well the combinational interactions of the hemispheres with each other, constitutes the neural basis of creativity. In that sense, Bogen and Bogen explain that the absence of creativity could be caused by three factors: First, there is the possibility that the left hemisphere is impoverished, which causes the fact that the person concerned is not able to carry out creative tasks properly. Second, if the right hemisphere is impoverished, the person concerned is lacking in imagination and innovative abilities. Third, if the interhemispheric communication is steadily disrupted, the creation and implantation of novel ideas is permanently dysfunctional.

According to the literature, investigations about hemispheric asymmetry are still under debate (e.g. Kaufman et al., 2010), which leads to many other approaches of explaining the underlying of creative thought. Another prominent view is the Disinhibition Hypothesis (Martindale, 1999), explained in the next subchapter.

3.1.2. The Disinhibition Hypothesis

The Disinhibition Hypothesis states that cognitive disinhibition, meaning the ability to lose already existing schematic constraints or biases, is facilitating and enabling creative processing (Martindale, 1999).

Martindale (1977) explains that the brain state of cognitive disinhibition is neurobiologically manifesting by *low levels of cortical activation*. Low cortical levels are generally believed to inhibit systems in the brain. In that sense, the Disinhibition Hypothesis states that an increased cortical activation is blocking the processes that are necessary to find remote associates, meaning the recombinations of words. This again means that reduced cortical activation is inhibiting certain schematic, cognitive mechanisms that are already steadily anchored. This, in turn, makes creative thinking possible because new combinations can be found more easily.

The majority of empirical evidence for the Disinhibition Hypothesis was established by Colin Martindale and his colleges. Martindale (1997) reviewed his studies and summarized their outcomes in stating that creative individuals generally have a lower cortical activation, which basically shows that those individuals are less prone to inhibit abnormal behavior. In that line, EEG studies showed that creative individuals have a lower cortical arousal during creative tasks. This was measured in the form of alpha waves that were either remaining the same or increased during a creative task. In situations where the creativity of highly creative individuals is not demanded, they exhibited the same alpha wave blocking as noncreative beings. This leads to the conclusion that creative individuals have a certain ability that allows them to enter a certain cognitive state of less schematic, cognitive thoughts which facilitates creative cognition.

Besides from a different level of cortical arousal during creative thinking processes, it is also likely that there is a different level of cortical activation between creative and noncreative individuals during the earlier inspiration stage and the later creative process stage (Martindale, 1999). Martindale (1977) argues that creative beings are more sensitive to stimuli in general and found scientific evidence for that using a series of mild electric shocks that were rated stronger by creative individuals than by noncreative ones. He then further explains that due to their stronger sensibility for stimuli, highly creative individuals are more prone to isolate themselves to reach a state of stimulus deprivation. Paradoxically, highly creative people are often novelty seekers, which automatically goes along with new stimuli. Martindale (1999) states that one possible reason why stimuli-sensitive creative beings are searching for novelty is because their withdrawal from social interactions could possibly lead to cravings for novelty and stimulation.

Kaufman

et al. (2010) explain that another possible explanation for these two contradictory findings would be that novelty seeking is not a compensation process for periods of stimuli deprivation, but happens at subsequent stages of a creative process. That means that novelty seeking in creative beings is a factor of their working process, rather than a personal need.

Accepting this argument would lead to the question of whether creative individuals could possibly control their levels of cortical activation unconsciously through surrounding or not surrounding themselves with certain external stimuli. Interestingly, quite the opposite was found through EEG and biofeedback experiments (Kaufman et al., 2010). These experiments showed that highly creative beings are in most cases worse in learning to control their own EEG patterns in cortical arousal compared to rather noncreative beings (Martindale, 1989).

Although the Disinhibition Hypothesis is still partly contradicting, it currently attracts the attention of many creativity researchers. Kaufmann et al. (2010) explain that it has to be pointed out that the hypothesis is only addressing the very first stage of creative processes, in which individuals are getting ready for the actual creative action. That means that the cognitive disinhibition is mainly important for the first, inspirational stage, where individuals are starting their idea finding processes. This results in the circumstances that the Cognitive Disinhibition Hypothesis as well as the Hemispheric Asymmetry Hypothesis could possibly be combined because they are explaining different stages of a creative process. This means that the first step of the idea finding procedure would be explained through the Disinhibition Hypothesis, whereas the actual creative act is happening other parts of the brain, possibly explained by hemispheric asymmetry.

3.2. Cognitive Theories of Creativity

Investigations about creating novelty, problem-solving and creativity have expanded within the last century due to increasing applications of creative studies in the fields of education, business, innovation, art and sciences (Runco & Albert, 2010). All different fields of creating novelty expanded in interdisciplinary directions, including various approaches and concepts. In order to fully understand the multifaceted phenomenon, it is necessary to examine the individual, social and cultural factors that determine creative outcomes (Ward & Kolomyts, 2010). Hence, various different theories and approaches about creativity developed through

elaborating creativity from a perspective of subjective experiences as well as from rather generalized approaches. Creativity research includes a multitude of conceptualizations, domains, disciplines and definitions that relate to a variety of research approaches, empirical methods as well as analysis theories.

Kozbelt, Beghetto and Runco, (2010) explain that ten general categories of creativity research have been identified: Development of Creativity, Psychometrics of Creativity, Economic Creativity, Stage and Componential processes in Creativity, Creative Cognition, Creativity in Problem-solving and in Expertise, Creativity in Problem Finding, Evolutionary Creativity, Typological Creativity and Creativity in Systems. The categories themselves are not monolithic, therefore they vary within themselves in the majority of cases, which causes the differentiation between within-categories to often be as diverse as the difference between the categories themselves. Cognitive theories of creativity are as diverse as creativity research itself. On the one hand, there are traditions that mainly focus on universal, human capacities, such as attention and memory. Other approaches rather concentrate on individual differences that are generated through certain psychological methods, such as divergent thinking tasks. Furthermore, some cognitive approaches focus on conscious cognitive activities, whereas others emphasize on pre- or subconscious operations.

Within my thesis, I am particularly focusing on describing the concepts of the so called "*Creative Cognition Approach*" (Finke et al., 1992; Ward et al. 1999), which has its roots in cognitive psychology and developed into an interdisciplinary, cognitive science approach (Kozbelt, Beghetto & Runco, 2010).

This thesis refers to the Creative Cognition Approach (Finke et al., 1992; Ward et al. 1999) because it encompasses a variety of different theories and models about creativity (e.g. Finke, Rothenberg, 1979; Ward, Smith, 1992; Ward, Finke & Smith, 1995; Ward, 2001; Ward & Wickes, 2009; Ward & Kolomyts, 2010).

Before starting with an explanation of the Creative Cognition Approach, I am shortly introducing three often mentioned concepts of how creative ideas and thoughts are occurring. All three influential concepts are describing one certain view of how creativity emerges. Each of the three views is relevant in many different creativity theories, particularly in the field of cognitive psychology (Finke et al., 1992; Ward et al. 1999). After explaining these rather straight forward psychological theories, the interdisciplinary Creative Cognition Approach will be

presented. It is important to notice that these psychological concepts are having a big influence on the interdisciplinary, scientific research in creative cognition.

3.2.1. Associatives

One of the most established creativity theories emerged from the Remote Associates Test by Mednick (Mednick, 1962). Mednick (1962) argues that creative processes emerge through associative operations. Associatives among different ideas and concepts can emerge due to different reasons, as for example functional or acoustical relations. The theory suggests that creative individuals move faster from obvious associates to rather remote ones. This includes the assumption that creative individuals are having flatter hierarchies of associations than less creative individuals. In that sense, Mednick (1962) states that people who are more creative have a broader set of associates for a given theory, which again constitutes a great basis for a simultaneous set off for remote representations.

3.2.2. Divergent and Convergent Thinking

Another important and widely used concept in a lot of creativity approaches is the conception of *divergent* and *convergent thinking*, that origins from Guilford's SOI model (Guilford, 1980). Divergent thinking occurs when ideas as well as associations are expanding into various directions, which ideally results in new ideas (Kozbelt, Beghetto & Runco, 2010).

On the contrary, convergent thinking is used in order to identify a conventional answer for a given problem, meaning a solution that is already existing within the thinkers mind. Both convergent as well as divergent thinking could be effectively used in creative efforts (Kozbelt, Beghetto & Runco, 2010).

3.2.3. Metacognitive Processes

Furthermore, metacognitive processes are often strongly connected to creative thinking processes (Davis, 2011). Davis (2011) explains that one example for metacognitive processes is so called *tactile thinking*. In tactile thinking, several different tactics are used as metaphors for new or different ways of thinking, e.g. "think backwards", "shift your perspective" or "turn the situation upside down". Metacognitive processes, which are always proceeding from conscious thinking

operations, are applied in creative thinking as well as in problem-solving processes.

3.3. The Creative Cognition Approach

The Creative Cognition Approach is rooted in the fields of Cognitive Science and Cognitive Psychology (Ward & Kolomyts, 2010). The phenomenon of creativity is investigated through an interdisciplinary stance, including psychological, philosophical as well as neuroscientific investigations (Ward & Kolomyts, 2010). The field of creative cognition focuses on the cognitive ingredients that underlie and constitute creative acts. Researchers (e.g. e.g. Finke, Rothenberg, 1979; Ward, Smith, 1992; Ward, Finke & Smith, 1995; Ward, 2001; Ward & Wickes, 2009; Ward & Kolomyts, 2010) are mostly concerned with finding out how cognitive structures are operating on stored knowledge in order to make creative products happen. In that sense, the approach follows the broadly agreed upon idea that the combination and accessibility of knowledge is playing an important role in creative operations and determines the final outcome.

3.3.1. The Geneplore Model

An often used framework for explaining creative cognition is the *Geneplore Model* developed by Finke, Ward and Smith (1992). The model explains new and creative thoughts as a *results of generative processes*. These processes are producing aspirant ideas that have different degrees of creative potential. In the ~~flowing~~ they are resulting in exploratory processes, which are expanding on that creative potential. The model assumes that there is a variety of creative processes that work together within different creative acts. The interaction of different processes raises the probability for a creative outcome.

Finke, Ward and Smith (1992) explain that the model consists of two main phases: a generative phase followed by an exploratory phase. In the generative phase, different mental representations are created by the retrieval of information and knowledge, in order to find approaches for creative solutions. This inquiry of information results in so called *preinventive structures* that have different properties, such as ambiguity, emergence, divergence etc. Preinventive structures are resulting in candidate ideas for the final, creative solution. In that sense, preinventive forms represent a possible starting point for different creative

outcomes. Within the exploratory phases, all preinventive structures are interpreted in a meaningful way by modifying, elaborating and considering different implications.

Finke, Ward and Smith (1992) go on explaining that if the exploration stage is immediately successful, meaning it immediately leads to satisfactory resolutions, an initial preinventive structure can lead to a creative product. If this is not the case, further procedures are necessary. One possible procedure mainly requires to go back to the generative phase in order to modify the already existing preinventive structures or generate new ones.

