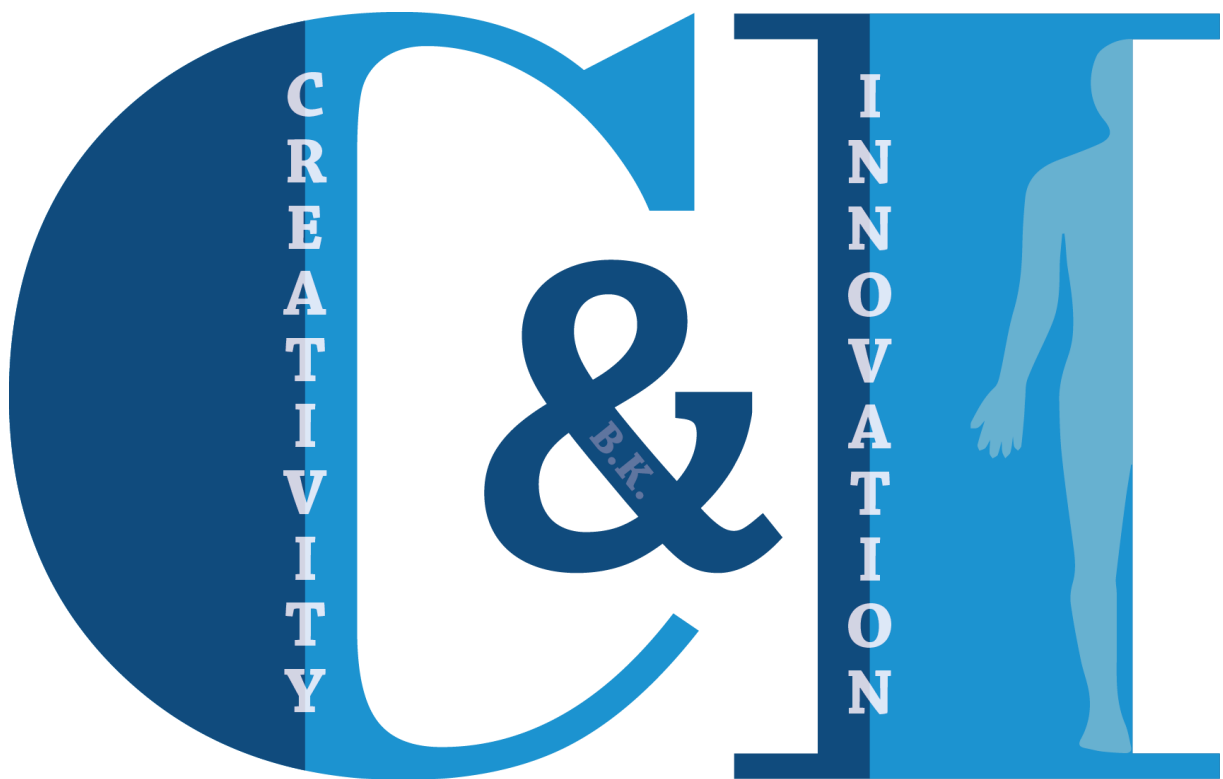




B A A T
M E D I C A L



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Increasing the level of creativity and innovation for employees of BAAT Medical during the first two stages of the design process

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PREFACE

Finding a bachelor assignment that suits you is not always that simple. Sometimes the department of my study, Industrial Design at the University of Twente, proposes an assignment, but mostly it is found by searching one yourself. Eventually, I came across this assignment with the help of Sanne Wolbers, Christiaan Endert, and Ryelle de Wit.

For a period of 14 weeks I was embraced as a fellow employee by the people of BAAT Medical, Hengelo. A company, consisting of almost only technical people, but all with a heart for the medical world and the aim to develop orthopedic products.

In this report I would like to describe my findings and results I discovered during my internship. This piece is intended for all employees of BAAT Medical, customers of BAAT Medical, and the mentor and examiner provided by the University of Twente.

My thanks go to Sanne Wolbers, Christiaan Endert, and Ryelle de Wit for helping me to find this assignment. Without them I would have had to search for an assignment even longer. In addition, I would like to thank Arthur Aalsma of BAAT Medical for providing me with this assignment.

During my time at BAAT Medical I received the full support of all employees, for whom I am thankful. However, special notice goes to Harry Christenhusz and Ryelle de Wit for performing as mentors within the company. They were always available when I needed them and helped me throughout the entire process.

Finally, my thanks go to Julia Garde, mentor provided by the University of Twente, for helping me finding the right literature and guidance throughout several phases of the assignment.

Hengelo, August 8th.

Bart Konjer

ABSTRACT (NL)

Om oplossingen te vinden voor een gegeven probleem moeten mensen creatief denken en dit verwerken in een gegeven methode. Zonder deze creativiteit zal het team stil komen te staan en zal het alleen maar kunnen werken met producten die al bestaan. Dit in zal het geheel nooit tot innovaties kunnen leiden.

Wanneer een bedrijf innovatief wil zijn moeten de medewerkers een bepaalde graad van creativiteit hebben. Ook al is iedereen creatief geboren, niet iedereen is in staat om dit creatieve beest eruit te laten. Dit kan meerdere oorzaken hebben, variërend van het moeten meedoen aan een onderwerp waarin je niet geïnteresseerd bent, tot het verkeren in een situatie waarin het proces waarbinnen de creativiteit tot uiting moet komen enigszins is vastgeroest. In geval van het laatste, wanneer het ontwerpproces al voor langere tijd op dezelfde manier wordt gebruikt waardoor het is vastgeroest, is er een verandering nodig. Binnen deze opdracht is hiervoor naar een oplossing gezocht binnen het gebruiken van brainstormmethodes. Het literatuuronderzoek heeft aangegeven dat er totaal drie verschillende niveaus zijn met in totaal 15 elementen met onderliggende factoren die de graad van creativiteit en innovativiteit beïnvloeden. Op het level van *Source (Bron)* waarin de elementen worden benoemd die vereist zijn voor elke creatieve actie zijn de elementen *Job Skills (Baan Vaardigheden)*, *Devotion (Toewijding)*, en *Method (Methode)* te vinden. Het tweede level, *System (Systeem)*, omschrijft de organisatorische context waarin creativiteit en innovativiteit tot stand komt. Hierin zitten de elementen *Person (Persoon)*, *Team*, *Wherewithal (Hulpbronnen)*, *Aim (Doel)* en *Structure (Constructie)*. Het laatste level, genaamd *Culture*, vinden we de elementen *Ideas (Ideeën)*, *Freedom (Vrijheid)*, *Humor*, *Environment (Omgeving)*, *Company (Bedrijf)*, *Risk (Risico)* en *Growth (Groe)*.

Mede met dit model voor het beïnvloeden van de creativiteit en innovativiteit zijn meerdere methodes geselecteerd. In meerdere pilots zijn methodes getest met de hulp van medewerkers van BAAT Medical, Hengelo. In een totaal van 11 pilots zijn 10 verschillende methodes behandeld. Tijdens elk van deze pilots zijn de verschillende elementen van het model zo goed mogelijk behandeld, maar de focus lag voornamelijk op de elementen en factoren van *Method*, *Risk*, *Structure*, *Team*, *Criticizing* en *Interaction*. Dit omdat de andere elementen en factoren moeilijker te behandelen waren en omdat de tijdsduur van de stage een beperkende factor vormde voor de hoeveelheid uit te voeren pilots.

Door het analyseren van de resultaten van de pilots (inclusief bevindingen van de deelnemers), aangevuld met het literatuuronderzoek, zijn in totaal 18 instructiekaarten gemaakt. Binnen het gebruik van deze kaarten is een verschil op te maken tussen de verschillende onderdelen van het ontwerpproces, reikend van het analyseren en herdefiniëren van het probleem tot het kritisch analyseren van de concepten. Deze kaarten zijn aangevuld met kaarten die de algemene richtlijnen en regels voor brainstormsessies weergeven.

Om de graad van creativiteit en innovativiteit van medewerkers van BAAT Medical te verhogen zullen zij gebruik moeten maken van deze kaarten tijdens toekomstige brainstormsessies. Daarnaast zullen aanvullende studies moeten aantonen welke elementen nog meer moeten worden behandeld voor het verder verhogen van de graad van creativiteit en innovativiteit.

ABSTRACT (ENG)

In order to produce ideas and concepts for a certain problem, people need to think creative and act upon it within a given framework or method. Without that creativity the team is standing still and can only act on the concepts already available. In the end this will never lead to innovation.

If a company wants to innovate it needs to insert a certain level of creativity of its employees. Even though all people are born creative, not everyone is able to unleash their creative beast within himself. This can have several reasons, differing from having to participate on a topic one does not find interesting to a situation in which the process wherein creativity is sought is somewhat rusted. In case of the latter, in which the design process has been used for such a long time in the same way that it has become rusted, a change is required. Within this assignment the solution is sought within the use of new brainstorm methods. However, a profound literature review states that there are three levels with a total of 15 elements with underlying factors that influence the level of creativity and innovation. At the *Source* level, containing the elements required in any purposeful creative act, we have the elements of *Job Skills*, *Devotion*, and *Method*. At the *System* level, describing the organizational context in which creativity and innovation happens, there are five elements, consisting of *Person*, *Team*, *Wherewithal*, *Aim*, and *Structure*. At the last level, named *Culture* we find the elements of *Ideas*, *Freedom*, *Humor*, *Environment*, *Company*, *Risk*, and *Growth*.

With this model for influencing the level of creativity and innovation several pilots were held. In these pilots methods were tested with the participation of employees of BAAT Medical, Hengelo. In a total of 11 pilots 10 different methods were treated. During each of these pilots the different elements of the model were treated as much as possible. However, the focus lay mainly on the elements and factors consisting of *Method*, *Risk*, *Structure*, *Team*, *Criticizing*, and *Interaction* since other elements and factors were more difficult to serve. Moreover, the duration of the assignment created a limitation to the number of elements and factors to be treated in the pilots.

Through analyzing the results of the pilots (including participations reviews), supplemented with the information of the literature review, a total of 18 instruction cards were created. In these cards a distinction can be made between four different stages of the design process, ranging from analyzing and redefining the problem statement to critically analyzing the concepts. The cards for the four stages were supplemented with cards containing overall guidelines for brainstorming.

To enhance the level of creativity and innovation employees of BAAT Medical are to use these cards within future brainstorm sessions. Furthermore additional studies should indicate which other elements can be treated as well in order to enhance the level of creativity and innovation even more.

DECLARATION OF AUTHORSHIP

I, Bart Konjer, hereby affirm that I wrote the assignment presented here on my own and only with the help of the named sources. All quotations and corresponding assumed parts are clearly stated.

Place and date

Signature of the author

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GLOSSARY

Annex II certificate for class IIB products

Indicating that the company is certified to develop and produce certain medical projects

Problem initiator

Person that formulated the problem and presented it to the group

Problem monitor

The person that makes notes of the meeting and forms conclusions

Cage

Object that is to be placed in the spine during certain a medical operation

ALIF (Anterior Lumbar Interbody Fusion)

Approaching the spine from the front when operating with the aim to insert a cage

PLIF/TLIF

Approaching the spine from the back when operating with the aim to insert a cage

Insertor

Tool used to control the cage when inserting it in the spine

POP-hours

Individual hours employees of BAAT Medical have to increase their overall knowledge about topics with which they work. The number of hours per year per person are determined. For which topic they are used is for the employee to decide.

Ideation

The creation of new ideas

Artefact

Anything produced or shaped by human craft. In knowledge work it is anything tangible, portable object that holds information (e.g. post-its and BAAT-books).