Therefore, Finke, Ward and Smith (1992) describe the creative process as cyclic, because individuals are going back and forth between the phases of generation and exploitation when they are engaging in creative thinking tasks.

Additionally, the Geneplore framework considers the constraints of the creative product itself and tries to figure out which cognitive processes underlie them through the process. Possible constraints can come up either in the generative or in the explorative phases (Finke, Ward, and Smith, 1992).

The model considers the fact that people can be creative in several different ways, which is mainly caused by their individual ability and whether they have experience in generating preinventive structures (Finke, Ward, and Smith, 1992).

3.3.2. The Convergence Approach

The creative cognition approach works with different methods because of its interdisciplinarity. Besides from empirical procedures, anecdotes and historical accounts of different creative accomplishments or failures are used in order to get subjective insights in creative operations (Ward, Finke & Smith, 1995).

Ward, Finke and Smith (1995) explain that the combination of 1st person reports and laboratory investigations should ideally provide a more complete picture of creativity. Anecdotes about creative insights are highly important because they can possibly provide new perspectives as well as additional information about ecological validity. Still, they often cannot be verified in a scientific sense because they are retrospectively reported, and therefore not free from personal interpretations.

Ward, Finke and Smith (1995, 2001) go on to explain that if a creative accomplishment operated in the exact same way as it also appears in the

anecdotal report, it does not necessarily mean that it also follows the identified cognitive or behavioral processes. Even if the processes are rightly identified it could be the case that they are not relevant for the creative act and therefore maybe also not be relevant for the creative outcome. Additionally, it cannot be proven if the identified processes could have also led to a creative outcome that is even better than the already accomplished one. According to this lack of solid information, some researchers argue that it is not possible to make recommendations about the best processes of approaching creative insights.

Ward & Kolomyts (2010) explain that the strength of studies which are conducted in laboratory settings constitutes itself through the fact that it is possible to manipulate independent variables that are thought to be of interest. The removal of real world settings eliminates possible vagaries and makes clear investigations about the direct connections between possible process and outcome. Furthermore, laboratory insights add new information to the research field they are grounded in. However, the artificial situation of laboratory settings leads to the scenario that the researchers often have the complete control to evoke certain phenomena. Although this results in a gain of knowledge, it does not mean that the same manipulation of the phenomenon in a real world setting does lead to the same result.

Ward and Kolomyts (2010) go on explaining that the Convergence Approach tries to balance out the advantages and disadvantages of both approaches by combining them in a meaningful way. Combining and comparing these approaches often leads to the fact that i.e. the laboratory findings contradict a report of a creative act that a certain kind of cognitive process is beneficial. In this case, either the cognitive process or the distinction between real world and laboratory setting is brought into question in order to receive appropriate, convergent results.

3.3.3. The Path-Of-Least-Resistance Model

The *Path-of-least-resistance Model* (Ward, 1994, 1995) states that whenever people are trying to develop new ideas or concepts for a certain domain, the tendency is high that they are accessing basic-level exemplars of this certain domain as starting points, projecting as many properties as possible on those already existing concepts.

Ward and Kolomyts (2010) explain this in giving an example, which is about trying to create a new backpack. The predicted, predominant tendency is that people are starting their creative act by thinking of already existing backpacks in order to pattern the new backpack after already given examples. It is expected that the creative results that come off that method are less original, but still quite ~~para~~ and useful because of their reliance on already-established ideas. Apart from scientific research on the model, there are various historical anecdotes of different innovative ideas that are describing the method when trying to come up with new ideas.

Ward & Kolomyts (2010) go to explain that investigations on the model are focusing on the likelihood that individuals are relying on a certain kind of basic-level exemplar when trying to find a new idea for a creative act. The studies are focusing on the internal structures of categories as well as on the hierarchical, taxonomic relations that exist between the category and all members of the category. Furthermore, the model is generally concerned with patterns that appear across individuals, rather than with individual experiences itself.

In order to investigate this model, researchers (e.g. Finke, 1990; Lubart & Sternberg, 1995; Smith, Ward & Schumacher, 1993; Ward, 1994) use several laboratory techniques, in which participants have to complete already existing creative products, such as designs, prompts, drawings as well as sketches and descriptions. The productions are generally rated for originality, creativity as well as practicality. The ratings themselves are not primarily important, they should rather offer information about the relations of internal and external factors and how ~~they~~ are influencing each other. Furthermore, the categories are used in order to investigate cognitive processes and structures that are often used while creative acts.

Ward (1994) states that laboratory findings which target at devising a new domain instance found out that people are introducing products that are highly similar to already existing products of the domain. For instance, when the task entailed envisioning animals on another planet, participants were usually coming up with drawings or descriptions from typical Earth-Animals, including additional properties such a third leg or a second mouth.

Further experiments (Marsh, Landau & Hicks, 1996; Marsh, Ward & Landau, 1999; Sifonis et al., 1997) showed that participants are not only influenced by generally

accessible domain instances, but also by categories and instances that they were exposed to recently. When participants were exposed to certain features of random examples, i.e. light bulb designs, stagecoaches etc., they were integrating those features in their creative acts more frequently.

Additionally, Ward (1994) explored the correlation of attributes as a structure given principle of imagining something new. This means that certain groups of features that usually have a strong correlation in the real world, i.e. “wings” and “feathers”, are often also occurring together in imagined products or designs. Ward asked participants in a laboratory settings to imagine and draw animals from a different planet, having completely different characteristics than the known ones from Earth. Participants were split in different groups, some groups were told to imagine creatures that have either feathers, scales or fur. The other groups did not receive any guidelines at all. Participants in the feather condition group were much more likely to include wings in their additional conditions, whereas participants from the scales groups added characteristics such as fins and gills more often than the ones that have been in the group “fur”. Self-reports also showed that participants were initially relying on known instances from already known birds, fish or mammals. In some cases they were coming up with new instances that aren’t commonly found in earth animals. However, the more uncommon and creative solutions were found on a much smaller scale.

Further research (Ward, Patterson and Sifonis, 2004) showed that if participants are exposed to rather abstract representations and not to concrete instances of categories, they are more likely to come up with original creations. For instance, if they were asked to imagine life on another planet, they were more likely to produce original results when asked to come up with any kind of living organism as when asked to design animals with specific characteristics, i.e. feathers, fur, scales.

Ward (2008) explains that although accessing abstract information frequently leads to more original ideas, it is important to consider the practicality of innovative products. Relying on already existing products, organisms or designs generally lowers the level of originality but at the same time can also lead to better results in actual practicality. In that sense, relying on already existing products in developing new ones includes relying on already established characteristics that are indeed not innovative, but nevertheless often meeting the need at hand. Originality and

practicality are not necessarily negatively correlated, thus their contrary power must be acknowledged.

Ward (2008) further states that another important factor that was discovered to have positive effects on the quality of the actual outcome was the factor of knowledge. If participants were knowledgeable in the domain where the creative act was required, the quality of their results was significantly better. Whether more specific or more abstract knowledge is preferable, depends on the value that is given to originality or practicality. In that sense, highly specific knowledge will probably lead in the majority of cases to results with high levels of practicality, whereas general knowledge will lead to very original creative acts. In general it can be said that accessing multiply levels of abstraction is the most helpful approach. Also, Ward and Wickes (2009) state that it is important to acknowledge that the accessibility of exemplars is a dynamic and changeable factor in individuals. This means that it can be manipulated in participants, for example through an increased exposure of certain terms. Ward and Wickes (2009) used this effect in order to prime certain exemplars from the domains of fruit and tools in order to find out if the priming method effected the usage of the terms when participants were completing creative tasks. The main finding of their research was that participants were more prone to base their creative acts on the exemplars they have been exposed to. In that sense creative acts can not only be manipulated, but they can even be predicted on the basis of the accessible data.

In summary, it can be said that the more abstract the exemplars, the more innovative the ideas for the products. Nevertheless, it has to be considered that either originality or practicality can be a negative correlation to each other (Ward, 2008).

3.3.4. Conceptual Combination

Ward and Kolomyts (2010) explain that the process of conceptual combination constitutes itself through mentally merging previously unconnected ideas or concepts in a new, innovative way. The method of conceptual combination, mentioned in various historical accounts, is cross-disciplinarily. The combination process not only consists of the summation of different elements and ideas, it also includes emergent features which are occurring as a result of the merging process. Emergent features can either produce salient properties or ones that are very low

in salience. However, even very simple combination such as „pet“ and „bird“ can lead to emergent properties such as “talks“, which would easily be seen as an attribute of those properties.

Rothenberg (1979) argues that the combination or integration of two distinctive ideas or concepts was the underlying process of creative acts from famous artists and scientists such as Da Vinci, Mozart or Einstein.

Another intriguing example would be the concepts of the fantasy writer Stephan Donaldson. Donaldson (1992) reported that he drew his inspiration for the book series “Thomas Covenant, The Unbeliever“ by combining the concepts of unbelief and leprosy. Donaldson wanted to write a story about unbelief but he felt blocked until he had the idea to combine it with the concept of the disease leprosy. When combining the concepts he reported that his “brain took fire“.

Ward and Kolomyts (2010) state that Donaldson got this breakthrough because of the readers that were suffering from leprosy themselves. People who have the disease are highly attentive to potential injuries and are therefore possibly more prone to accept the reality of any kind of fantasy world in a book, especially if the originally suffering people are healthy, superheroes in this world. The combination of these properties led him to Covenant’s dynamic tension between the need for continued self-vigilance and his attraction to the fantasy world.

Although it is clear that the process of combination does help people of all professions to get new ideas and knowledge, the question of the power of combination is reproducible in laboratory settings remains still open. A persistent phenomenon that occurred in a variety of studies is that emergent properties came up during the process of combining ideas and concepts that were pretty unrelated or even totally absent from each other (Ward & Kolomyts, 2010).

In Wilkenfeld and Ward’s study (2001), participants had to interpret combinations which were varying in similarity as well as in the number of features that were assessed. College-student participants had to write down 2 separate definitions for 16 pairs of words, one for each word. 8 pairs were composed from similar concepts, whereas the other 8 pairs consisted of dissimilar concepts. Besides from definitions, participants were also asked to define a list of features for that things necessarily need in order to be a valid part of one of the five instances. The set of features could then be used in order to find out if new properties emerge from combining the concepts. Additionally, the results show if dissimilar

combination show more fruitful results than similar word combinations. Wilkenfeld and Ward (2001) found that dissimilar combinations resulted in a larger number of emergent properties. Additionally, they found that second interpretations lead to a higher number of emergent properties, especially when it comes to similar pairs. Second interpretation describes the process when people first take their easiest interpretation and then engage more with the with the creative exploration in order to produce a second interpretation.

Scott, Lonergan and Mumford (2005) found that combination approaches can also be used in more complex structures. In one of their studies, they were investigating a certain amount of college students who had to combine information from different descriptions of educational programs in order to develop their own ideas for the curriculum.

Mumford et al. (1997) found that shared attributes across exemplars are more effective for related concepts, whereas metaphoric interpretations are more effective for rather dissimilar concepts. Related concepts are generally ~~share~~ more attributes, whereas dissimilar concepts aren't and therefore require people to go beyond the usual meaning.

Finke's (1990) study showed that people who are mentally combining visual forms and patterns have been able to discover new ideas for inventions and discoveries for different domains and procedures. Within the study, participants were confronted with sets of geometric forms and asked to integrate the given form into more complex structures that could be seen as inventions of different ~~domains~~. When the domain, i.e. vehicles or fruits, was defined before the participants had to come up with something the creativity decreased. When participants felt free to change and connect the patterns and forms however they wanted, participants were able to come up with more creative ideas and products. Within this attempt, the final products were categorized afterwards. In that sense it turned out that it is beneficial for visual creative processes when visual materials are combined without a specific goal and interpreted afterwards.

3.3.5. Analogical Reasoning

Another process that has been investigated intensely in creative cognition is *Analogical Reasoning* or *Transfer*. In analogical reasoning preexisting knowledge is

projected or transferred from a familiar to a rather unknown domain (Ward & Kolomyts, 2010).

Researchers (Basala, 1988; Crouch, 1992; Friedel et al., 1986; Gentner et al., 1997) state that Analogical Reasoning can easily be detected in different ~~historical~~ inventions, as for example in Rutherford's use of solar systems, which was modeled after the concept of hydrogen atoms. Further examples would be Kepler's reasoning about planetary motion, Edison's development of an electric light distribution system as well as the flying machines invented by the Wright Brothers.

The history of Analogical Reasoning and its fruitful outcomes resulted in intense investigations of this approach within the field of creative cognition. The transformational power of analogies mainly derives from the fact that good analogies are connecting on deep levels, going beyond the surface because the majority of concepts have to be understood closely in order to apply them on other domains (Gentner, 1983; Gentner and Toupin, 1986).

Dunbar (1977) explains that there are various applications and manifestations for Analogical Reasoning. The most obvious applications for using this technique is when applying knowledge from one domain to another. Furthermore, analogies are often used in order to explain ideas and concepts in a concise way.

3.3.6. Problem Formulation

Besides the combination of concepts such as the use of analogies and the application of other transformational processes, the formulation of problems also has been investigated in creativity research (e.g. Basadur, 1994; Mumford et al., 1991; Runco & Chand, 1994). The way that problems or tasks are formulated and conceptualized is seen as an important and determining component of creative processes, which was also described in the second chapter of my thesis.

Ward & Kolomyts (2010) point out that those approaches should not get mixed up with problem-solving processes, instead, they rather point out that creativity is probably more than that. In that sense creative professionals are in the majority of cases not dealing with well-defined problems, but part of their work is to define, construct and formulate problems or tasks that need to be accomplished.

Mumford, Reiter-Palmon and Redmond (1994) found that engaging in problem formulation positively influenced the originality as well as the quality of different

problem solutions. In their study, they were testing college students that were performing in a creative generations task. Within the task, students had to come with a marketing survey as well with an advertisement. Students that were part of the problem-construction condition were instructed to list important factors and to reformulate the problem before engaging with it. This was contrary to the no-problem construction group who only had to come up with the marketing survey and the advertisement. The group that had to also work on the problem formulation produced results that scored much higher in quality and in originality than in the latter group.

3.4. Conclusion

The short excursion into the neurobiological foundations of creativity shows two different theories of how creative thought possibly manifests in the brain, the Hemispheric Asymmetry Hypothesis (Borgen & Bogen, 1969; Carlsson, 1990; Mashal et al., 2007) and the Disinhibition Hypothesis (Martindale, 1977; 1999; Kaufman et al., 2010).

After a short excursion into the neurobiological foundations of creativity, the third chapter shows different theories of how creative cognition possibly works. Starting with theories from cognitive psychology, the interdisciplinary Creative Cognition Approach (Ward & Kolomyts, 2010) is presented. The Path-of-least-resistance Model (Finke, 1990; Lubart & Sternberg, 1995; Marsh, Landau & Hicks, 1996; Marsh, Ward & Landau, 1999; Sifonis et al., 1997; Smith, Ward & Schumacher, 1993; Ward, 1994; 1995; Ward, Patterson & Sifonis, 2004; Ward, 2008; Ward & Wickes, 2009; Ward & Kolomyts, 2010), the Conceptual Combination Model (e.g. Finke, 1990; Mumford et al., 1997; Scott, Lonergan & Mumford, 2005; Rothenberg 1979; Ward & Kolomyts, 2010; Wilkenfeld & Ward, 2001) and Analogical Reasoning (Basala, 1988; Crouch, 1992; Friedel et al., 1986; Gentner et al., 1997; Ward & Kolomyts, 2010) assume that creative ideas, and therefore also creative Aha! experiences, are emerging due new applications or new combinations of already existing knowledge and information. This new composition of concepts leads to new ideas and creative concepts.

The Geneplore Model (Finke, Ward & Smith, 1992) assumes that creative thoughts are a result of generative processes, which are resulting in aspirant ideas with different levels of creative potential. In the next step, there are exploratory processes that

expand on that creative potential. Within a creative act, there are various exploratory processes that all work together on some level.

These five models are investigating creative idea finding processes from a third person perspective, examining them in laboratory settings that are reproducible (e.g. Ward & Kolomyts, 2010).

The sixth model, referred to as the Convergence Approach (Ward, Finke & Smith, 1995; Ward & Kolomyts, 2010), also includes first person reports about creativity. These reports are combined with third person research from laboratory settings. Therefore, the Convergence Approach constitutes an ideal transition to the second part of the thesis.

The research presented in the second and third chapter of the thesis is approaching the questions “What are creative Aha! experiences?” from an interdisciplinary point of view. The conceptual research showed that an Aha! experience is mostly understood as part of insight problem-solving (e.g. Gick & Lockhart, 1995; Gruber, 1995; Metcalfe & Wiebe, 1987; Reber, Schwarz & Winkielman, 2004; Topolinski & Reber, 2010). Depending on the problem space, successful problem-solving also needs a certain level of creativity (e.g. Dorst, 2003). In general it can be summarized that the more open a problem space is, the more creativity is necessary to find an appropriate solution. For that reason, it could be argued that there are also different types of Aha! experiences, ~~depending~~ on the problem space that triggered them.

The third chapter about creativity provides an overview of some stances of recent, interdisciplinary creativity research. The chapter shows that creativity is understood as a result of different cognitive processes (e.g. Cross, 1984; ~~Das~~ 2003; Meijers, 2000; Roozenburg & Eekels, 1995).

II. Qualitative Research

The second part of the master's thesis consists of a description of the qualitative research that was done for the thesis. For this research 12 creative professionals were interviewed with the Elicitation Interview Technique (Petitmengin, 2006) in order to investigate *the process and experience of their creative Aha! moments*. As a consequence of inquiring them about their creative processes, the participants were also interviewed about the circumstances that facilitate their creative processes.

The deliberations are starting with an introduction about the fundamental principles of the used technique. In the next step the method and the results of the elicitation interview period is described, including a model of the process of creative Aha! experiences that emerged out of the data from the interviews.

Within in the last chapter, the results of the interviews are compared with particular research findings that are presented in the theoretical part of the thesis. Apart from that, the last chapter will offer additional information about investigations of creativity and innovation enabling circumstances, introducing research stances of the "The Creative Change Model" (Puccio, Murdock and Mance, 2007) as well as of the "Enabling Spaces Model" (Peschl and Fundneider, 2014).

5. Elicitation Interviews

5.1. The Elicitation Interview Technique

"... we are blind to what is closest to us, our lived experience, and we must learn to see it." (Petitmengin et al., 2013, p.657)

Petitmengin (2006) explains that subjective experience was for a long time excluded from scientific investigations as a consequence of the fact that subjective experiences are not identically reproducible. Additionally, it is difficult to ~~act~~ them by an objective and external observer that is not related to the subject of study. Hence, classical, experimental psychology was refusing subjective investigations of experience, only focusing on third person research.

Following the tradition of phenomenology, first person research approaches gained more and more attention in cognitive science (e.g. Varela & Shear, 1999)

Researchers (e.g. Petitmengin, 2006; Varela & Shear, 1999; Vermersch 1999) stated that it is important to consider subjective dimensions of different ~~cognitive~~ aspects in order to get a more holistic picture of cognition. Interestingly, this development is mainly a result of increasingly sophisticated neuro-imaging techniques. Data resulting from these techniques does require a lot of interpretation in order to make sense of it. The description of the subjective experience of cognitive processes is therefore used in order to construe third person research results. Within the third chapter of the thesis it became clear that creativity research is also mostly focusing on third person research (e.g. Ward & Kolomyts, 2010). Nevertheless, the Convergence Approach (e.g. Ward, Finke & Smith, 1995; Ward & Kolomyts, 2010) is aims to combine reports from creatives with laboratory findings, trying to include first person research.

After realizing that first person research should also be a part of scientific investigations, another realization soon followed, pointing out the problem of expressing subjective experience (Petitmengin, 2006). Describing one's own experience is extremely difficult and perhaps even impossible. We know how to carry out our cognitive actions such as writing a text, memorizing or solving different kinds of problems. Nevertheless, we have very limited access to how we make our cognitive abilities do what they do. Even the cognitive abilities that we are using now, in our current situation, are somehow completely foreign to us when we start thinking about them (Petitmengin, 2006).

In that sense Petitmengin (2006) claims that turning our attention to our experience and consciousness does require a *certain kind of training* as well as a special kind of expertise. The constructed theory that tries to make this access possible is inspired by *Buddhist meditation techniques*, that make certain dimensions of subjective experience recognizable. Although the method which emerged out of this theory is trying to make parts of the subjective experience visible, it does not claim to realize all cognitive processes, nor does it intend to make verbal descriptions for all of them. Hence, it is proposed that researchers should work with an interview method, called Elicitation Interview Technique (Vermersch, 1999; Petitmengin, 2006) that enables the interviewer to make the interviewee access his or her own subjective experience and express it in the next step.

The Elicitation Interview method was originally proposed by Pierre Vermersch (1999) and then further taken up in the context of Cognitive Science by different

researchers (Braboszcz, 2012; Petitmengin, 2006; Valenzuela Moguillansky, 2012). The Elicitation Interview Method (Petitmengin, 2006) aims to gather first person data. Due to the aforementioned issues, it is important to point out that the interviewer learns how to overcome certain difficulties in order to enable the participant access to some parts of his or her own cognitive processes. The first stage of the interview is concerned with finding appropriate participants for the interviews, trying to evaluate which participants would suit the question at stake as well as the interview technique. If appropriate participants are found, the interviewer and the participants are entering the Elicitation Stage.