Meta-cognition

Thinking about the way that you think/thought

1 INTRODUCTION

BAAT Medical is a full-service specialist in the field of product development within the orthopedic world. With the recent acquired annex II certificate for class IIB¹ products they deliver services, ranging for idea generation to the actual development of CE marking orthopedic products under private label. Within these projects they work together with partners, both domestically and abroad. Customers of BAAT Medical are critical professionals with a demand towards high flexibility, up to date knowledge, service provision, and creativity during the entire process. The workstyle of BAAT Medical has resulted in over 30 different products and a growth which resulted in moving to a new building in Hengelo, Overijssel.

The mission of BAAT Medical is to empower the creative design, develop and deliver new medical devices turnkey. Their focus lies in the entire product development process, from basic user requirements as input of the customer to CE mark and production.

BAAT Medical works with a design process, consisting of five sequential phases, to make projects manageable, predictable, and reliable. However, this has limited the level of creativity and innovation of its employees since it has become a bit rusted over time. The aim of the study was to find and introduce methods which can be used during brainstorm sessions in order to reduce this degradation. In this assignment it was found that multiple factors influence this level of creativity and innovation. Not only the introduction of new methods can be successful in this mission, but there are a total of 15 factors (read elements) that need to be affected. However, the introduction of new methods was the primary target.

The assignment took place in the total duration of 14 weeks, containing the phases of a literature review, testing researched methods in pilots, and the creation of instruction cards. For a more elaborated version of the activities done in this time period, see chapter 2 'Strategy', page 13.

It was determined that at the end of the assignment (mid-August 2016) the author would deliver a substantiated advice on what to do for increasing the level of creativity and innovation with the main focus on elaborated methods.

¹ See 'Glossary', page 11

2 STRATEGY

In order to find a way to increase the level of creativity and innovation within the company of BAAT, multiple research questions have been proposed (see paragraph 12.1 *'Plan van aanpak'* in the Annex, page 73). Firstly, it was sought-after what the expectations, effects and demands are for increasing creativity and innovation in general. This was done through a broad literature review, treating many articles and books (see Bibliography, page 70). Results of this research can be found in chapter 3 *'Creativity and Innovation in general'* (page 14). Secondly, an analysis was conducted of BAAT Medical, treating the incentives and inhibitions of the company towards creativity and innovation. It was also researched what the benefits of using new methods were according to employees of BAAT Medical. This second research question was answered through questioning both the management of BAAT Medical and employees of the company. The answers to this research question can be found in chapter 4 *'BAAT Medical Analysis'* (page 25). Thirdly, the question of which methods are useful within BAAT Medical needed to be answered. This research question did not contain the implementation of pilot sessions yet, but only consisted of researching methods that are available in the literature. This was supplemented with the help of mentors, other students, and employees of BAAT Medical. The results can be found in chapter 5 *'Methods Analysis'* (page 38). The real testing of the methods (read pilots) occurred next. After this practical part of the assignment, the fourth research question, consisting of what the findings of the pilots were, was treated. The data and other findings, retrieved from these pilots, were then analyzed and summarized. Together they form chapter 6 *'Pilots and their results'* (page 46). From this, the fifth research question was preluded. In this question it was sought-after how the methods could be implemented on a long term basis, using some kind of instructions. The answer to this was found through analyzing the results, combining that with the results of the first three research questions, and then merging that information into instructions. Results can be found under chapter 7 *'Creating instructions'* (page 58). The question of how it can be assured that the newly formed instructions will be used in the future can be found in the chapter containing the recommendations on this assignment (page 65). This chapter is further supplemented with other recommendations that came to light in this research.

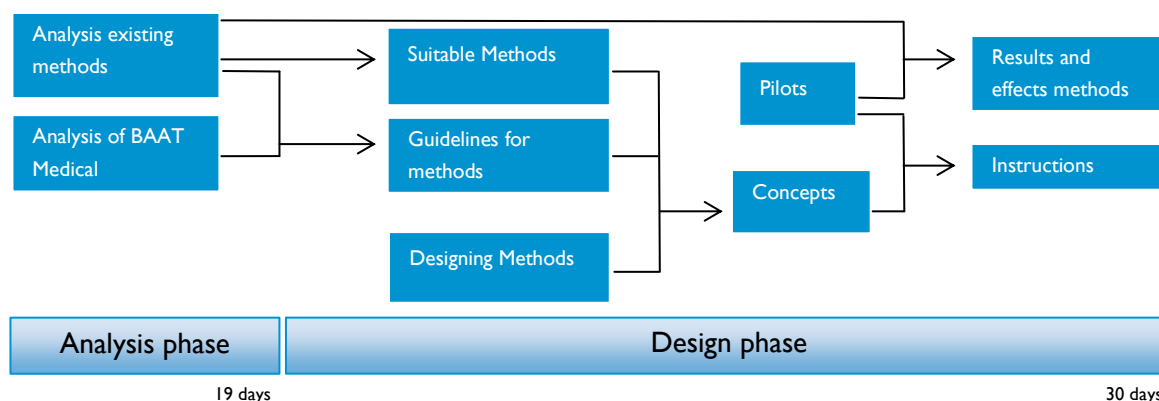


Image 1: roadmap for the assignment in general

3 CREATIVITY AND INNOVATION IN GENERAL

In this chapter the literature review that has been conducted in the light of this assignment will be elaborated. First, an explanation of the term 'creativity' will be given. From that the influences and limitations of creativity will be addressed. From paragraph 3.5 the term 'innovation' will be treated with the same components (term, influences and limitations). At paragraph 3.7 a newly formed model is introduced and clarified.

The information in this chapter is used as a reference work throughout the rest of the assignment since it contains the literary background, and thus spine of the research.

"Creativity is just connecting things. When you ask creative people how they did something, they feel a little guilty because they didn't really do it, they just saw something. It seemed obvious to them after a while"

- Steve Jobs

3.1 Creativity

The term creativity is defined as the tendency to generate or recognize ideas, alternatives, or possibilities that may be useful in solving problems, communicating with others, and entertaining ourselves and others (Franken, 2004). It is the process of having original ideas that have value. There are three distinct reasons (and thus motivations) for people to be creative. Firstly, there is the need for novel, varied, and complex stimulation. Secondly it is driven by the need for communicating ideas and values. Thirdly it is required for solving problems. Especially the latter will be treated here.

Creativity includes more than being original and inspiring toward others and the task at hand. Creating a great piece of art or coming up with a new idea for a product requires creativity, but less imaginative professions such as a speechwriter or a cashier have a demand for creativity as well. For instance, a speechwriter needs to be creative in translating a somewhat dull and tiresome topic into an attractive and pleasing speech. True, we differ to each other in the level of this creativity, but we all are creative (Plsek, 2013). Being creative means you have what it takes to come up with original ideas, new solutions, new methods, and/or new procedures with the tasks at hand. Failure is something that can occur in that process. It is a myth that creative geniuses rarely fail. According to Professor Simonton of the University of California, the opposite is true: creative geniuses, ranging from artists like Mozart to scientists like Einstein and Darwin, are quite familiar with the event of failure. They just don't let that stop them. In Simonton's research it is found that creative people simply do more experiments when compared to people who are assumed to be less creative. Their ultimate 'strokes of genius' don't come around because they succeed more often than other people. They just do more, by taking more shots at the goal. That is the surprising, compelling mathematics of creativity and innovation: if you want more success, you have to be prepared to become familiar with failure. The faster you find weaknesses during an innovation cycle (through failure), the faster you can improve what needs fixing.

"Innovative organizations must reward success, celebrate failure, punish inaction"

-Robert Shelton, leader and author in innovation management

Research within the cognitive sciences conclude that the ability to generate creative ideas and act upon it is a 'gift' we all possess (Plsek, 2013). The statement is strengthened by a study of Kaufman, But, Kaufman & Colbert-White (2011) in which a cognitive and neurobiological framework for creativity in animals is created. This study is based on recent animal behavior research, behavioral neuroscience, and creativity theories. It is found that recognizing and seeking out of novelty is linked to the dopamine system, a hormone which plays a major role in experiencing pleasure and wellbeing. The second level is observational learning, ranging from imitating another to the cultural transmission of creative behavior. At the top of the model is innovative behavior, including the creation of tools and displaying a behavior with the understanding that is somehow new and different. Combine this framework with the human abilities of complex thinking and human intelligence and it is impossible to say that some people are not creative at all.

3.2 Education as a limitation to creativity

We are all creative from the day we are born. From an early age we play with toys and discover new worlds along the way. This exploring is fed by the way we think from a young age and can best be described as divergent thinking (Anderson, 2015). Children, especially from a young age, are not always aware of the rules and limitations that are made for all the objects in their lives. They simply interact with them in unlimited ways until some adult sets boundaries. For example, a child will see a sofa not only as an object that can be used for sitting and laying on, but it is also a trampoline, the foundation of a castle, a place to hide, and many more. After a while, the parents tell the child to stop jumping on the couch and only use it for activities that do no harm to it. The appearance of these limitations will occur for all the activities the child faces in the future. Especially schools limit the way children think since they educate a certain curriculum with underlying goals (Anderson, 2014). Essentially those limitations break the creative-, and thus divergent, mind of children. Research shows that 98% of children under the age of 6 think divergent. From the age of 6 to 12 years old that number declines dramatically to 40%. Around the age of 18 only 10% of people can think divergent. At the age of 25, only 2% of people can think creative (Anderson, 2015). In addition, Anderson conducted another research in which he asked pupils whether they thought of themselves as being a creative person or not. In it, 90% of the second grade children answered 'yes'. That number dropped to 8% by the time they reached high school. In conclusion, he writes, children are drilled in education to not be creative. This is strengthened by the fact that in today's education only giving the right answer is good, described in the analytical schooling system. The basis for this teaching can be found by looking back to the start of this system, which is in many ways the westerns industrial age. During that time the educational system was designed for a linear economy. The aim for this was to 'produce' people who could follow rules, formula, and do that efficiently. That system is not about divergent, not about liquidity. It is about doing things fast and getting it right the first (Anderson, 2016). In addition to the latter, operant conditioning (also known as Skinnerian conditioning) is happening in every day's school. This conditioning is described as learning that is controlled and results in a shaped behavior through the reinforcement of stimulus-response patterns (McLeod, 2007). With the latter is the use of reward and punishment meant, since rewarding the desired behavior will make the behavior more likely to happen. Starting in elementary school, children receive stickers for doing a certain test well. In high school grades are introduced, with in the Netherlands a scoring system of getting a mark ranging from 1 to 10. So now it is doing things fast, with the highest grade, and still the fastest.

"The greatest invention is the mind of a child"

- Thomas Edison

3.3 Influences of creativity

Creativity is very sensitive when it comes to how it can be affected. In order to know how to unleash the creative inner selves it is necessary to determine the different influences of creativity itself. To create order in the large amount of information that is available on the topic of creativity, the influences have been divided into four different areas: person, team, company, and environment.

3.3.1 Person

Creative ideas are formed and initiated by individuals. Surely they are embraced and executed in team format, but every idea has come from an individual moment of Eureka. But what is the basis for this moment of Eureka? First of all, one needs to work hard on an idea or solution (Tan & Perleth, 2015). Key to this is enthusiasm. Without the will to do and create more than others, creativity is dead. Secondly, one needs to be inspired, which is strengthened by the aspect of free association. Together they create a platform which cancels the limits created by existing structures, methods and procedures (Van Dijk, 2016). Combining ones creative- and analytic capacities with the experience and knowledge on a topic can create a new view and perspective. With this new view it is possible to see problems from a different perspective, and thus finding new solutions (Piirto, 2011). Once a solution is found and one is really creative, it will not stop there: even more possibilities (and thus solutions) might appear when working even more on the topic.

Not only knowledge, experience and capabilities of the brain are the key characteristics of a person in order to be creative. Even more important are the aspects which are related to psychology. Optimism, openness, belief structures, self-esteem, attitude, being progressive, perseverance, empathy, taking initiative, norms and values, and the will to think broad are highly underrated within the concept of creativity (Fagerberg, Mowery & Nelson, 2005). Also, without the courage to make a change it is hard to be creative. Last but not least, one needs to be a people-person. This opens the door for the second influence area.

“Over many years of experience I created a model which grasps (to my opinion) all components for a creative person. Within the model of ‘6 Characteristics of Truly Creative People’ I call out the need for the three inner (and most valuable) characteristics of the model: attitude, imagination, and knowledge. Attitude is described as the drive, confidence, and motivation to solve a problem. Knowledge contains the toolbox for your imagination, which can be described as the ability to find (new and creative) solutions. Imagination is described as the ability to look further and using ones existing knowledge for finding new solutions.”

- Stanford professor Tina Seeling

3.3.2 Team

Creativity is initiated as an individual effort but is way faster and more efficient when done in a team format (Acikgoz & Günsel, 2016). In reality people need to listen to each other and make way for other people their opinions. One person can know much about a topic, multiple people even more. One person can be creative, multiple people even more.

The total amount of knowledge within a team, and thus the cognitive tools available, is determined by the composition of the team. The more divers the team is in terms of professional background, the more likely the team is to be creative (Pirola-Merlo & Mann, 2004). This is strengthened by findings of McDonough. In his research, used by Chryssochoidis (2003), it is found that radical developments requires a directive style from the project leader and with a team consisting of members who are relatively new to the business. This in contrast to projects with a need for more routine

development with teams consisting of better educated team members with an understanding for the business processes and practices. Chryssochoidis (2003) added that the 'Big Five' personality factors, consisting of conscientiousness, extraversion, neuroticism, agreeableness and openness to experience, have implications for team performance. Another influence to a team's creativity is the amount of humor and fun. Like creativity, this invites people to see things from different viewpoints; it builds bonds and reduces stress and anxiety for both individuals and teams (Anderson, 2014). Working from the other way around, being creative should be fun (Anderson, 2015).

The most enriching rewards for creative endeavor are of an intrinsic level, consisting of the pleasure the team takes in doing the work and in achieving the results. The pay or prizes are of a less great value when it comes to the enriching reward (Piirto, 2011).

Important for the level of creativity of a team is the method with which they work during brainstorm sessions. Sitting in a room with multiple people and a problem at hand will not result in a session with much creativity. The team needs some kind of tools and one or more methods to hold onto.

3.3.3 Company

It is said that some of the most creative people are working for Apple and they get paid to create time to brainstorm and let their minds take its course, rather than keeping a somewhat programmed way of thinking (Waters, 2013). In today's world there is little to no time reserved for real thinking, brainstorming, or even experimentation without judgement. With the economic focus on quick results (see paragraph 3.2 '*Education as a limitation to creativity*', page 16) it is getting harder and harder to look away from the amount of tasks to be accomplished (Waters, 2013). So, it is important for a company to give its employees some degrees of freedom to work in. This should not be limited to the liberty to plan their activities to a certain degree, but should also consist of the freedom to, for example, speak out and disagreeing with management.

When starting a certain project, a company has calculated a certain risk in this project: will it be likely to succeed, or is its success not guaranteed? In projects with the desired result of radical innovative products this risk is higher than projects where the result is deemed less innovative and more routine. So, what is the aim of the project? This risk is of influence to the project and the creativity of the members of the team treating the project.

Independent of whether the project has a high or a low risk of succeeding, employees need to be given sufficient resources to allow ideas to emerge (Seelig, 2014). Not only physical resources (such as desks, computers, and meeting spaces) should be available, but non-physical elements (such as time, money, and knowledge) should be made available as well. The more resources available, the more likely the team is to be creative (Piirto, 2011).

All this information, combined with even more company-dependent information like norms and values, forms the culture within a company. Culture can be described as the way someone feels about a situation due to the given rules, manners, and norms and values. Such norms already exist in every company, but should also be developed by each team to meet its needs and purposes. Once norms are in place, openness, risk-taking, and tolerance for ambiguity will find their place (Piirto,

2011). Creativity (and thereby innovation) happens when the sources of creativity are mobilized in an organized structure and within an appropriate culture. It is lots of things working together (Michaelides, 2012).

3.3.4 Environment

Creativity can do so much, but only in a climate in which it can flourish. People can be creative and be willing to act upon it, but when the environment itself prohibits or impedes it, it is impossible (Tan & Perleth, 2015). The environment here is a summation of aspects like the physical space people work in and the people with whom you work with. Songwriter and poet Bob Dylan spoke of how nature inspired him: “*Environment affects me a great deal. A lot of the songs were written after the sun went down*”. Yet, not only going out of the office can be of influence to the creativity of employees. Manipulating the direct environment of the office can create a more positive sphere and can even be of inspiration to the employees who work in it (Piirto, 2011). Putting up posters on the wall which have a direct relationship to the work that is done within the company can foster the creativity of employees. Including comfortable chairs and sofas in the environment creates relaxed and freer working conditions. There are many things that can be done to create a relaxed environment.

3.4 Limitations to creativity

In general, there are four steps that an individual goes through in order to come up with an idea (Stillman, 2014). The first stage is called *Preparation* and consists of absorbing knowledge and getting insight in the challenge that one is facing. Every idea is based, and builds, on knowledge already there (the divergent information). The second stage is *Incubation*. Most ideas are found in moments we are not faced with the problem for which the idea is for. This is due to the brain that makes connections subconsciously. The third stage is *the moment of Eureka*. This is the moment one realizes or makes notice of the connection in your brain. It is therefore the moment that you come up with the idea. The fourth, and last, stage consists of *verifying the idea*, comprising the sharing of idea(s). At every stage the level of creativity can be limited (or even killed) by endless numbers of internal and external factors. Next up are factors that are thought of as the most important ones within BAAT Medical.

3.4.1 Preparation

Absorbing knowledge and getting insight in the challenge that one is facing has many factors which can be influenced. For example, the amount of information available can limit the level of new knowledge that can be acquired by the employee and/or team. Also, giving limitations to the resources that are available for certain groups or people due to, for example, their clearance level can influence the amount of knowledge they can acquire. Surely one can rely on the knowledge that is already within other team members, but limit the freedom to seek beyond that can kill creativity. Another thing that limits peoples’ creativity is our mind which thinks in existing patterns, rather than thinking in new patterns (Plsek, 2013). For instance, a biomedical engineer at BAAT Medical can

quickly zero-in on a problem based on an initial review of the problem and situation. Since he has seen this problem before, or something close to it, he has a good idea of what to do next. We use experiences, stored in our memory, as a guide for problems to come. This type of knowledge is called convergent information: we know how things are since we already have been there. But, while this flexible and pattern-finding mechanism is great for some iterative tasks, it stands in the way of creativity. *“The point is that creative thinking requires that we think in a new direction: away from or beyond our current mental patterns towards some new patterns”* (Plsek, 2013).

Additionally, people do not think about the assumptions they make when trying to find a solution to a problem (Anderson, 2014). They make assumptions within the areas of compromises, functions, sacred items (things that are used to be untouched due to unwritten rules), and many more (see paragraph 12.3.7 ‘Questioning Assumptions’, page 87). Thinking with these assumptions in mind (unconsciously) limits the amount of ideas that come forward. Also, predetermined conditioning (treated in paragraph 3.2 ‘Education as a limitation to creativity’, page 16) is a limiting factor.

3.4.2 Incubation

Creating an environment where people can relax and take inspiration from other areas can create moments where they can form new and creative ideas. Environmental factors are also extremely important in the development of talent (Piirto, 2011). With this talent, one can create new links in the brain. Forcing employees to think of creative ideas in, for example, cubicles with a low amount of freedom can work contradictory. Other limitations of freedom (stipulated in the company’s culture) like the company’s bureaucracy, can also limit creativity (Owens, 2012).

3.4.3 Moment of Eureka

Think of it: When do you come up with good ideas? It is likely that the answer is *“while under the shower”* or *“when taking a walk”*. Again, this has to do with the dopamine system in our body (see paragraph 3.1 ‘Creativity’, page 15) and thus has a biological background. Even more it has to do with the amount of distractions and the level of relaxation you endure during these activities.

It is said that life consists of three different main aspects: relationships, work, and yourself (Anderson, 2015). Especially the latter is of influence to your personal creativity and is used within the other two aspects. However, the aspect that suffers most from stress and other distractions is also yourself (Anderson, 2015): we always efface that before relationships and work. Surely it can be described as non-selfish, but it also affects our creative mind and ability to think divergent. For example, until approximately seven years ago we had moments of Eureka while lying in bed. Now, those moments have been ‘killed’ by our mobile phones which are the things we see last when awake. Checking the mail from work, updating social media, and texting friends are more important than spending time for ourselves, even if that means simply lying in bed.

Again, the environment plays a big part in the level of creativity in this stage. An atmosphere where one is, for example, overworked is not likely to be stated as positive towards the level of creativity.

3.4.4 Verifying the idea

When one comes up with an idea, he can think that it is not good enough. From here he can either continue working or move on to a new idea. The latter kills the creativity since not all ideas have to be good and/or feasible. Working from rough ideas is always easier than working from scratch. When the idea is assumed to be 'good enough' it is shared with the team. Sharing your idea(s) with others is what forms a creative team. However, the workgroup can be very critical towards some ideas. For example, a conservative team can be shivery towards very absurd and strange ideas and thus not accepting those. However, these non-feasible ideas can be of inspiration to other more feasible ideas. Not only a team can reject an idea. Also the customer, or even society, can kill an idea. In many cases the idea is than put in the trash, rather than altering some specifications that made the idea 'not good' (Csikszentmihalyi, 2014). Even further, Csikszentmihalyi states that "*Creativity is not produced by single individuals, but by social systems making judgements about individual products*". A strategy to accommodate the fact that social judgements are so central to creativity is not to deny the importance of creativity and persuasion, but to separate them, and then claim that both are necessary for a creative idea or product to be accepted.

3.5 Innovation

Innovation is often defined as a new idea, product or method. Since that is the same definition as for creativity, a better one is needed. We start were creativity ends. When people are creative they produce new ideas and/or methods in a specific topic. The results are solutions for a problem they faced, but only stating the solution does not make the problem go away. Within 'Directed Creativity', a model created by Plsek (2013), it is stated that it is imperative that after having found creativity, it must be fully or partially implemented in some way in order to become called an innovation. Eveleens (2010) stated that innovation is the process of trying to get value out of ideas, created through creativity.

Sometimes, invention (the 'idea') and innovation are hard to distinguish from each other. However, most of the time there is a considerable time lag between the two which can take several decades (Fagerberg, Mowery & Nelson, 2005). Take for example the inventions of Leonardo da Vinci. He was able to invent machines that could fly, but was not able to create them due to the lack of (at least) adequate materials and a power source. These requirements need to be worked out first in order to becoming an innovation. To be called innovation, the idea must further be feasible in terms of replicable at an economical cost and must satisfy a specific need. Innovation involves deliberate application of information, imagination, and initiative in deriving values from resources.

By trying to innovate, companies and individuals are able to identify successful applications that are able to generate new products, ideas and methods. Even complete new business models are amongst the possibilities. When innovation is done continuously, those companies and individuals can respond quickly to changing environment demands.