5.1.1. The Elicitation Stage

Petitmengin et al. (2013) state that the first important step that has to be performed by the interviewer is to help the interviewee choose one particular experience of a cognitive process. If the inquired subject has decided for one certain cognitive occurrence, it is the interviewer's turn to make the participant relive the situation where the experience happened both cognitively and emotionally. This means that the interviewer should try to *bring back interviewee into the felt and experienced situation*. The interviewer also has to try to make the subject stay with the actual experience when he or she is moving away towards beliefs, explanations or justifications.

Petitmengin (2006) states that in order to retrieve or evoke the chosen experience in the subject, the interviewer has to make the participant recall his or her memory. The interviewer helps the subject retrieve visual, tactile, auditory, kinesthetic or perhaps even olfactory sensation where present in the situation of the occurrence. This means that the interviewer is, for example, asking the participant "What have you been feeling, seeing, hearing etc. at this moment?". The goal of these questions is to *bring the individual mentally and sensorially back in the experienced situation*.

Petitmengin et al. (2013) point out that there are certain verbal indicators that indicate that the interviewee is back in that intense state of the experience. This includes the *use of the word "I"* as well as verbally expressed context indicators of place and time where the experience happened. Another strong indicator is the use of the *present tense* instead of past tense. Additionally, participants that re-enact their experiences are usually talking more slowly.

Apart from verbal indicators, there are also nonverbal ones (Petitmengin, 2006), such as staring into an empty space when they are trying to go back to the cognitive experience, which occurs often. This enables the participant to focus purely on their inner world, without getting distracted by the interviewer or the environment. It is only when the interviewer can successfully identify some of these key indicators and regards this condition as stable that he or she should start with posing questions about the experience of the inner, cognitive process.

The third, key component of the Elicitation Stage that is mentioned by researchers (Petitmengin et al., 2013) is helping the interviewee direct their attention to the processes of *“how” the experience evolved*, instead of focusing on *“what” the experience was*. In order to collect information about how the cognitive procedure was experienced, the interviewer has to pose content-empty questions, that are ideally not imposing his or her own presumptions. The interviewer has to ask about the personal perceptions of the interviewee’s inner states as well as about the sensorial modalities of the experience.

It is important to point out that the structure of the interview is iterative (Petitmengin et al., 2013), which means that the process of evoking a relived experience, followed by describing the experience’s modalities, has to be revised a few times until a certain level of detail has been reached.

At the end of each interview, the interviewer should ask if there is anything else that is concerning him or her, that should be part of the interview (Petitmengin et al., 2013).

5.1.2 The Post-Interview Stage

After the interviews are done, Petitmengin et al. (2013) stress that it is of great importance that the interviews become formalized properly. There is no analysis method that is specifically recommended for the technique. Nevertheless, Petitmengin (2006) argues that it is important that the structure of the described experience is represented as it was described by the interviewee. Additionally, it is crucial that the interviewee’s perception of the experience as well as the modalities of it, are displayed in detail. In that sense it is crucial that the interviews are fully or partly transcribed after the interviews were taking place. This offers the base for a detailed analysis, that could offer new insights in the field of inquisition.

52. Methods

5.2.1 Participants

For the elicitation interviews conducted for my master's thesis, *12 participants were interviewed*, all of which *working in a creative field*. Although I believe that every individual has to be creative in his or her job to some extent, I decided to only interview creative professionals because they are highly trained in producing creative output on a regular basis, which results in a high probability of having many creative Aha! experiences. Additionally, chances are high that the participants have certain methods and techniques that they apply when facing the need to get the creative process going.

This assumption is in line with cognitive neuroscience research (i.e. Sternberg & Lubart, 1996), which tends to divide individuals into two different groups. ~~Studies~~ assume that there are “more creative” and “less creative individuals”. Therefore, study participants of both groups were investigated, trying to find out which cognitive mechanisms underly each group. This implies the hypothesis that all individuals are creative to some extent, yet there are differences in the level of creative performance. The level of creativity is believed to be dependent on factors such as innate intellectual ability, personality, motivation, cognitive style and knowledge.

In only choosing creative professionals, I am not implying that only creative professionals are so called “more creative individuals”, but am assuming that there is a greater chance in finding highly creative individuals when referring to this professional category.

Within my 12 interviews, creative professionals from four different groups have been inquired, including 7 designers, 1 architect, 2 artists, 1 writer and 1 photographer. The group of designers was divided into 4 digital designers, creating websites and apps, 2 print designers as well as 1 fashion designer. Four participants were male, and 8 participants were female. All participants were between the ages of 25-50.

5.2.2. Procedure

Before meeting the participants for the interviews, all received a short, written briefing about creative Aha! experiences and the Elicitation Interview Technique (Petitmengin, 2006). In the briefing, participants were asked to prepare one creative Aha!

experience that they were experiencing during their creative work. Although only some participants were coming to the interview with some concrete creative Aha! moments, all of them have been thinking about the topic before.

After starting the voice recording, I first had a conversation with all participants, getting to know them and their work. After this short introductory phase, I progressed to the Elicitation Stage, also verbalizing this switch in the conversation clearly. In most cases this change went alongside the switch of language from German to English.

The Elicitation Stage

The cognitive occurrences investigated in my Elicitation Interviews were creative Aha! experiences. In order to make this investigation possible, the first part of the interview was about making the participant decide on one creative Aha! moment that was to be investigated more intensely during the interview. All of the participants were preparing more than one experience because they felt unsure about what a creative Aha! experience actually is. After a short introduction about the topic, the participants started to feel acquainted with the phenomenon, which allowed them choose one experience that they felt they were able to recall properly.

In the next stage I tried to urge participants to recall their experience as detailed as possible through posing questions that should bring them back into the situation of the creative Aha! moment. Therefore, I asked them how the situation of the Aha! moment was experienced, starting with simple questions about the season, weather or daytime. After those rather simple questions, I began to intensify my inquiries, asking the participants what kind of sensory input they received during the moment of the creative Aha! experience. In all interviews these questions brought the participants back into the situation of the actual experience quite fast. I realized these changes by making sure to pay attention to the verbal and nonverbal markers mentioned above, i.e. using the present tense or staring into an empty space when talking about the experience.

When participants were back in the experienced situation for the first time, I started asking them how the situation of the Aha! experience evolved, mainly capturing some of their expressions for asking in more depth. In that sense, I was asking, i. e. “How did you feel when the puzzle finally fit together?”, “What was this

“fuuuuu” [mimicking the participant] like?” or “How did you feel after the Aha! experience?” etc.

The third stage, which was talking about the experience in depth, was the most difficult because the participants were in almost all cases drifting their attention to something else. This resulted in a lot of repetition of the second and third stage, exactly as predicted by the theory of the technique.

The inquiries about the creative Aha! experiences also automatically lead to finding out which circumstances enabled and facilitated the creative idea finding processes. Hence, I was also following this naturally appeared route by additionally asking the participants what circumstances enabled and facilitated their creative processes. By asking these questions, I was imposing an additional, more practical field of study in my interviews.

1. Making the participant decide for one creative Aha! moment.
2. Making the participants recall their experience as detailed as possible.
3. Asking *how* the situation of the Aha! experience evolved.
4. Talking about the experience in depth.
5. Bringing back the participants to the experienced situation repeatedly.
6. Asking the participant which circumstances enabled the experiences.

The Post Interview Stage

After finishing an interview, the transcription period began by listening to the voice record of the interviews for the first time. This first period of listening left me with having a more concrete idea which parts are relevant for the research questions and therefore important to transcribe. In the next step the actual transcription period started by writing down all relevant parts of the interview word by word. The rest of the interview, which did not include relevant information for the research questions, was excluded. This resulted in rather brief transcripts between 3-6 pages, constituting a good base for further analysis.

The interviews were analyzed with the qualitative data analysis software Atlas.ti.

For coding the interviews, a technique that was based on Grounded Theory (Charmaz, 2006) was used. In the first period of coding I was coding sentence by sentence or line by line. Both options were accepted in order to get meaningful codes out of the transcripts.

The next coding period was about going through all the codes again, trying to find different code-groups and code-subgroups. The identified groups were assigned to a different color each, resulting in another phase of color coding where all codes were re-examined in order to determine if they fit a color category. This means that the majority of the codes were ascribed to the color categories, whereas the others weren't utilized further. This resulted in different code groups that each had a distinguished color. Nevertheless, some colored codes are in more than one group because they fit into more categories. By re-examining the code groups, different subgroups resulted that were again partly connected to other code groups or other code subgroups. The process of analyzing codes and sorting them into groups is generally iterative (Charmaz, 2006). This means that categories and groups are reworked and refined repeatedly.

In order to show the relation of codes and codes, codes and code groups, code groups and code groups as well as of code-subgroups and groups, so-called networks were created. Networks basically look similar to mind maps and are made in order to visualize all analysed relations.

Out of the different code-to-code relations, I tried to closely identify which hypotheses were supported. In the following I will go in depth with the results.

5.3. Results

Throughout the process of closely examining the transcripts and coding them, 722 different codes were identified. The relations of these codes resulted in the following 13 code groups, each marked by a different color:

1. "After the Aha! experience" marked by the color brown,
2. "Circumstances of Aha! experiences" marked by the color pink,
3. "Conviction of the idea" marked by the color green,
4. "Descriptions of Aha! experiences" marked by the color orange,
5. "Ease & Relief" marked by the color grey,
6. "Emergence & Development of ideas" marked by the color light green,
7. "Evaluating ideas" marked by the color light blue,
8. "Pause" marked by the color turquoise,
9. "Pleasure and Excitement" marked by the color yellow,
10. "Project Structure" marked by the color dark blue,
11. "Research and Inspiration" marked by the color black,

12. "Suddenness and Surprise" marked by the color red and
13. "Time" marked by the color purple.

Generally, every code has the color of its primary group. However, some codes are related to two or more different groups, which means they will be identified by one color, yet also be part of more than one group.

Out of this code groups, different categories and relations emerged that resulted into code-to-code relations, code-to-code group relations as well as code group-to-code group relations. These connections have been constituted in the following 7 *different networks*.

1. "Affective Reactions to Creative Aha! Experiences",
2. "Idea Development",
3. "Idea Enabling Circumstances",
4. "Idea Evaluation",
5. "Idea Progression",
6. "Research & Inspirations",
7. "Starting the Idea Finding Process".

In the following the results that emerged out of these codes, code groups and networks are described, starting with a model of the process of creative Aha! experiences. The next step will go in more depth with each point of the model, describing it in more detail.

5.3.1. The Process of Creative Aha! Experiences

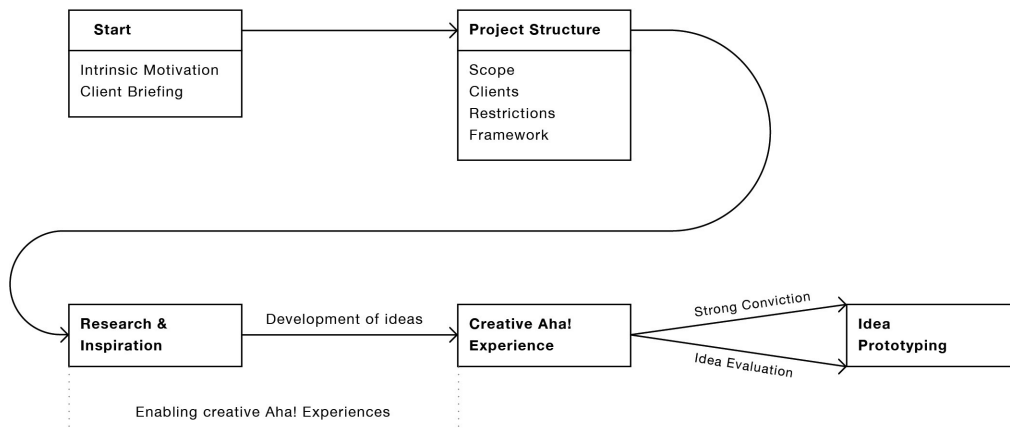
Asking my participants about their individual creative Aha! experiences resulted in the finding that there is a similar procedure that leads to creative ideas in all cases, as well as an alike behavior which follows up the creative Aha! moment.

In that sense, I want to introduce these results in the form of a simple model because it makes the whole process and development of creative Aha!

experiences more understandable. Every step that is mentioned in the model is found in the interviews of 5 creatives or more. This means that the process model

Figure 5. The Process of Creative Aha! Experiences.

above is summarizing the patterns of thought and behavior that become visible when coding the interviews.



As summarized in the model, the results of the interviews show that a creative process usually starts with either *intrinsic motivation* to create something or with a certain *client briefing*. Although all my participants are working professionally in the creative industry, some of them decided to describe creative Aha! experiences that came up while thinking of private side projects. Ideas for those projects usually start with intrinsic motivation to create an artwork or any other personal project for themselves or their company. If the project is not started with intrinsic motivation, the professional creatives are starting with a certain client briefing for the project. Immediately connected to this first kickoff, the creative professionals are *becoming familiar with the framework of the project*, including possibilities, restrictions as well as personal assessments about the client (if there is one).

In the next step the professional creatives are entering a period that is described as *research and inspiration* stage. The period of research and inspiration seeking can be an active as well as a passive period (or both). This means that some of my interviewees were actively seeking for inspiration through certain activities such as reading, doing sports, scrolling through the internet etc., whereas others were consciously pushing the project away for a certain amount of time in order to let the inspiration come to them through unplanned situations. Research was generally understood as an active process that often followed a previous inspirational stage.

Interestingly, besides from different activities, there was also periods of rest and/or procrastination which were playing an important role in all of my interviewees idea development periods. The *idea development period* ends if the creatives are successfully *coming up with a creative Aha! experience* (which was obviously the case in all scenarios explained in the interviews).

The states *Research and Inspiration* as well as *Development of Ideas* are both part of the category “Creativity Enabling Circumstances“. Nevertheless, there are further creativity enabling circumstances that are not part of these two states and are therefore depicted separately in an extra state, referred to as “Other Enabling Circumstances for Creative Aha-Experiences“.

All of the Aha! experiences explained were accompanied by *different affective reactions*, which will be explained in the following. After this peak, the participants were either strongly convinced by their idea or they were entering a stage of idea evaluation. If the professional creatives were evaluating the idea, they were questioning it and finally making a decision for or against it. Either way, the follow-up of this period was described idea prototyping, trying to advance the initial idea. In the following I will go in more depth for all of the mentioned states, beginning with the initial state of the creative idea finding process.

5.3.2. Intrinsic Motivation or Client Brief

The initial stage that emerged out of the data is about how the creative professionals are starting the idea finding processes.

In general, it can be said that there are two different starting scenarios. On the one hand, participants were explaining that they were starting their idea finding process with a certain briefing that they’ve got from their clients. This client briefing contained the task which demanded one or more creative ideas.

On the other hand, participants were explaining that they had some kind of intrinsic motivation that lead to them to start their creative process. One participant was explaining that he or she was having a creative Aha! experience during a period of time where he or she was constantly thinking about how to improve the company that was recently founded. Bringing the company further with new, innovative projects therefore acted as an intrinsic motivation and made the participant think about new, possible projects.

Another participant was stating something similar in explaining that he or she was at the beginning of their career when constantly thinking about how to become a successful designer. During this process, the participant was intrinsically motivated to create something that had creative value and brings him or her further as a designer. As a result of being in this state for some time the participant had a creative Aha! experience.

Apart from intrinsic motivation about getting one's career to the next level, three participants stated that they were starting their idea finding process because they felt the motivation to show their art or photography. All participants wanted to create a good piece of art and were mainly motivated by this intention.

5.3.3. Project Structure

In the following phases participants were stating that they were *getting familiar with the structure of the project or briefing*. This means that if there was a client briefing, participants were getting familiar with the general framework, the scope and the restrictions of the project. Additionally, participants mentioned that they were making an effort to get familiar with the clients themselves, trying to get a feeling for them or the company that they're working for. In that sense, participants were trying to find which direction of work their clients could possibly like in order to set these preferences as an additional restriction for their idea finding process.

One participant also explained that he or she set additional restrictions for the idea finding process in limiting him-or herself to only use certain kind of colors or shapes that he or she thought could fit the project. These restrictions help the participant's creative process because they narrow down the design problem at stake.

If the participants were not facing a certain client briefing, they were limited by the techniques they were using for their work, i.e. Adobe Photoshop or Adobe Illustrator when being a webdesigner. Additionally, participants were explaining that they also restricted themselves due to their own standards and preferences that they wanted to keep up with.

In summary, the project structure, given by an external client or by the creative itself acts a general framework that is narrowing down the problem at stake.

5.3.4. Enabling Creative Aha! Experiences

a) Research and Inspiration

According to the interviewed participants, the factors research and inspiration can be seen processes that are mostly intentionally provoked or applied in order to help oneself to get a certain idea. The interviews showed, that the professional creatives are regarding *research and inspiration as two different kind of mechanisms*. The process of research is always described as an active one, which means that the creative professional is actively searching for something to back up information that is necessary for his or her creative process. For this process, the creative professional is mostly using the internet, magazines, books or other sources that build on information on the already given framework they are working with. For 2 participants, the research process also included a period of brainstorming where personal thoughts about the topic as well as collected information was set into a mind map in order to get a better overview about it.

The process of inspiration can be *active* as well as *passive* due to participants reports. That means that some of them were stating that they were actively searching for inspiration using different tools like books, magazines, ~~museums~~ museums, pinterest.com, instagram.com etc. This shouldn't be confused with a period of active research because in the phase of active inspiration seeking, participants are trying to get something out of that source that may inspire them, whereas in research they are searching for particular information that is building on the project at stake. Although the sources of inspiration are quite diverse, the following table summarizes the most frequently named categories:

Source of inspiration	Number of participants
Reading (Books & Magazines)	6
Museums	4
Internet (Pinterest, Instagram etc.)	3
Places & Travel	3
Nature	2

Figure 5. Source of active inspiration seeking.

Apart from this *active inspiration processes*, there is also something that could be described as *passive or random inspiration seeking*. 6 creative professionals stated that they were either being inspired randomly or that they were *actively pushing away their current project in order to wait to be randomly inspired*. This means that 2 participants stated that at some point they were inspired by a random situation they found themselves in, and out of that they got their creative Aha! experience, i.e. *"In the subway is always a lot going on - people are talking here, some guys are playing around over there and I - I think I was seeing some young boys that were showing middlefingers to each other and were yelling with laughter because they were showing each their middlefingers. And somehow there was something happening inside my head - suddenly it was there- that Aha-effect! It was 'Ding' and then there were so many connections out of nothing [...]"* (Participant (Pt.) 8, p. 1).

The other 4 creative professionals were addressing the current project, but consciously decided to push it away in order to get a distanced view. They stated that this distance *helps them in letting the ideas come to them*. However, it is important to point out that they weren't doing nothing at all, but rather putting themselves in situations where they could get inspired by their environment without consciously thinking about the project. This means that they were, i.e. strolling through the city, meeting with friends, doing sports or going outside enjoying nature. It can be stated that these creative professionals have a kind of trust relationship with their own creativity, which leaves them waiting for the right moment to come.

However, even if participants were getting inspired in this way, some of them were also entering a more concrete period of research that enabled them to go more in depth with the first sparks of their ideas.

b) Methods of Idea Development

After participants were being inspired or doing some research for their projects, they entered a state of idea development. This period of idea development is encompassing different kinds of processes that are dependent on the individuals and their working circumstances.

6 participants were explaining that their idea development period was including a phase of intensive thinking and sense making. This means that they were actively

trying to bring together all the inspiration and information that they gathered for the project, i.e. “ *and for this project I was sitting, hmm let’s say two hours or something, where I was sitting and thinking about it really intensily and only concentrating on this*” or “*Then trying to make sense of it...*” (Pt. 9, p.4)

5 participants were stating that *unconscious processing was an important factor in their idea finding process*. This means that they had the project in the back of their mind for a period of time without consciously reflecting about it, i.e. “*Yeah in the back of your mind - you associate it somehow. This is something that could influence the project!*” (Pt. 4, p.3).

8 participants explained that it was important for their idea development period that they were having enough breaks, where they were not working on the project. That time helped them to process their thoughts and made them feel good and relaxed. In that sense participants were stating, i.e. “*That’s just getting complete, to give the brain more space I guess. Also what helps for me is a bit doing sports, going longboarding or something...*” (Pt. 7, p. 3)

Ways of Idea Development	Number of Participants
Breaks	8
Intensive Thinking	6
Unconscious Processing	5

Figure 6. Ways of idea development.

c) Further Creativity Enablers

While interrogating my participants about the process, development and experience of their creative Aha! experiences, the conversation also included information about the circumstances that facilitate and enable creative Aha! experiences. Out of the data from all 12 interviews, I was able to identify 5 general categories that influence the idea finding processes

Idea Enabling Circumstances	Number of Participants
Mood	10
Personal Needs	5

Idea Enabling Circumstances	Number of Participants
Personal Assumptions	4
Physical Working Environment	6
Social Circumstances	6

Figure 7. Enabling Creative Aha! Experiences.

Interestingly, 4 participants stated that their personal assumptions about the project were essential for their creative processes. This means that besides the already given framework of each project, these 4 participants were setting themselves further work determining principles due to their personal interests and beliefs. This was, for example, the case with one participant who was working with a client briefing and set himself the constraint that he wants to create a “*community-thing*” (Pt. 7) out of the project.

Besides from personal assumptions, 4 professional creatives were stating that social interaction and feedback is an absolutely beneficial factor for their creative process. Those participants explained that their best ideas emerged when they were spending time with colleges or friends. On the contrary, 2 creatives explicitly stated that they need time alone and only with themselves in order to get their creative process going.