Values of innovation

Innovative solutions create a certain value for the users and for the organizations that are involved in the creation of it. The word 'value' is used very often, but it does not mean the same to everyone in every situation. To better understand it, it is of importance to distinguish the level at which it is perceived. In a framework, created by Den Ouden (2012), four different levels of value are set:

Value for users

The aim of the innovation is to target the end-user of the product. It is the ultimate target. In the case of BAAT Medical, there is no direct contact with this party but they always think about the end use of the products.

Value for the company

Not only value in terms of money is of influence here. Also aspects like providing jobs are of direct value to the company. Essentially it is the aim of the company to be innovative.

Value for the ecosystem

The ecosystem mentioned here can best be described as the combination of products and services within the large systems, consisting of different organizations. In the case of BAAT Medical this consists of the companies with whom they work with, ranging from consultancy to production.

Value for society

Society (containing all the citizens) is always stakeholder for innovations as the ecological footprint of the products and services consumed affects it directly or indirectly. On the upside, understanding the issues in society provides a basis for many new transformational innovations.

3.6 Influences and limitations to innovation

Just like the influences to creativity, innovation can be influenced and limited in the areas of person, team, company, and environment.

3.6.1 Person

Although employees are fundamental to the generation and development of innovative ideas, in the innovative phase of a project they are of less influence (Lemon & Sahota, 2004). The literature argues that employees need to be given sufficient resources, time, materials, and finance to allow ideas to emerge (Pavitt, 2002). It is therefore the role of management to make sure that the process of innovation is successful and that the employees are aware of how to interact with this innovation process (Fagerberg, Mowery & Nelson, 2005). In that process some flourish and others do not feel that comfortable. Thamhain (2003) supports the view that employees that are empowered and autonomous have a greater degree of control over their work. This degree of control means that employees feel comfortable in their role to be innovative in their own work environment (Thamhain, 2003). However, some literature argues that the level of management support, given to empowered

employees will affect their ability to innovate (Van Ouden, 2012). Therefore employees must not feel alone in the pursuit of innovation.

In a sense creative people differ from innovative people. Creative people can be seen as those who pitch ideas, upset the status quo, try new things, and take risks (Vozza, 2015). On the other side, innovative people refine ideas, understand risk/constraints, prevent problems, and respect customers (Thamhain, 2003).

3.6.2 Team

While lone employees can develop innovations, teams of employees will be more important in influencing the overall ability of the organization to innovate (Lemon & Sahota, 2004). That organization must then assign resources to the team, such as funds, information, technology, and expertise. Honda Motor Corporation's success can be attributed to empowering the formation of qualified teams in innovative projects by allowing employees to join teams whom are exploring ideas that they think are interesting. Allowing teams to be changed like that has led to numerous innovations throughout the company, from minor improvements (e.g. a type of rag used to wipe down dashboards) to more technologically complex innovations (e.g. how the hood and their frames are stamped) (Ireland & Web, 2007).

3.6.3 Company

The aim of innovation is determined by the management of an organization/company. However, it is not always a choice that can be made. For example, it is difficult for older organizations to generate innovations due to distorted perceptions, dulled motivation, poor creativity, political deadlocks, and disconnected actions. In these organizations innovation is unthinkable (Chryssochoidis, 2003). On the other hand, very young organizations may in contrast, not have sufficient resources to develop radical innovations (Koops, Oosterlaken, Romijn, Swierstra & van den Hoven, 2015). The need for innovation has been highlighted by a study in which was found that between 30% and 50% of both a firm's sales and its profits originates from products that were commercialized in the past five years. These percentages have remained stable over the past decade, marking the necessity to create a consistent stream of innovation to maintain success for the organization (Ireland & Web, 2007). However, the level of innovation might differ, but essentially every organization needs to be innovative in some way. There are three types/aims of innovations for companies (Michaelides, 2012):

- *Continuous improvement*

The innovation is driven by the aim of the company to continue producing newly formed innovations within the products they are already producing. It is what a firm is able to achieve as a result of balancing exploitation and exploration (Ireland & Web, 2007). *Example:* A car manufacturer produces cars for many years but inserts some form of innovation by adding new features to the newest models in order to serve a broader market.

- *Redefinition of existing business*

The final product is already known to the world, but the company implements a new format for it to make it appear new and innovative.

Example: McDonalds did not (re)invent the hamburger but they marketed in an innovative (and relatively new) way.

- *Radical/Breakthrough*

The entire product is really innovative and new to the world. Everything is new, from process to product to the marketing of it.

Example: The introduction of the smartphone was one of great proportion: nobody thought that a device could hold so many functions, let alone what the future held for it.

Recourses (and decisions) in an anti-innovation configuration are centralized, systematically controlled by individuals or individual groups, rely on unclear criteria, are budget fixed, have a fixed date, have over defined job descriptions, and people are reassigned without any concern for innovation (Chryssochoidis, 2003). The opposite is true for an organization with a pro-innovative configuration of power. Here resources are made available for everyone, necessary information is shared, valuable rewards are consistent with innovation, collaborative structures are in place, decision making criteria are based on a collective judgement, and procedures move innovations through development in clear distinctive steps. Most importantly, innovation is considered legitimate for all organization members (Chryssochoidis, 2003).

3.6.4 Environment

In today's fast-paced environment with many competitors, firms need to be more nimble and adaptive than ever. While often able to establish a certain level of performance based upon existing technologies, companies are just as often to be left flat-footed when new emerging and novel technologies come ashore. More than ever, radical innovations are radically changing the nature and environment of competition (Ireland & Web, 2007). Take for example the situation of SanDisk and an Intel-Micron joint venture, both using state of the art technological capabilities as a foundation for beating the competition. By employing these strengths and capabilities, they are creating customers value that seems to exceed that what the less-novel technology firms are creating. By being able to create a higher customer value it is difficult for some of the more traditional hard-drive manufacturers, like Maxtor, to keep up with today's pathway to success. And this pathway is driven by rapidly changing dynamics and the will to innovate (Ireland & Web, 2007). So to be innovative, a company needs to be aware of its surroundings and play with the technologies available or it will lose ground to competitors. It is required to exploit today's advantages and to explore for innovations that can be the foundation for tomorrow. Ireland and Web (2007) added: "*rapid environmental change, and the uncertainty that this often creates for decision-makers will stimulate innovation in organizations*".

3.7 Model of Creativity and Innovation

The aim of this assignment was to increase the level of creativity and innovation within the company of BAAT Medical. To make sense out of the large amount of information of elements that influence this creativity and innovation, it needed additional summarization. Secondly, a shorter version of the literature review could be beneficial for the pilots later on since it could become useful in selecting the right methods, but also during the pilots the different elements could be pointed out and treated. Thirdly, creating an easy to read piece can later be implemented in the instructions.

The summarization was done by creating a model, consisting of a total of 15 different elements that all work together for enhancing the level of creativity and innovation. In this model, every element has given a specific name so that every first letter of that name is different from the others. Through this it is easier to find the different elements if you know what to look for. Also, it creates some kind of logo which distinguishes every element from the others.

Starting from the inner part of the model (indicated by the color red), there are three elements that influence the source. This 'source' can best be described as the elements required in any purposeful creative act. The elements are:



Job Skills

Set of skills by which we imagine new things and make them happen. We all have them and develop them ourselves;



Devotion

Personal resources we devote to an issue (determination, effort and time). This can be very personal since it comes from within. However, it also has a social side: it is fueled by others;



Method

The formalized way by which we creatively confront challenges. It is what makes creativity efficient.

Note: As one can see, the latter was to be the aim of this study (“...creating and implementing methods that can influence the level of creativity and innovation...”). The literature review however states that there are many more elements that influence creativity and innovation and only implementing new methods will not do the trick.

The second level of the model, indicated by the color blue, is reserved for elements treating the organizational context in which creativity and innovation happens. To establish a structure for innovation: offer every *person* meaningful work, develop innovative *teams*, have plenty of *wherewithal*, clearly define your innovative *aim*, and implement *structure* to achieve those targets.



Person

Every person in a team has their personal influence. People need to be connected with their passion since all good ideas come from individuals, not from teams. Also, individuals bring creativity to a team and its members, not the other way around.



Team

Ideas come from individuals, but innovation is never a solo act: it always involves a team. Teams can differ in their composition since everybody is different.



Wherewithal

The wherewithal (also known as ‘resources’) are the summation of all tools available for the teams. This is not limited to only the physical elements (e.g. books and computers), but non-physical as well (e.g. internet, experience of others, and time).



Aim

What is the aim of the planned innovation of the company? This can differ since there are multiple kinds of innovation (see paragraph 3.6.3 ‘*Company*’, page 23):

- radical/breakthrough: everything is new (product, target audience...);
- redefinition of existing business: take something that already exists and give it a new look;
- continuous improvement: some products need ‘to grow’ with time.



Structure

In order to be able to be creative, deliver innovation, and innovation targets, organizations need to collect, evaluate and implement new ideas. For example, an organization can implement creative problem solving groups, or give people time to work on new ideas (solitary or within a team). However, it is a true challenge for an organization to find the mechanism(s) by which ideas are collected and exploited that is most appropriate for itself.

The third, and last, level of the model treats the elements that have to do with the culture in which people work. It is indicated with the color green. It embodies the behaviors, norms, and values in which creativity and innovation thrives. The results are *ideas*, developed in a *company* under the circumstances and opportunities of its *environment*. With the package of *freedom*, *humor*, and the opportunity to take *risks*, both the company and the individuals are able to *grow* and then flourish in creativity and innovation.



Ideas

The foundations upon which creative cultures are build, consisting of thoughts, concepts, insights, and new ways of understanding. But, we all have an idea-killer inside of us. Sometimes it is good to let that out, sometimes it is better to tame it.



Freedom

It is possible for someone (or a team) to be creative under restrictive, or even repressive, conditions. However, innovation thrives where there is more, not less, freedom. People need to be able to have open debates or even disagree with their boss.



Humor

Humor, like creativity, invites people to see things from different viewpoints. It builds bonds and reduces stress and anxiety for both individuals and teams.



Environment

People working for a company do so in a mostly somewhat static environment consisting of, for example, a building with desks, chairs, windows etc. But the term environment encloses more than just the physical elements of the room and technologies available. Influences like religion, work-atmosphere, and other mental models can be of credit to the overall work environment.



Company

The size of the firm, the type and/or number of markets it covers, the financial resources it has at hand, whether it has multiple offices or not, company's history, the aim of innovation etc. All factors which have to do with the company and are somehow determinative for many things that happen within it.



Risk

Taking risks means making mistakes and coming to terms with failure. Without risk, innovation is impossible. These risks can take place on all levels (individual, team, and company) and during all phases of the design process.



Growth

Both the company and the individual need to grow in order to keep each other professionally alive. This unwritten contract takes both sides to develop that trust and energy in which creativity and innovation flourishes. Only then it can stand the test of time..