Furthermore, 10 out of 12 participants were referring to their mood when talking about creativity enabling circumstances. 7 participants explained that they get the most creative ideas when they are feeling stressed and pressured. The majority even stated that a decent amount of time pressure is even necessary for them in order to produce something. In contrast, 3 participants stated that they can only produce creative outcome when they are feeling relaxed and calm, and that stress and pressure makes them unproductive.

Looking at the results concerning the categories social circumstances (social interaction and time alone) and mood (pressure and relaxation), it is obvious that the results are quite contradicting. Nevertheless, it can be stated that because of their frequent mention, these two categories are important for the creative process, no matter what this exactly means in each case.

Furthermore, the category “Personal Needs” appeared out of data, encompassing the subcategories “sleep” and “motion”. 4 participants stated that the importance

of rest and sleep in their creative process. This particularly means that they were getting their creative ideas in a sleepy status, i.e.: *“Properly it was in the sleep [...] that’s often for me, I wake up in the morning and then I know.”* (Pt.7, p. 3) or *“[...] and when I was falling asleep I... somehow had the idea.”* (Pt. 5, p.1).

On the contrary, 2 other creative professionals explained that in periods where they are trying to produce creative outcomes, it is really important for them to stay in motion. Therefore, they try to move or do sports on a regular basis. Both of them stated that they often got new ideas while being active. The subcategories “sleep” and “motion” are again quite diverse, nevertheless they indicate that it is important that the creatives are always taking good care of their individual needs, especially in times where they have to produce a certain creative outcome.

Another category that was clearly emerging out of the codes was the importance of physical environment in the creative working process. 4 creative professionals explained that it is highly determining in which physical environment they’re in when trying to produce an idea, i.e.: *“[...] there are different kinds of ~~stations~~ Sometime I feel like when I have to sit down and do something and work on it concentrated then I need a cozy little space- for example Jonas Reindl - the cafe at...”* (Pt.2, p. 3). Another participant was talking about his office, stating that ~~the~~ introducing a wall that works as a huge whiteboard, the creative processes are much more animated: *“since we have this big whiteboard where you can stand and... write something on the wall. I think that really helped our creative process ...”* (Pt.12, p.4).

5.3.5 The Experience of Creative Aha! Moments

Through the iterative process of the elicitation interviews, participants entered a state of deep introspection, trying to share their own cognitive and affective mechanisms when having a creative Aha! experience. In order to evoke this intention in the participants, it was important to create a good atmosphere for the conversations and to patiently bring attention back to the actual topic repeatedly. This step was especially important for the stage where participants were trying to express the cognitive and emotional experience of their creative Aha! moments.

Through analyzing the interviews, I was able to find that the creative Aha! experiences of my interviewees are experienced with the following qualities for the majority of cases:

Affect	Number of Participants
Suddenness	8
Pleasure	8
Excitement	5
Relief	3
Ease	2
Surprise	2

Figure 8. The Experience of creative Aha! experiences.

a) Suddenness: 8 out of 12 participants explained that the creative Aha! experience was occurring suddenly. Although the process of idea development was going over a long period of time, the moment when the actual idea happened was experienced as a sudden flash.

b) Pleasure: 8 out of 12 participants stated that the creative Aha! experience was a moment of pleasure, manifesting itself through a lot of positive feelings.

c) Excitement: 5 out of 12 participants described the moment of the creative Aha! experience as exciting, stating that they were feeling a strong level of excitement or even nervousness.

d) Relief: The results showed that 3 participants stated that the creative Aha! moment was experienced as a relief. This was in all three cases told by participants that were trying to get an idea for client projects and therefore had to produce a creative outcome until a certain moment of time. All of them felt pressured before and therefore relief when they finally got an idea.

c) Ease: 2 participants stated that the creative Aha! experience felt easy, although the idea finding phases was experienced quite differently. Additionally, 2 participants explained that the creative Aha! moment came surprisingly, which left them wondering how this idea came across.

Besides from these rather straight forward descriptions of particular affective reactions, participants were often referring to linguistic expression or metaphorical descriptions in order to describe their cognitive experience. 3 participants described having the creative Aha! experience with an intuitive sound, i.e. *“In the morning - it was fast - it just came together like „fuuuuuuuu“ (makes a noise).“* (Pt 7, p. 2) or *“And somehow there was something happening inside my head - suddenly it was there- that Aha-effect! It was “Diiing” and then there were so many connections out of nothing ...“* (Pt 8, p.1).

Interestingly, 4 participants were comparing the creative Aha! moment with the process of finding a match, a fit or a solution. This was for example stated as: *“[...] and then everything somehow in combination turns out to be like „Ah yes - everything is matching together somehow[...]"* (Pt 4, p. 2).

Other expressions that were used in order to describe the creative Aha! experience were, for example, that *“... but .. it was somehow popping into my mind.“* (Interview Katharina Zimmerman, p.1) or *„Yeah, I do remember because the beauty about these kind of moments or that specific moment was ahm... it kind of clicks in your head..."* (Pt 9, p. 2).

These kind of linguistic expressions are not only interesting in the sense that they show different ways of expressing creative Aha! moments, but also because they are used in order to describe creative Aha! experiences, which have no generally agreed on descriptions that are used in everyday language. This again points in the direction of cognitive phenomenology, stating that there are few if any descriptions of our cognitive processes, no matter how familiar they might be.

Apart from describing the creative Aha! experience in its qualities, the majority of participants also stated more abstractly how the creative idea came up. In that sense, 9 individuals explained that the idea that was accompanied by a creative Aha! experience was emerging, which basically means that idea was somehow there at a certain moment of time. Although the idea emergence could appear random to some extent, it is important to point out there were a lot of different working processes going on before the actual creative Aha! experience was emerging. In that sense participants were stating, i.e. *“ I think it was just... there. And it felt great.“* (Pt. 12, p.3), or *“ Yeah then somehow you got a this information inside your brain and then it somehow happens - everything suddenly makes sense altogether“* (Pt. 4, p.2) or *“I cannot tell - normally it is just there.“* (Pt. 7, p.3)

5.3.6. Conviction and Evaluation

When describing creative Aha! experiences, nearly all participants were referring to the immediate reactions that followed them up. In that sense 7 creative professionals stated that they were immediately convinced by their ideas. This means that they were having the idea and basically at the same time they already felt a strong conviction about it, i.e. *“and I knew in my head „That’s it!!!!“* (Pt. 9, p. 2) or *“Its always like... the convincing moment. Now I know how I do the job!”* (Pt. 11, p.3). 2 participants also stated that they were so convinced by their idea, they immediately wanted to work on it and drop everything else, i.e. *“I’ve immediately been completely convinced that it could work out - the thought - I really needed to get it done. It was never - I just couldn’t wait until being on my computer again - it was like a drug somehow. I just couldn’t stop thinking about it because I believe my conviction was so strong“* (Pt. 8, p.2)

The other 4 participants, who did not experience this strong convincing moment, stated that they were evaluating their ideas, which included questioning them, evaluating them in terms of restrictions, reflecting about them and then finally deciding for or against them. The creatives who were evaluating their creative ideas were also stating that this is their usual way of handling their ideas, whereas the convinced ones said that the only work with an idea if they have this strong feeling about it right from the beginning onwards.

5.3.7. Idea Prototyping

After experiencing a creative Aha! moment, participants were stating that there are two ways of continuing with their idea. It can be the case that the idea is discarded shortly after having it because it is not regarded as good enough to put effort in its realization.

If the creative decides to work on the idea further, he or she is starting a period of *idea prototyping*. In the majority of cases this process starts with recording the idea at stake. That means that participants are either writing the idea down, sketching the idea or making a presentation about it.

After making sure that the initial idea is recorded, 6 participants stated that they were immediately working on a concrete realization of their ideas. This period is of course dependent on the individual profession of the creatives. That means that, i.e. webdesigners started their designing process while already reaching out for

programmers that could possibly program their project and the fashion designer started with sketching the idea for his or her handbag etc.

My interviews were mainly concerned with the process of creative Aha! experiences, which made me left with only a limited outlook of the processes that might follow up the actual idea. Still, I wanted to mention the category of idea prototyping because I think it makes the description of the process of creative Aha! experiences more understandable and complete.

6. Discussion

In the following, I am comparing the results of my qualitative research about creative Aha! experiences with the conclusions I found from the conceptual part of my thesis. In examining the category *Enabling Creative Aha! Experiences*, I am additionally presenting some studies and investigations of current creativity and innovation research.

The third chapter of my thesis showed that current research in the field of creative cognition is mostly referring to third person cognitive psychology approaches, which yields to theories like the Geneplore Model (Finke, Ward & Smith, 1992), the Path-of-least-resistance Model (Finke, 1990; Lubart & Sternberg, 1995; Marsh, Landau & Hicks, 1996; Marsh, Ward & Landau, 1999; Sifonis et al., 1997; Smith, Ward & Schumacher, 1993; Ward, 1994; 1995; Ward, Patterson & Sifonis, 2004; Ward, 2008; Ward & Wickes, 2009; Ward & Kolomyts, 2010), Analogical Reasoning (Basala, 1988; Crouch, 1992; Friedel et al., 1986; Gentner et al., 1997; Ward & Kolomyts, 2010) or the Problem Formulation Model (Basadur, 1994; Mumford et al., 1991; Mumford, Reiter-Palmon & Redmond, 1994; Runco & Chand, 1994; Ward & Kolomyts, 2010). Within the third chapter, I also referred to another well-known creativity model, called the Convergence Approach (Ward, Finke & Smith, 1995; Ward & Kolomyts, 2010), which combines first person reports about creativity with laboratory findings.

Although first person reports are used as a research method, the Convergence Approach is different from the Elicitation Interview Technique (Petitmengin, 2006) in that it uses reports, whereas the Elicitation Interview Technique uses empirical phenomenological interviews. Both methods use first person approaches, nevertheless, it can be argued that the Elicitation Interview Technique is more oriented towards avoiding subjective interpretations due to its specified interrogation method (Petitmengin, 2013).

Nevertheless, I want to refer to Path-of-least-resistance Model as well as to Analogical Reasoning when discussing the interview results about research and inspiration.

Firstly, I will start the actual discussion of my results by referring to the state of getting familiar with the Project Structure.

6.1. Project Structure and Problem Space

The results of my qualitative research showed that the project structure is a very important factor for creative professionals when they want to get their creative process going. Due to the results of the interviews, a project structure is either a result of a certain client briefing or a set of standards and restrictions that a professional creative sets for him or herself, e.g. his or her own taste, personal goals, preferred technical tools and equipment etc.

These findings go in the direction of the investigations presented in the second chapter of the thesis, where I was describing parts of the discussion about different problem spaces (e.g. Dorst, 2003; Ward, 2011). Within this chapter it is stated that Aha! experiences occur in different kinds of situations. First, there are Aha! experiences which appear during classical problem-solving (e.g. Gick & Lockhart, 1995; Gruber, 1995; Metcalfe & Wiebe, 1987; Reber, Schwarz & Winkielman, 2004; Knoblich & Öllinger, 2006; Topolinski & Reber, 2010; Chu & MacGregor, 2011). These insight problem-solving cases are characterized by a high level of structure and definition, which means that they are having a clearly defined starting state as well as clearly defined goal state. If the goal state is reached by finding a solution for the problem, the insight moment is occurring with an Aha! experience (i.e. Ward, 2011). On the contrary, there are so called ill-defined problems or design problems (i.e. Cross, 1984; Dorst, 2003; Ward, 2011). Ward (2011) states that these problem cases are indeed having clearly defined starting states, nevertheless it is not clear how a possible goal states could look like. Creative solutions for these problems are found through multiple rounds of open idea finding processes that can look in various ways. As already mentioned, the creative professionals I interviewed were also stating that the level of problem definition is important for their working process. Therefore, it can be argued that the project structure given by the client is defining the starting state of the problem case. If there is no defined client briefing, the creatives are sticking to their own standards, which means that they are defining the starting state themselves.

Although it is necessary that the creatives are sticking to certain standards and restrictions in order to find a solution, it is important to point out that they need to have a certain level of freedom and openness in order to produce a creative outcome. In that sense it can be said that creative work demands a strong balance between freedom and restrictions.

In summary, it can be said that *the results of my interviews coincide with current problem-solving and creativity research* when stating that *creative Aha! experiences are coming from open thinking processes that are starting with a defined starting states*.

6.2. How to Evoke Creative Aha! Experiences

Within the course of this chapter I will discuss results concerning the states *Research and Inspiration*, *Methods of Idea Development* as well as *Further Creativity Enablers*, because they are all part of the category “Enabling Creative Aha! Experiences”.

Referring to the results about *Research and Inspiration*, I will discuss similarities with some stances of the Creative Cognition Approach (Finke et al., 1992; Ward et al. 1999), as the Path-of-least-resistance Model (e.g. Finke, 1990; Ward, 2008; Ward & Wickes, 2009) and the Conceptual Combination Model (e.g. Finke, 1990; Wilkenfeld & Ward, 2001).

Due to the fact the results of the category *Methods of Idea Development* did not directly coincide with the conceptual part of the thesis; I will introduce two methods that are designed to help professionals with their creative processes. In that sense, I am introducing the methods Design Thinking (e.g. Dorst, 2011; Fulton-Suri, 2005) and Synectics (e.g. Gordon, 1960).

Besides from the interview results about research and inspiration and the development of ideas, participants were also referring to other factors that were beneficial for enabling creative Aha! experiences. Therefore, I will describe the named enablers and compare them to research findings from creativity and innovation research, referring to some categories of the *Creative Change Model* (Puccio, Murdrock & Mance, 2007) as well as to some categories of the *Enabling Spaces Model* (Peschl & Fundneider, 2014).

The Creative Change Model was originally offered by Puccio, Murdrock and Mance (2007), and is based on a system approach, providing a framework that allows the review of variables that are related to organizational creativity. This model offers one possible way of how important factors in creative work could play together. According to Puccio and Cabra (2010), creative ideas emerge as a result of the interaction between people, who are engaging in different processes. It is pointed out that the environment in which professionals are working in, is an important

factor concerning their creative outcomes. According to recent creativity research, the facet leadership was also added to model.

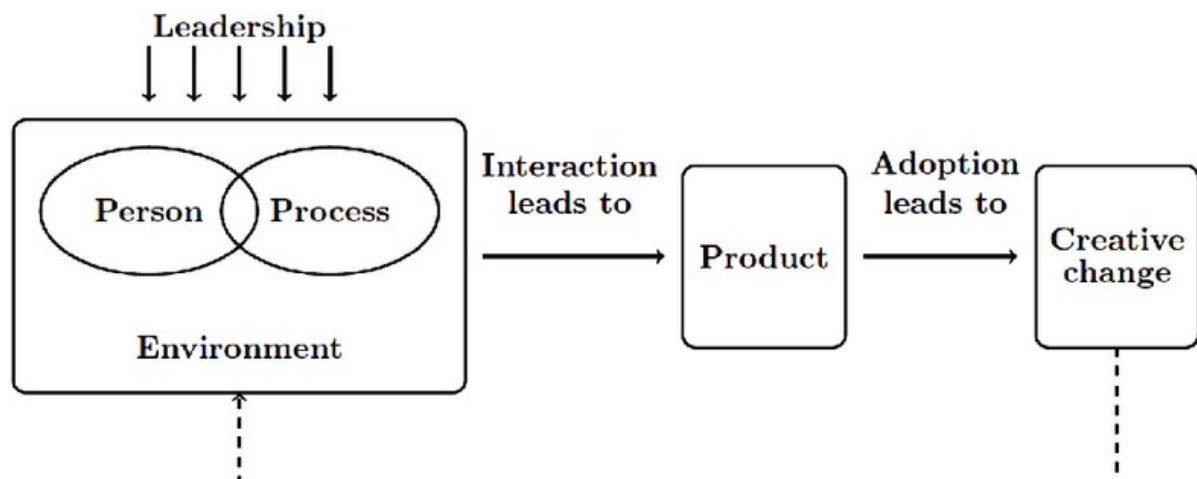


Figure 8. Creative Change Model: A Systems Model. Reprinted from *The Cambridge Handbook of Creativity* (p. 148), by J. C. Kaufmann & R. J. Sternberg, 2010, United States of America: Cambridge University Press.

While the Creative Change Model is targeting at idea finding processes in creative thought and behavior, the concept of *Enabling Spaces* (Peschl and Fundneider, 2014) is particularly focusing on innovation-finding itself.

Peschl and Fundneider (2014) state that creativity and innovation cannot be equalized because creativity is composed of various domain-specific traits, whereas innovation should be seen as a more general concept with a broader focus. In that sense, innovation is not only focusing on the process of the creation period but also on the successful application and implementation on the market.

Peschl and Fundneider (2014) explain that innovation should be seen as a social and epistemological process that has to be supported and enabled by facilitating structures and processes that are working on different levels. Therefore, innovation is a multidimensional phenomenon that emerges out of a complex network of different actors, constraints and dynamics. The concept of *Enabling Spaces* captures those innovation enabling processes and activities, integrating a broad variety of reciprocal and interactive factors such as architectural, cultural, emotional, social, epistemological, cognitive and technical circumstances.

6.2.1 Research and Inspiration

The results of the interviews show that the professional creatives interviewed generally *decide between research and inspiration*. Research is generally seen as an active process of information gathering, whereas inspiration can be actively approached, but has to happen spontaneously. Still, participants were able to name some factors that help them become inspired. Therefore, I was able to find 5 different sources of inspiration that have been named frequently. 6 participants stated that they get inspiration from reading books or magazines, 4 participants by visiting museums and 3 through using the internet (www.pinterest.com, www.instagram.com etc.). These results show that a considerable number of participants use other creative projects and art pieces as a source of inspiration for their own creative work. One could argue that these results can, at least to some extent, be compared to the Path-of-least-resistance Model (Finke, 1990; Lubart & Sternberg, 1995; Marsh, Landau & Hicks, 1996; Marsh, Ward & Landau, 1999; Sifonis et al., 1997; Smith, Ward & Schumacher, 1993; Ward, 1994; 1995; Ward, Patterson & Sifonis, 2004; Ward, 2008; Ward & Wickes, 2009; Ward & Kolomyts, 2010). Within the model it is stated that when creatives are trying to develop a new idea, they are prone to use properties from already existing, similar concepts (Ward, 1994, 1995).

In that sense the creative process of participants that are trying to get inspiration from other art, is similar to the Path-of-least-resistance Model. This means that they are using basic exemplars from other creative projects and art as inspiration for the their own work. When a participant reported that he or she looks at different websites when trying to create a webdesign for his or her own project, it can be stated that he or she is following the Path-of-least-resistance Model, using properties from other projects for his or her own creative work.

Nevertheless, 3 creative professionals stated that they become inspired by traveling and visiting new places and 2 participants were being inspired by nature. This means that the creatives were *being inspired by situations that are not directly related to their creative projects*. These findings can be compared with the *Conceptual Combination Model* (e.g. Finke, 1990; Mumford et al., 1997; Scott, Lonergan & Mumford, 2005; Rothenberg 1979; Ward & Kolomyts, 2010; Wilkenfeld & Ward, 2001), in which is stated that mentally merging previously unconnected

ideas or concepts in a new, innovative way will lead to creative ideas. This also includes a combination of elements from different domains.

Looking at the interview results in which participants stated that they draw inspiration from unrelated situations, it can be argued that they are following the Conceptual Combination Approach. This means that they are being inspired by visiting different places and nature because they are getting new input from it. This input is merged with features and concepts of their work projects. Therefore, a new way of connecting information leads to being inspired and therefore also to creative thoughts and ideas.

In conclusion, it can be summarized that the interview results about research and inspiration do show some similarities with the Path-of-least-resistance Model (e.g. Finke, 1990; Ward, 2008; Ward & Wickes, 2009) and the Conceptual Combination Model (e.g. Finke, 1990; Wilkenfeld & Ward, 2001). Nevertheless, this argumentation would need further research with more participants in order to be more significant.

6.2.2. Methods of Idea Development

The results of this category show that 8 participants stated that they need to have a *lot of breaks* in which they are doing something else, when they are trying to develop an idea. Furthermore, 6 participants explained that a period of intensive thinking, where they are trying to combine all gathered research and information about the project, does help with their idea development. 5 participants emphasized the importance of Unconscious Processing, stating that they did not follow a certain active technique when developing an idea, but they rather trust the idea comes from different, unconscious processes.

The results of my interviews show that the creative idea finding procedures of the interviewed professionals *occurs without sophisticated methods*, at least for the examples they were stating in the interviews. Nevertheless, creativity research has developed methods (e.g. Dorst, 2011; Ekvall, 2000; Fulton-Suri, 2005 Puccio et al., 2007; Puccio & Cabra, 2010) that should get the creative process going if the personal creativity techniques do not suffice.

- 1)
- 2)
- 3)

4)

5)

6.3. Experiencing Creative Aha! Experiences

Further investigations of my research questions were concerned with the experience of the cognitive phenomenon of creative Aha! Experiences itself. Therefore, I tried to summarize the current phenomenological stance of research about Aha! experiences in the second chapter of my thesis. This, in summary, lead to the following results:

Aha! moments are experienced...

- a) suddenly (Metcalf & Wiebe, 1987)
- b) with surprise (Metcalf & Wiebe, 1987; Gick & Lockhart, 1995)
- c) with ease (Gick & Lockhart, 1995)
- d) as a positive affect (Gruber, 1995)
- e) with truth and confidence in the solution (Gick & Lockhart, 1995)

Interestingly, the 12 elicitation interviews I was doing with the professional creatives were leading to similar results in terms of the actual experience of the creative Aha! moment. The most frequently named categories investigating the experience of creative Aha! moment were:

- a) Suddenness (8 participants)
- b) Pleasure (8 participants)
- c) Excitement (5 participants)

Additionally 3 participants also named "Relief" as an affective accompaniment as well as 2 others also stated "Ease" and "Surprise".