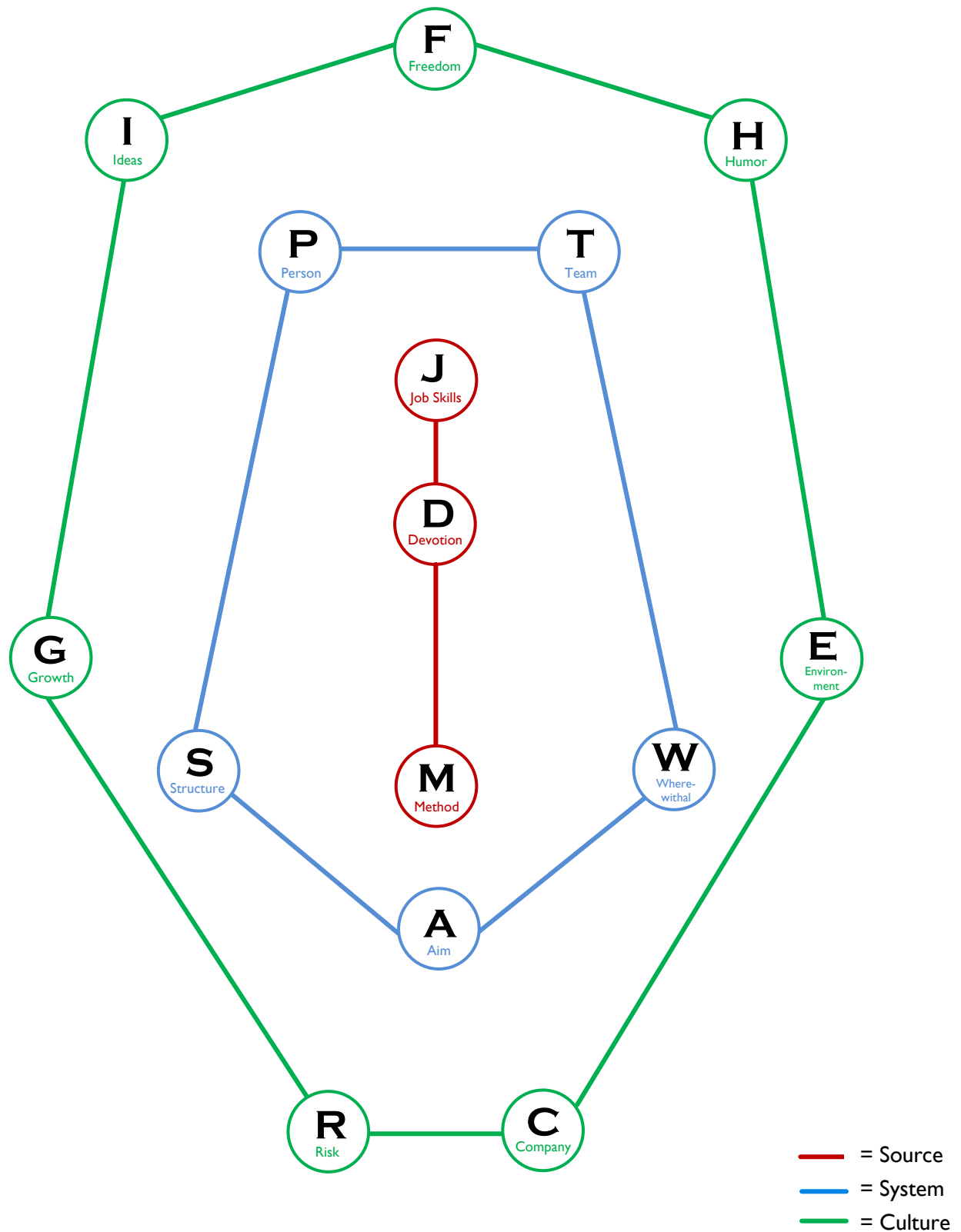


Image 2: Created Creativity and Innovation Model with separate elements that influence creativity and innovation.

3.7.1 Reasoning behind the model

The literature named multiple relationships between elements which created a direct link between them. In the model this is made visible by placing those elements near each other. It is likely that more relationships can be found and that other elements can be inserted in the relationships, but these are the most important ones according to the literature:

- I People work in Teams to find Ideas within a given project and do so by addressing the Job Skills they individually possess. In those Teams there needs to be a certain level of Freedom and Humor in order to work well.
- II The Devotion a Person has is mostly determined by the Team it works in and his Job Skills
- III A Method is introduced within a certain Structure to find solutions to a problem (determined by the Aim) and to allow Growth. This Method is used in an Environment with certain Wherewithal's at the disposal.
- IV A Company designates itself a certain Aim. With this Aim come certain Risks.
- V A Company lets Teams operate within an Environment with a certain amount of Wherewithal's and Freedom. It also leaves an amount of Humor open in order to keep it fun.
- VI A Person works with a certain Freedom in a determined Structure on Ideas in order to create Growth for both the company and the individual. In that working, they take Risks.

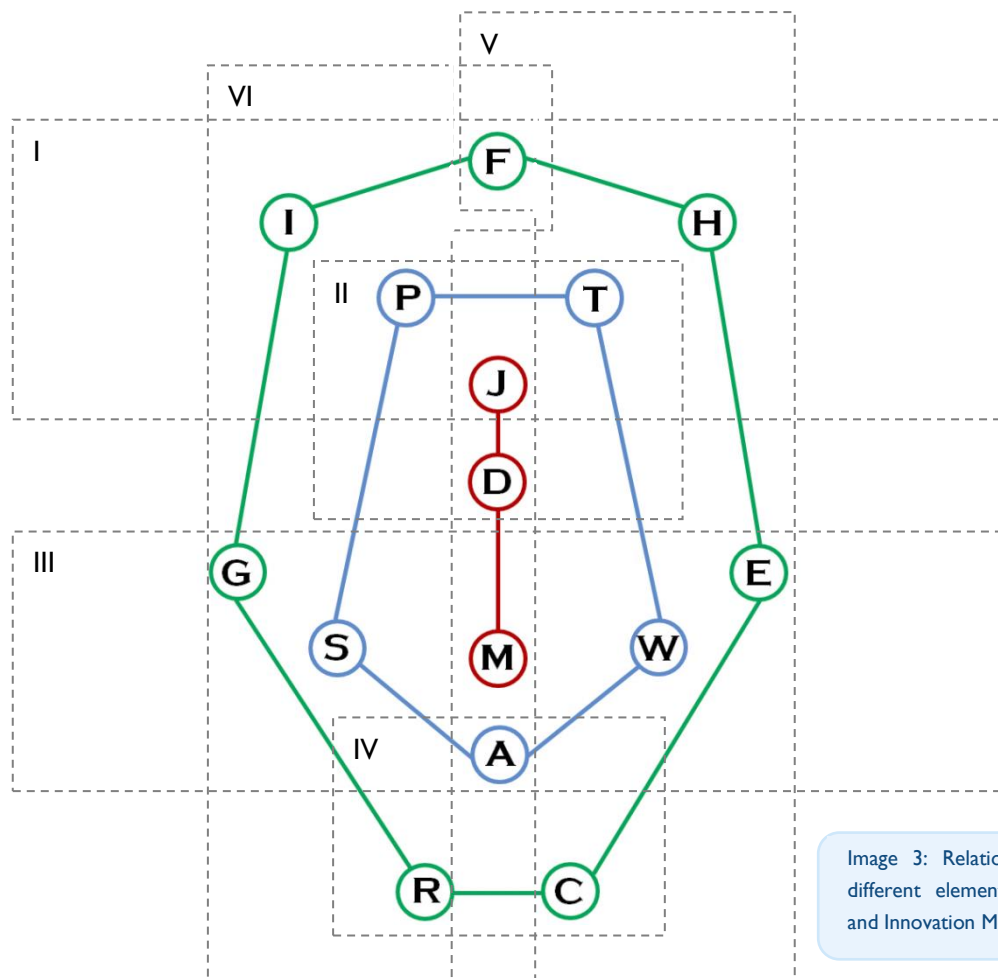


Image 3: Relationships between the different elements of the Creativity and Innovation Model

4 BAAT MEDICAL ANALYSIS

In this chapter the wishes and demands of both BAAT's management and its employees for adding creativity and innovation are treated. It was assumed that both parties only had the wish of *“adding more creativity and innovation to the design process”* without really knowing what ‘creativity’ and ‘innovation’ meant. To make them understand this, they needed to be acquainted with the created model of creativity and innovation (see paragraph 3.7 *‘Model of Creativity and Innovation’*, page 25). With this model they were able to understand what thrives and what limits creativity and innovation, something that would make them more aware of what it really means. Only stating a term with its meaning would not have sufficed.

The information in this chapter was the starting point for finding the right methods (see chapter 5 *‘Methods Analysis’*, page 38) which were to be treated in the pilots (see chapter 6 *‘Pilots and their results’*, page 46).

“Creativity is to see what others see, but see something different”

- Jamie Anderson

4.1 BAAT Medical

BAAT Medical is a transparent organization in which all people are equal and no real direct management exists. There are no 'orders' and there are hardly any people above others. True, team leaders guide their teams it towards results, but they do not always decide what should happen next. The same goes for management: they are the head of the company, but only formulate the overall goals and direction. There are even members of management involved in projects without leading them. Still, management creates the company's strategy. An example is the introduction of the '*IP Generation Tool*' by the management of BAAT Medical. In order to explain this tool, the original work- and design method of BAAT Medical needs to be explained. BAAT Medical works with a design process that consists of five separate phases, namely '*Explore*', '*Design*', '*Engineer*', '*Validate*', and '*Transfer*'. These phases are treated in sequence and have ultimately resulted in a somewhat crusted process where people are no longer unleashing their creativity to their maximum potential. This was the initial problem for which this assignment was designed.

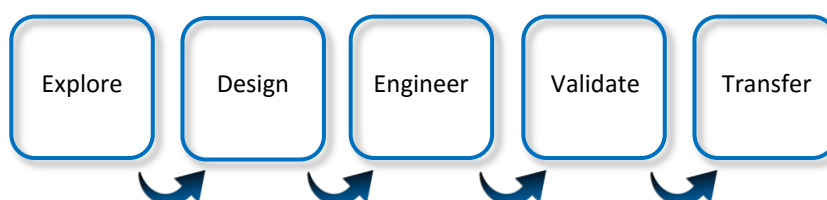


Image 4: The design process of BAAT Medical without the IP Generation tool

With the aim to be more creative and more innovations, combined with the expected results of this assignment, some new elements for this design process were introduced. Starting with an '*Initiation*', consisting of a reformation of the problem statement and a better know how about the customer and his problem, the IP Generation will be initiated. In a sense this phase treats the processes of '*Explore*' and '*Design*' in short, but with an extra amount of creativity. Results are not always feasible (something that is never the case of the original design process) but can create new paths for future projects. However, the customer needed to make the decision for treating this newly formed process since it has an additional price tag. When done, the original design process can (with the approval of the customer) be run through.

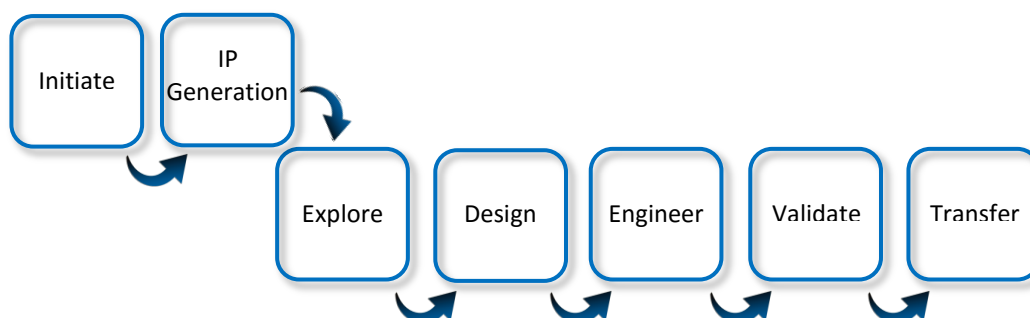


Image 5: The design process of BAAT Medical with the IP Generation tool

4.2 Determination of BAAT's focus points for C&I

First it was sought after which points the management of BAAT Medical (G. Bijenbanning and A. Aalsma) thought would influence the level of creativity and innovation. They were confronted with the model and were asked to point out their beliefs on which elements should be treated. Then within a brainstorm session, using the method of mind mapping (see paragraph 12.3.15, page 94), employees of BAAT Medical were asked to write down what they believe is of influence to their level of creativity and innovation. The reason for using two different methods of measuring motivations and inhibitions has multiple reasons. The most important one is that after presenting the model to management it was concluded that it is hard for people to find and mark important aspects since it was stated that “*they are all important and should all be treated*”. Rather than coming up with their own ideas of what is important, the model presents too much information. Additionally, groups are more likely to come up with multiple ideas and can therefore create their own model. True, they lack the information gathered in the literature review and thus might not know what is involved in creativity and innovation, but the essence of what they think that could be of influence can be gathered. Furthermore, with the use of this method (mind mapping) all participants are encouraged to participate. When faced with the model there is a change only a few people would speak up. In addition, the session could be seen as a pilot and therefore be treated in chapter 6 ‘*Pilots and their results*’, page 46. In a sense, a creative method was used to determine the enhancements and inhibitors of creativity with the aim to increase the level of creativity. It is some form of ‘*creativiception*’.

4.2.1 Management's focus points

Management beliefs that especially *Freedom*, *Growth*, and *Person* are factors of the Creativity and Innovation Model that are already treated sufficient within BAAT Medical. For example, people are already getting all the freedom they want and have the option to grow professionally with the appointed POP-hours². This personal development is calculated within the company's standards and visible in the overall growth of the company for the last couple of years. Other factors already treated fairly according to the management are *Humor* and *Team*; almost all projects are done in team composition, rather than individual. Within the teams, diversity is, unfortunately, not always possible since BAAT Medical is a technical company with only a few non-technical employees. Humor is less measurable and therefore harder to pinpoint for management. However, G. Nijenbanning and A. Aalsma believe that employees have enough space and freedom to release this energy and notice that this takes place all the time. That humor is not something rare within BAAT Medical is something that has been recognized in the time spent at BAAT Medical by the author of this report. Factors on which BAAT Medical can work in order to increase the level of creativity and innovation from the management's perspective are as followed (with the two most important ones on top):

² See ‘*Glossary*’, page 10

- **Wherewithal** Management believes that resources are of high influence to the degree of creativity of its employees. Multiple resources are already available (e.g. POP-hours and technical instruments in the newly opened test lab), but it is believed that some specific resources for creativity can be procured.
- **Risk** BAAT Medical is on the path to take more risks with introducing the new IP-Generation Tool. Without knowing whether it would work or not, BAAT Medical took the risk of trying it out. This tool is not the only innovation-tool to be implemented in the short future. For example, results of this report are to be used in both running projects and future projects. Management believes that they should take more risks in order to explore new possibilities and to distinguish themselves even more within the world of orthopedics.
- **Aim** The IP Generation tool is a change in aim and can lead to radical/breakthrough innovation, rather than continuous- and redefining innovation. However, this is a process still going, and even more changes are desirable.
- **Structure** Mechanisms by which ideas are collected are already available, like the so called 'BAAT boeken' (freely translated to 'BAAT books') in which employees of BAAT Medical can write down their daily proceedings and decisions. However, this system lacks the ability to look up previous made decisions quickly. Another factor is that teams sometimes lack non-technical members to find non-technical solutions for technical problems.
- **Environment** The physical work environment might be upgraded since it is a somewhat static and vacant room. The possibilities in the historic building are almost endless and some ideas are suggested, but hardly any are executed.

4.2.2 Employees focus points

The employees of BAAT Medical were involved in a brainstorm session in which the method of mind mapping was used to determine what they thought would influence the level of creativity and innovation. First they were asked to write down as many words they could on the topic of creativity and innovation on separate post-its. These were then hanged on the wall according to the framework of a mind map (see paragraph 12.3.15, page 94). The session took place with 15 participants present. On average, every person created 12 separate post-its. Out of the 178 words, 154 were unique and were to be included in the mind map as individual leaves for the mind map-branches. The other 24 were duplicates/copies of other words. Now participants were asked to mark those influences of which they thought would enhance creativity and innovation with a curl and limitations with a cross. Every person was asked to draw a maximum of three curls and three crosses each. Afterwards, the mind map was translated to a more detailed mind map with more thought through positioning of influences of factors with the help of an online program, available on www.mindmeister.com. With this came the positioning of single influences within multiple factors. For example, the influence of *Assumptions* (with a total of four crosses attached to it) can be found under both the factor *Job Skills* and the factors *Person* and *Team*. The total mind map can be seen in image 6 below.

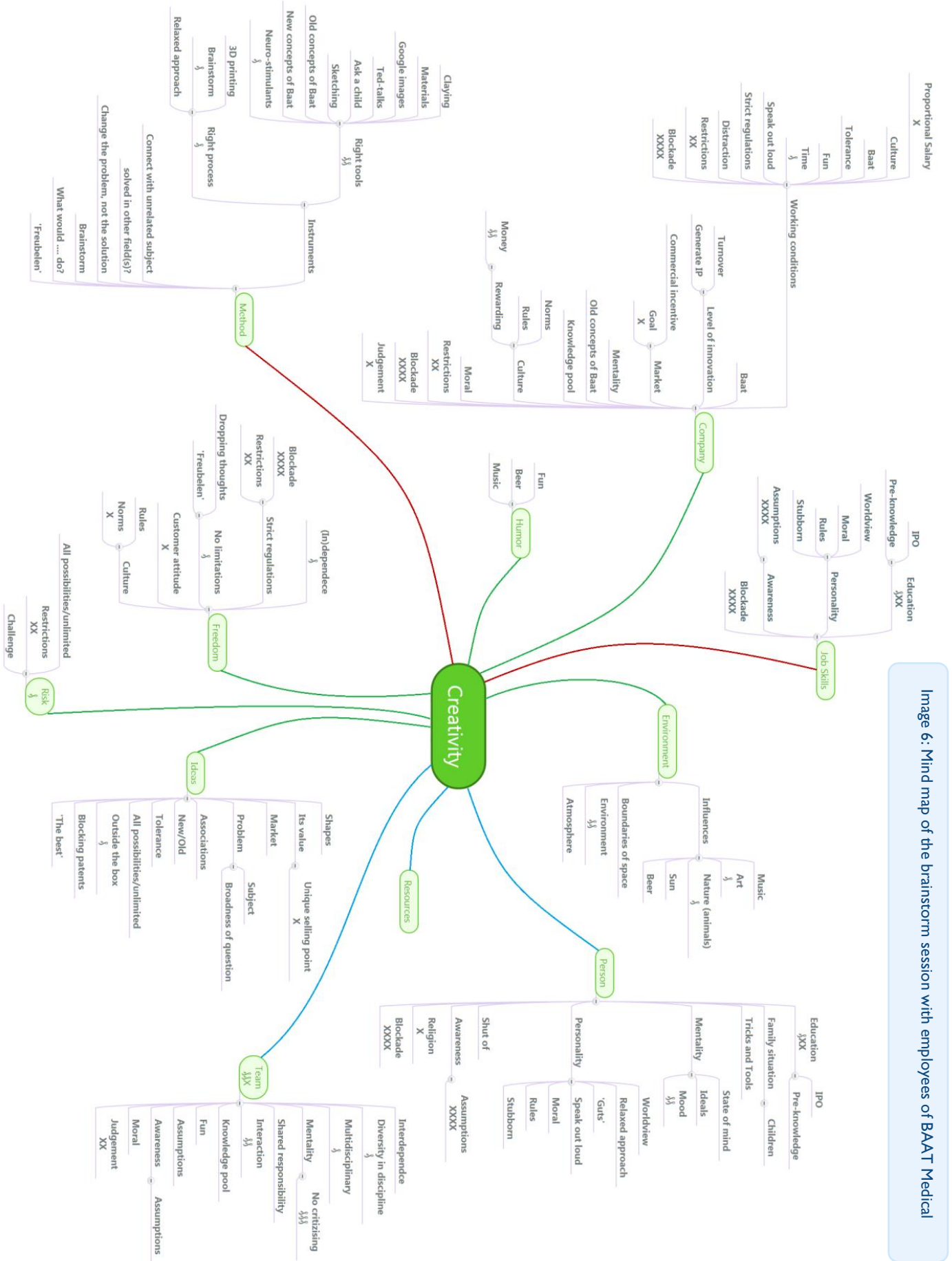


Image 6: Mind map of the brainstorm session with employees of BAAT Medical

Observations from the created mind map with post-its notes and attached curls and crosses can be seen in the Annex, paragraph 12.2, page 83. Conclusions that can be drawn from this are:

- The employees do know a lot about creativity and its underlying factors, even without reading the literature. They named 72.3% of the factors of the Creativity and Innovation Model. However, they can be informed on the other 27.7% of factors which can influence creativity.
- The difference in amount of curls (26) versus the amount of crosses (53) can be seen as a sign that employees of BAAT Medical are well aware of things that can limit their creativity. However, they mostly see limitations and much less enhancements within their model.
- The allocation of more attributes to the factors of *Company*, *Person*, and *Method* does not necessarily mean that the employees think of these as more important. However, it can be concluded that they are more aware of the variables in those factors when compared to the factors with the least amount of attributes (*Resources*, *Risk*, and *Humor*).
- Factors that are thought of to be of high influence to the level of creativity and innovation, based on the number of curls and crosses (read notes), are *Person* (14 notes), *Team* (13 notes), *Job Skills* (11 notes), and *Freedom* (10 notes).
- Factors that are thought of to be of less influence to the level of creativity and innovation, based on the number of curls and crosses (read notes), are *Humor* (0 notes), *Resources* (0 notes), *Risk* (2 notes), and *Ideas* (2 notes).
- The specific attributes that are thought of to limit creativity and innovation (*Blockade*, *Assumptions*, *Judgement*, and *Restrictions*) should be evaded. Attributes that enhance creativity and innovation (*No criticizing*, *Money*, *Environment*, *Mood*, *Interaction*, and *Right tools*) should be embraced and expanded.

4.2.3 Requirements for future methods

The conclusions of the previous two paragraphs should create a direction in which methods to treat in the pilots. Just selecting a number of methods from the thousands of methods that exist will not suffice. The methods to choose should treat a selection of elements of the Creativity and Innovation Model as best as possible. However, not all elements can be included in the pilots. For example, the element *Environment* is something that works around the methods and daily workings of the people working at BAAT Medical. Sure, some changes in the meeting rooms can be made, but only if a method indicates so. However, doing things beyond the introduction of these methods (like putting up posters on the wall for general inspiration, treating the element of *Environment*) is something that simply does not fit within the time given for this assignment. For that matter, the following elements and factors were selected to be treated as best as possible within the future pilots:

- **Interaction**

Methods should create discussions and other types of conversations between participants. Individual assignments like drawing concepts on a piece of paper are not to be excluded from the methods, but the aim should be to create a team spirit in which people all participate through interaction.

- Risk

The focus within this element should lie on the individual- and team level, not that of the company. Participants should be engaged in methods in which they are introduced to 'a new world'. With this it is meant that they should participate in methods with which they are not yet familiar. Also other aspects and events in which risks are taken in order to enhance creativity and innovation should be embraced.

- No criticizing

More of a general rule within the brainstorm sessions, but the fact that criticizing limits the creativity of individuals and a group as a whole should be mentioned and treated in the pilots. Methods which forces people to work from other ideas by supplementing those concepts is a way to get rid of criticizing and opens the way to finding out that *"the idea of that person is not that bad"*.

- Structure

Not only should the methods dictate a certain order to work with, but also aspects like preliminary targets of creativity and innovation (e.g. *"how broad can we diverge?"* and *"what is the aim?"*) and which employees to include in a brainstorm (*"only technical schooled or biological schooled as well?"*) should be treated.