Due to the limited amount of participants the results are only representative to some extent. However, it is interesting that these categories came about, especially because they are very similar to the results of research about Aha! experiences that occur during classical problem-solving.

Concluding from the results of my elicitation interviews, I argue that if further studies would confirm these outcomes, it can be stated that even if different Aha! experiences may emerge out of different problem scenarios, well or ill defined, they are experienced in quite a similar, maybe even the same way. In other words, Aha!

experiences, may they be creative or not, are experienced with similar or even same affective accompaniments.

6.4. Conviction and Evaluation after the Creative Aha! experience

The results of the research show that 7 interview participants stated that they felt immediately convinced by their ideas after the creative Aha! experience. They were no longer concerned about other possibilities but only focused on this idea. On the other hand, 4 participants explained that they did not feel immediate conviction but they evaluated the idea after the creative Aha! experience in order to find if they want to keep working with it.

Interestingly, chapter 2 showed that the phenomenological investigation about Aha! experiences that occur during problem-solving are also experienced with a strong feeling of conviction (Gick & Lockhart, 1995). Gick and Lockhart (1995) further explain that this conviction leads to confidence, which facilitates the implementation of the idea.

I argue that Aha! experiences, may they be creative or not, are experienced in similar ways. The results about conviction of an idea are not as distinct because 4 participants explicitly stated that they are evaluating idea and then decide about it. If further investigation would approve these results, it could be argued that creative Aha! experiences and Aha! experiences during problem-solving are different in this aspect. This could be the case because Aha! experiences in problem-solving do leave the solver with a solution for a defined problem case that is also having a clear goal state. In that sense the problem-solver can rather easily identify if the goal state is met with his or her solution approach, or not. When it comes to creative Aha! experiences that appear in rather ill-defined problem scenarios, it is more difficult to judge if the solution is good (enough) or not.

On the hand, 7 participants were saying they did feel immediately convinced by their creative ideas, which absolutely disputes this conclusion. This means further investigation could also show that creative Aha! experiences are in the majority of cases also experienced with a strong feeling of conviction, which is the same as Aha! experiences during problem-solving.

6.5. Conclusion

The discussion of the interview results showed that the project structure, which is defining the problem space, is an important factor for professional creatives because it sets the scope for the following creative work. Similar to the research about problem formulation (e.g. Dorst, 2003; Treffinger, Isaksen & ~~Sadov~~ 2006; Ward, 2011) described in second chapter, the professional creatives interviewed need to have some rules, such as a defined project structure that sets the starting state and other rules for the project.

Referring to the interview results about research and inspiration, it could be argued that the participants who stated that they become inspired from other creative work and art are probably following the theory of the Path-of-least-resistance Model (Finke, 1990; Lubart & Sternberg, 1995; Marsh, Landau & Hicks, 1996; Marsh, Ward & Landau, 1999; Sifonis et al., 1997; Smith, Ward & Schumacher, 1993; Ward, 1994; 1995; Ward, Patterson & Sifonis, 2004; Ward, 2008; Ward & Wickes, 2009; Ward & Kolomyts, 2010). The creatives that stated that they become inspired from visiting new places or spending time in nature, do perhaps have a creative process that is similar to the theory described in the Conceptual Combination Model (e.g. Finke, 1990; Mumford et al., 1997; Scott, Lonergan & Mumford, 2005; Rothenberg 1979; Ward & Kolomyts, 2010; Wilkenfeld & Ward, 2001).

The subchapter about idea finding methods showed that the creative professionals interviewed do not use any sophisticated methods in order to develop new ideas. Nevertheless, this development of such method is currently investigated a lot, which is the reason why I shortly introduced the method of Design Thinking (e.g. Dorst, 2011; Fulton-Suri, 2005) and the method of Synectics (Gordon, 1960).

During the discussion of the other creativity enabling factors mentioned by the participants, further research from the Creative Change Model (Puccio, Murdock & Mance, 2007) as well from the Enabling Space Model (Peschl & Fundneider, 2014) was introduced. This subchapter showed that the creativity enablers mentioned by the participants are similar to the creativity enabling factors of current creativity research (e.g. Chávez-Eakle, Lara, & Cruz-Fuentes, 2006; Haner, 2005; Hill, Tan, & Kikuchi, 2008; Feist & Brady, 2004; Kristensen, 2004; Peschl & Fundneider, 2014).

The phenomenological descriptions from the creative professionals about their creative Aha! Experiences were similar to the research finding of the

phenomenological studies about insight Aha! Experiences (Gick & Lockhart, 1995; Gruber, 1995; Metcalfe & Wiebe, 1987; Reber, Schwarz & Winkielman, 2004; Topolinski & Reber, 2010). Therefore, if further studies confirm these results it can be argued that insight Aha! experiences and creative Aha! experiences are experienced with the same affective components.

Discussing the results about conviction and evaluation, according to research, conviction of the idea at stake is usually a part of insight Aha! experiences (Gick & Lockhart, 1995). The elicitation interviews showed that some of the creatives also experienced conviction of the idea, whereas others spend some time evaluating the idea after the creative Aha! experience. Therefore, I argue that this could be the case because creative Aha! experiences appear in rather ill-defined problem scenarios, it is more difficult to judge if the solution is good or not. This argument is debatable because 7 interview participants stated that they did feel immediately convinced by the idea after the creative Aha! experience.

The discussion of the thesis showed that there are a list of similarities between the conceptual part and the qualitative part of the thesis. At the end of the second part the following key take-aways are becoming clear:

1. Aha! experiences are mostly investigated in the research of insight problem-solving (e.g. Gick & Lockhart, 1995; Gruber, 1995; Metcalfe & Wiebe, 1987; Reber, Schwarz & Winkielman, 2004; Topolinski & Reber, 2010).
2. The process of creative problem-solving is initiated when trying to solve problems in open, weakly defined problem spaces (e.g. Dorst, 2003).
3. The phenomenological description of Aha! experiences includes: Suddenness, Surprise, Ease, Positive Affect as well as Truth and Confidence (e.g. Gick & Lockhart, 1995; Gruber, 1995; Metcalfe & Wiebe, 1987; Reber, Schwarz & Winkielman, 2004; Topolinski & Reber, 2010)
4. Creative thought and behavior is defined in various ways, but is mostly understood as a result of different cognitive processes (e.g. Cross, 1984; Dorst, 2003; Meijers, 2000; Roozenburg & Eekels, 1995)
5. Creative Aha! experiences are Aha! experiences that are evoked in moments of creative problem-solving.

6. The phenomenological descriptions of Aha! experiences in insight problem-solving and creative Aha! experiences in the qualitative part are mostly the same when it comes to the categories: suddenness, pleasure and excitement (e.g. Gick & Lockhart, 1995; Gruber, 1995; Metcalfe & Wiebe, 1987; Reber, Schwarz & Winkielman, 2004; Topolinski & Reber, 2010).
7. Research and inspiration are two different processes that are both ~~important~~ for creative Aha! experiences.

Although there are interesting similarities between the results of the conceptual and the qualitative part of the thesis, more research with a larger number of creative professionals is needed in order to further investigate the results.

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Appendix

Abstract- English

Within the interdisciplinary field of creative cognition, researchers are trying to identify cognitive processes and structures that constitute creative acts (Finke, Ward and Smith, 1992). A further goal is to identify which cognitive processes are underlying creative acts, using different methods from the interdisciplinary field of Cognitive Science (Smith, Ward, Finke, 1997).

Inspired by the interdisciplinary research about the origins of creative cognition, this master's thesis is addressing two main research questions. The first research question is about finding out *what are creative Aha! experiences*, whereas the second research question is approaching the question what is *the process of creative Aha! experiences*.

The first main part of the thesis is about presenting the current stance of cognitive theories about insight, different ways of problem solving and creativity. Furthermore, it is argued how all of these concepts are relevant for investigating creative Aha! experiences.

Besides from the conceptual part, the thesis is also based on the data that is collected from interviews with 12 professionals, that are pursuing a creative profession. Therefore designers, artists, photographers and architects are interviewed about personal, creative Aha! moments that they experienced during their creative work. For interviewing the creative professionals the empirical phenomenological interview technique "Elicitation Interview technique" (Petitmengin, 2006) is used. This technique enables the interviewer to get access to conscious and pre-conscious cognitive processes of the interviewee. In that sense the goal of the interviews is to find out what are creative Aha! experiences for the professionals and how is the process of these Aha! moments experienced.

The scope of the master's thesis is to develop a model of the process of creative Aha! experiences that comprises the findings from the empirical, phenomenological research and incorporates possible similarities with actual interdisciplinary research from the field of creative cognition. The model should ideally work as generalized overview of creative Aha! experiences.

Das Ziel interdisziplinärer Forschung über kreative Kognition ist es herauszufinden, welche kognitiven Prozesse und Strukturen Kreativität ausmachen (Finke, Ward and Smith, 1992). Der wissenschaftliche Fokus liegt in der Erforschung welche kognitiven Prozessen Kreativität zugrundeliegen und wie diese zusammenspielen (Smith, Ward, Finke ,1997).

Diese Masterarbeit umfasst zwei Forschungsfragen im Bereich der kreativen Kognition. Anhand der ersten Forschungsfrage soll ermittelt werden, was kreative Aha! Erlebnisse sind. Darüber hinaus soll die zweite Forschungsfrage die Prozesse von kreativen Aha! Momenten genauer beleuchten.

Der erste Teil der Arbeit besteht aus einer theoretischen Auseinandersetzung mit den Themen Erkenntnis, Problemlösen und Kreativität. Neben der Darlegung von verschiedenen Forschungskonzepten wird klar in welcher Weise diese Bereiche für die Erforschung von kreativen Aha! Erlebnissen relevant sind und wie sie zusammenspielen.

Im zweiten Abschnitt dieser Masterarbeit wird der qualitative Forschungsteil beschrieben. Im Zuge der Masterarbeit wurden 12 Personen interviewt, die alle hauptberuflich kreativ tätig sind. Es wurden Designer, Künstler, Fotografen wie auch Architekten über ihr Erleben von kreativen Aha! Momenten befragt. Für diese Interviews wurde die empirisch, phänomenologische Interviewtechnik „Elicitation Interview technique“ (Petitmengin, 2006) verwendet. Diese Methode ermöglicht dem Interviewer einen Zugang zu bewussten und teilweise unterbewussten kognitiven Prozessen der interviewten Personen. Das Ziel der Interviews besteht darin herauszufinden was kreative Aha! Erlebnisse sind und durch welche Prozesse diese zustande kommen.

Das Ziel dieser Masterarbeit ist es herauszufinden was kreative Aha! Momente sind und ein Modell über den Prozess und Verlauf von Aha! Erlebnissen zu erstellen. Dieses Modell soll die Ergebnisse des theoretischen wie auch die des qualitativen Forschungsteils miteinbeziehen und darstellen.