- Team

As mentioned earlier, a team should work together. Individuals should work within a structure in which teamwork is guided and encouraged. In addition, teams should embrace the knowledge and experience of the individuals. For example, only observing that one member is generating many ideas and no following reactions of the rest of the team on those ideas should be prevented.

Elements and factors that can enhance creativity (according to the interviews) should be embraced and appointed as good. These elements and factors are *No criticizing*, *Environment*, *Mood*, *Interaction*, and *Right Tools*.

Elements and factors that should be suppressed since they can limit creativity are *Freedom*, *Blockade*, *Judgement*, and *Restrictions* (according to the interviews). When these limitations to creativity and innovation are observed within the pilots, they should be appointed and then reduced to a level in which they can do no more harm.

5 METHODS ANALYSIS

This chapter will comprise the appointment of the different methods that already exist, found in the literature. These methods are used before, during, and after brainstorm sessions and are selected with the information of the previous chapters in mind.

The summation of methods in this chapter were used as the matrix for the following phase of the assignment in which the pilots where held (see chapter 6 *'Pilots and their results'*, page 46).

"Creativity involves breaking out of established patterns in order to look at things in a different way."

- Edward de Bono

5.1 Rules for brainstorming

Gathering people together and simply asking them to be creative and come up with multiple concepts that treat a certain problem will not work. One needs to provide the team with brainstorm methods which they can follow and/or use during a session. The methods used for creating concepts are then to be used within a framework, consisting of different rules for brainstorming. These rules/essentials, where brainstorming is seen as 'a game', are as follows (Gray, Brown & Macanufo, 2010):

- 1 *Opening and Ending*
It is the way a brainstorming activity is orchestrated. The goal of an opening is to establish a frame of reference and set the context. Closing forces an end to the session.
- 2 *Fire Starting*
This is the spark that ignites the imagination. Start a fire in the wrong direction or place and things might get out of control. The way one initiates a session can inspire the kinds of thoughts for the rest of the participants. It also affects the sensation, emotion, and reflection that will result in the sought result(s).
- 3 *Artifacts*
The importance of artifacts, as an aid to thinking, can be illustrated by imagining playing chess while being blindfolded. It is impossible to remember the different turns in the game, so it is easier that the pieces (with their shape, colour, and relative position) are displayed on a board.
- 4 *Node Generation*
To create order in the possibly large amount of artifacts there needs to be some kind of order or grouping. This is done through nodes, consisting of connections between artifacts.
- 5 *Meaningful Space*
Imaging trying to play chess without the board. The grids of the chessboard create a meaningful space with boundaries of the world. Pieces (artifacts) populate it.
- 6 *Sketching and model making*
A good sketch contains just the right amount of detail and information to deliver some kind of message to others. It can take a team hundreds of sketches before they settle on one or more specific ideas. In order to come there create as many sketches as possible.
- 7 *Randomness, reversal, and reframing*
People are good at finding patterns in what sometimes might appear as random orderings. Once found, these patterns are hard to let go of and one is hardly able to see anything else. Creating randomness is a way of fooling the mind in order to find new patterns.
- 8 *Improvisation*
Once we are improvising we create in the moment by reacting to the environment and our inner feelings.
- 9 *Selection*
In order to converge one has to let go of multiple ideas and continue working on a selection of ideas. It is a natural tendency to bite off more than one can chew, what leads to being overwhelmed with ideas.

- 10 *Try something new*
Taking no risks frequently can result in losing grip on discovering new things. One cannot inspire others when they cannot make a fire themselves. Try to produce and/or do new things every time in a brainstorm session. This will keep one honest, forces one to be creative and improve, and keeps things fresh.

Within this framework are elements that are of high value to the participants. In order to become useful during a brainstorm session, the different elements need to be summarized into only a few words since giving participants a document which consists of many words and sentences will not suffice. Furthermore it should be extended with other elements that are of influence to the participants during the brainstorm session. The following image sums up all the rules and essentials participants need to keep in mind when conducting a brainstorm session and was used in all pilots.



Image 7: Rules and essentials for brainstorming

5.2 Brainstorm methods

Early on it became clear that there are several thousands of documents with all kinds of brainstorm- and idea generation methods. Choices for which methods to possibly include in the pilots were based on a total of three factors:

- Information gathered in BAAT Medical Analysis

It was made clear what BAAT Medical wanted to be treated in the sessions since they were asked to pinpoint the elements of which they thought that would enhance the level of creativity and innovation. This information was used as requirements for the selection of methods.

- Opinions of other students and mentors

Reviewing all kinds of methods with other people created a clear view of which methods were feasible, not only within BAAT Medical but as brainstorm methods themselves.

- Gut-feeling

During the time spend at BAAT Medical a lot of aspects like the way employees work and how projects are conducted became clear. These observations created a gut-feeling for which methods would possibly work and which would not. The mentors of BAAT Medical made clear that this gut-feeling should not be ignored since mastering the science of 'creativity and innovation' in primarily the first stage of the assignment (the literature review) gives way to making those choices.

The methods which were chosen out of the large amount of available methods differ in their approach, purpose, and their level of exoticness. With the latter is meant that there is a difference between more classical methods and those who treat a more radical and/or novel approach.

In result a total of 15 different methods were selected for becoming treated in the pilots. Whether they were actually used in the pilots or not depended on multiple factors, consisting of for example the problem statement(s) of project, opinion of the problem initiators, and the phase in which the project was at that time. The different methods are shortly described below. Elaborated versions, including the different steps within the method, can be found in the Annex, paragraph 12.3, page 84 .

Method 1: Rewording the problem

This method forces one to look at the problem from different views. It often happens that the problem for which solutions need to be found is not well formulated. This can set people in the wrong direction when confronted with the problem. A great advantage of this method is that all group members can become aware of the actual problem. Were people 'just following the problem statement' earlier on, now they are more aware of what the problem consists off. By questioning some valuable words of the problem statement, it can become clear that the customer demand differs from the problem statement. More of this method in paragraph 12.3.1, page 84.

Method 2: Breakdown

A method for reframing the problem statement. Through breaking down the sentence and analyzing each word a team can find a new, and better, problem statement which can be more focused on the

real demand of the customer. The method consists of five sequential steps, as can be seen in paragraph 12.3.2, page 84.

Method 3: PSI (Problem – Stimulus – Idea)

The first phase of the method of PSI is great for reframing your problem statement. Looking critically at what defines success creates possibilities for changing the problem statement and thereby its focus for the project. It consists of the first two steps of the method, both elaborated in paragraph 12.3.3, page 85.

Method 4: Problem Statement Analysis

Within this method the team analyses whether the customer's demand (often given in the form of a single sentence or question) is really what the customer wants. It often happens that the customer thinks he wants a solution in the form of a product which works in a particular way. However, after asking some targeted questions, the product designer can propose a new direction in which a solution can be found. This can differ a lot from the original customer's demand, but still tackles the entire problem. The method consists of three steps, each treating two or three questions, see paragraph 12.3.4, page 86.

Method 5: Morphological Analysis

Morphological analysis is an idea generation method that let participants find the structural aspects of a problem and study relationships within them. For example, take the problem of finding the right motorized/powered vehicle transport from location A to location B. The structural aspects of the problem are, for example, the type of vehicle (e.g. car, motorcycle); the source of power (e.g. electrical motor, steam); and the medium (e.g. air, tarmac). Combining those creates, for example, a scooter on water, driven by a steam engine. As the example states, some novel combinations are possible. The five sequential steps are visible in paragraph 12.3.5, page 86.

Method 6: Reverse Thinking

Like the name suggests, instead of thinking about a problem in known and logical manners, here we reverse it and think about the opposite solutions and/or create the problem or worsen it. For example: "*How can I triple my sales?*" can be changed into "*How can I make sure I have no sales at all?*" It is found that the majority of participants find it easier to produce ideas for the 'negative challenge', simply because it is much more fun. More in paragraph 12.3.6, page 87.

Method 7: Questioning Assumptions

The majority of industries have the unspoken and deeply held belief that everyone and everything works in order to get things done. By doing so, they fail to question assumptions during the process of product development (Kelley & Kelley, 2003). These assumptions restrict the possibilities and ideas. This method can serve two goals. Firstly, it can determine whether the customer demand really treats the problem he wants a solution for. It is also possible that the customer was already too narrowed down onto a particular solution or solution area. To treat this particular goal, question

each assumption (and thus word or combination of words) in the customer's demand. Secondly, it can be of influence when the design team is already busy coming up with ideas. In this situation designers can create (false) assumptions when treating this problem statement. To treat this goal, clarify the assumptions made when exemplifying a created design. Even if these are sketches, it is good to question the assumption made since the team can benefit from it as a whole. More of this method (e.g. different areas in which assumptions are made) in paragraph 12.3.7, page 87.

Method 8: S.C.A.M.P.E.R.

Scamper is a mnemonic that stands for *Substitute, Combine, Adapt, Modify, Put to another use, Eliminate, and Reverse*. With this method one is able to improve a product to new needs or finding better solutions to the problem. It also can be used for the development of new products. Using the tool requires asking questions about existing products, using each of the seven prompts above. This method mostly results in a session with many debates and discussions, rather than a number of designs through drawings. The prompts can be found in paragraph 12.3.8 page 88.

Method 9: Attribute Listing

Attribute listing is a de-compositional approach where a product is broken down into smaller parts that can be examined individually. Through examining all the different parts the team is able to see into detail what the product consists of (both physical and their attributes with values) and what can be altered to serve the problem statement. The four different steps of this method can be found in paragraph 12.3.9, page 89.

Method 10: The 5 Why's

This method explores the cause-and-effect relationships underlying a particular problem since problems are tackled more sustainably when they are addressed at the source. As the name suggests this method consists of five why's. The method is further explained in paragraph 12.3.10, page 90.

Method 11: Business Process Re-engineering (BPR)

Consisting of 20 different questions, it dissects a product to its core functionality by asking what, where, when, who, and how things are done. The method is only useful when a product needs alteration or a comparable product (which serves as inspiration) needs clarification. The different questions can be found in paragraph 12.3.11, page 91.

Method 12: Brainwriting

This method is used to generate ideas in a group setting. Participants draw ideas on a piece of paper and after passing on the paper to another participant they are to supplement the drawings of the previous participant. It is a method which forces people to work from the ideas of others. The method is further elaborated in paragraph 12.3.12, page 91.

Method 13: Post-up

First the level of detail revealing is determined (and thus limitations in ideation later on in the session) since it is of influence to the potential level of creativity of the participants. For example, when participants are faced with a problem with many specifications, and thus limitations, they have to find solutions in a very narrow area. However, are they introduced to the problem with a low level of information, than they can think more freely and creative since there are fewer limitations. Next up is the phase in which individuals generate as much ideas as possible with the use of post-its. The different levels of detail revealing and steps in drawing ideas are treated in paragraph 12.3.13, page 92.

Method 14: Image-ination

This method focuses on the use of (random) images since they have the ability to create new relationships and associations. It consists of assembling a collection of images (without words) that are either related to the problem or have no relationship with the problem at all (random images). Then participants try to find similarities between the pictures and the problem at hand. More of this in paragraph 12.3.14, page 93.

Method 15: Mind mapping

A mind map is a method to visually organize information, gathered by all participants. It is often created around one single concept/problem, positioned in the center, to which associated presentations of ideas are added. The most important and major ideas are directly connected to the central concept. Other ideas branch out from those ideas. It results in a spider web in which all there is known about the concept is presented. Elaboration of the method is found in paragraph 12.3.15, page 94.

6 PILOTS AND THEIR RESULTS

In this chapter almost all practical events that were conducted during the time spent at BAAT Medical are treated. First a number of sessions will be mentioned in which there was no involvement of 'new' methods. So, there was only observation on what previously happened at BAAT Medical when employees were asked to brainstorm. Second, the lunch lectures that were given are explained and elaborated. These lectures gave a good view of the way employees of BAAT Medical approached creative issues through conducting some simple tests. Within these tests a number of influences on the level of creativity and innovation that could serve as inspiration during the pilots were communicated.

The third and last part of this chapter contains the conclusions, characteristics, and recommendations of the different methods that were used in the pilots. The events that took place during the different session can be found in the Annex, from paragraph 12.7.1 (page 102) to paragraph 12.7.10 (page 107).

Results of these pilots were used to form the instructions, presented in chapter 7 'Creating Instructions', page 58.

"Creativity is intelligence having fun"

- Albert Einstein

6.1 Observing current brainstorming

In order to know how brainstorming is currently conducted within BAAT Medical - and thus knowing a starting position from where to work – a total of two brainstorming sessions were observed. Within these sessions only employees of BAAT Medical were participating. A full description of the sessions can be found in the Annex, paragraph 12.4, page 95.

In the first session a number of shortcomings were observed. For instance, a possible solution for the problem was given during the introduction, resulting in a predetermined solution area in which participants sought for new ideas, rather than looking for a divisive solution. However, the problem initiator did mention that *“all ideas are good, none are bad”*. The second session made clear that BAAT Medical sees certain problems more than often, resulting in a view consisting of *“We know how things are done since they have always been done in this way”*. They certainly were not bored, yet they lacked the energy and enthusiasm for being really creative.

To summarize the positive observations of the two sessions, for future sessions it is:

- wise to make notice of some general brainstorming ‘rules’. Norms and values (e.g. *“every idea is a good one”* and *“listen while others speak”*) are to be mentioned at the beginning of every brainstorm;
- clarify the problem and its underlying cause to the maximum amount possible in the session;
- encourage asking questions.

For overcoming the negative observations, future sessions should:

- not contain a possible solution in the presentation;
- present the cause of the problem early on;
- be well prepared in both determining a timeline and arranging allocated materials;
- somehow alter the problem statement to make it ‘new’ for the participants.

6.2 Lunch Lectures

Lunch meetings are a great way for people within BAAT Medical to show their latest findings and/or create an audience for asking questions. In a time span of about one hour employees come together and listen to one or multiple speakers in a relaxed and free setting. Employees of BAAT Medical participated in a total of two lunch lectures that were conducted in the light of this research. As such, they can be seen as the support for the methods to be used. After the bachelor assignment, when most of the employees are back from their holidays, a third lecture will take place. In this lecture the employees will be introduced to the conclusions of this study and the different methods and their instructions. Since that is to take place in the future, it will not be treated in this report.

Lunch lecture I – Creativity in general

While being in the middle of the literature review, a presentation was given to all of BAAT Medical’s employees. In this presentation the following topics were treated.

Assignment

What is the purpose of this bachelor assignment? What is going to happen, both in general and with whom? All these topics, which are treated earlier on in this report, yet unknown to most employees of BAAT Medical at the time. Most importantly, it made clear that several sessions were to be held with the participation and that they could expect invitations to these sessions. As suggested by the personal mentors provided by the company for this assignment (H. Christenhusz and R. de Wit), employees were also made clear what the benefits of participating in those session could be; benefits in the field of both personal development and the growth of the company as a whole.

Concept definition and elaboration

Most people do not really know and understand the concepts of creativity and innovation. Not only the concept definitions were cited, but the influences and conditions in which they flourish were named as well. Firstly, some different essentials for creativity were named (e.g. 'inspiration', 'thinking positive', 'analytical skills', and 'knowledge'). Secondly, the model created by the Creative Problem Solving Group (CPSB) was introduced. This model describes the flows and relations between product, place, process, and people, and how they influence creativity and innovation in an easy to understand way. For a full explanation of this model, as given in this lecture, see the Annex, paragraph 12.5, page 97.

What to do next?

In the future pilots the creative inner selves of employees were to be unleashed. Just stating they were about to 'think outside the box' was not good enough. Just like the term 'creativity' and 'innovation', this saying is empty, if not only a buzzword (free translation: 'modewoord') when not further explained. Yet, since everybody knows the saying it can be a strong message as long as it is substantiated with a good explanation. This was done with the following illustrations and elaboration which also summarizes what was going to happen:

Within BAAT Medical there is a lot of knowledge, a culture in which this knowledge is manifested, and many other aspects and items which make BAAT BAAT (visible as the words above the question-box, see image 8). When facing a new problem within a project, this information is seized and very quickly ideas are generated within the minds of people. In order to think outside the box, something needs to be added (the 'X' in image 8). This can be a very weird or even absurd additive and is called *divergent information* (Anderson, 2016). Together, these two pieces of information can create 'outside of the box thinking'. This plus sign in image can be seen as the bridge from that what is known, to there where people did not think of yet.

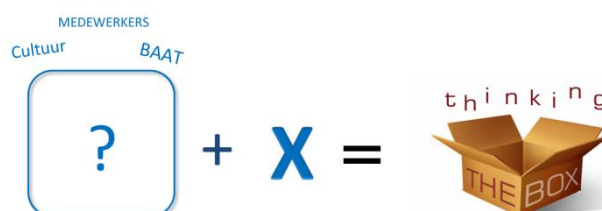


Image 8: The equation behind 'thinking outside the

Lunch Lecture 2 – Make BAAT Innovative again

In this lecture some aspects that could influence their creativity within the coming (and future) sessions were tagged. This was done in the form of certain simple tests/tasks, accompanied with some background information about what they did or did not do during these tasks. Most importantly, a more profound part of these tests tasks was discussed: Where did the conditioning, ways of thinking, and assumptions come from? Why did they do what they did? This part is more *meta-cognition*³, rather than performing a task. The details of the previous tests and information can be found in the Annex, paragraph 12.6, page 98.

Reason for creating the self-awareness on these topics is that participants can now be more creative when they keep them in mind. When the pilots are held, someone only had to say “*Think about the assumptions that you make*” and people can act upon it. True, some people will not act different, but creating some kind of consciousness can do no harm, but creativity can only benefit from it.

Lunch lectures conclusions

The first lunch lecture presented the main goals and different components of the bachelor assignment, including the personal gains they could benefit from participating in the pilots. However, not all employees were patient enough to wait for an invitation and started asking to set up a brainstorm very soon. From that moment on it was clear that this assignment could receive much support from the employees of BAAT Medical.

The second lecture served as an inspiration for many employees and people saw these ‘lessons’ about meta-cognition as very helpful. During the sessions later on, they were repeated in its essence.

Another element of the lunch lectures that needs to be repeated in future sessions is the use of warmups. The simple tests/tasks in which participants participated themselves were labelled as inspiring and most of all served as a mirror.

³ See Glossary, page 11

6.3 Measuring creativity and innovation

A typical verbal communication between designers can be sentences like: “*Hmm, this seems pretty big; I was thinking more about this size*”. Statements like this occur many times during collaborative ideation (CI), a phase in where designer’s thoughts are expressed in words and drawings. The use of graphical and psychical representations follows. Verbal communication is considered to be the first design tool and the principal way of explaining ideas, even before visual representations (Johnson, 2005)). Typically, designers see more in their own sketches and models they created than what they put in when they made them (Van Dijk, 2016). Often they have to work with information which is not complete so they are limited to assuming and making decisions which might need to be revised. Inaccuracy (flexibility), ambiguity (alternative meanings), and abstraction (simplification) are characteristics of this representation.

To assess the CI process, a methodological and theoretical framework was created to measure components of design conversations in brainstorm sessions (Dorta, Kalay, Lesage, & Perez, 2011). At first this framework seemed useable to measure the level of creativity and innovation in the pilots. However, conclusions with the use of this framework depend on quantitative data such as numbers of questions asked and drawings made. The latter in particular did not occur all the time. Especially in pilots who analyze and redefine the problem statement, and pilots where an overall understanding of the problem is created, no drawings were made. Even more methods for measuring the level of creativity were investigated, but all had shortcomings when it comes to comparing the different methods used in the pilots.

For this, conclusions of the methods were drawn from qualitative data such as the opinions of the participants. Through evaluating the pilots they were able to clarify their findings and elaborate on them. This information was then supplemented with the findings of the pilot monitor (B. Konjer) about the pilot and combined into practical conclusions.

6.4 Pilots with methods

Post-up

For a detailed description of this method, see paragraph 12.3.13, page 92. This method was used in a total of two pilots with different people. In the first one a high level of data revealing was used. The second pilot treated a lower level of detail revealing by making the problem statement more abstract. Summarizing the two pilots it can be said that the use of the Post-up method can be very useful since it can result in a lot of different ideas. The first drawing opportunity gives people the time and space to think about solutions within their own view, a setting which works best for some people. Others flourish in a more teamwork setting, which is treated in the second part of this method: arranging all the different ideas on a wall and processing them separately. After this, there is yet more room for individual ideation but now with more knowledge and input of other people (through their ideas). Information which can be gathered from the first set of ideas was of great inspiration for the second drawing opportunity within the two pilots. Sometimes there were even eye openers which led to even more creative ideas. Whether there is a relation between the amount of ideas and the level of detail revealing is hard to say since only one session of each form has been tested.

CHARACTERISTICS

- Group size of at least 4 people;
- well defined problem statement needs to be available (which can be made more abstract later on);
- level of creativity is determined by the creativity of participants themselves within the two drawing opportunities. The method itself does not force creativity.

RECOMMENDATIONS

- Involve participants who are not familiar with the problem and have not worked with it yet;
- participants need to think really broad in possible solutions. Especially in the first drawing opportunity where not-feasible ideas can inspire others towards ideas that are feasible;
- if the group feels like adding an additional drawing opportunity, they should do so;
- combine this method with other methods;
- use the method in a timespan of approximately 2 hours, with 10 minutes per drawing opportunity;
- most of the time should be spent explaining, elaborating, and discussing the different ideas.

Brainwriting

For a detailed description of this method, see paragraph 12.3.12, page 91. After conducting one pilot with this method it is safe to say that this method has both some positive- and some negative aspects. On the plus side, participants are forced to work from the work of others, rather than only working on their own ideas. However, this method is still an individual endeavor and not something in a team format. True, the results are that of an entire team, but every participant works individually and there is almost no communication throughout the session. Therefore it is not received very well by the participants.

CHARACTERISTICS

- Group size of at least 4 participants;
- well defined problem statement, yet some uncertainties may occur since that can create even more diverse ideas;
- level of creativity is determined by the creativity of participants themselves within the two drawing opportunities. The method itself does not force creativity.

RECOMMENDATIONS

- Involve participants who are unfamiliar with the problem;
- allow the use of an additional row for new ideas, even if you are not the first one to fill in that specific row. Thus, don't be limited to the number of rows used by your predecessor;
- allow participants to expand the number of elaborations of one idea in a previous row, rather than being limited to one elaboration;
- combine this method with other methods (e.g. Business process re-engineering (BPR)/Frame it up);
- cut out the different ideas and arrange them in an affinity map or bottom-up tree;
- use the method in a timespan of approximately one and half hour.

S.C.A.M.P.E.R.

To know what the different prompts of this method are, see paragraph 12.3.8, page 88. This method was treated in two separate sessions. The first pilot was accompanied with printed products of comparable products to support several prompts. The second pilot was executed without the help of additional materials. After the two sessions it became clear that even though the method dictates to follow a certain sequence of prompts, following that sequence is not a golden rule that should be followed all the time. The second pilot shows that just using the different prompts randomly throughout the session can be just as good, if not better, as following the method in successive steps as done in the first pilot. Whether the group follows the prompts in sequence, or uses them more as some kind of reference is to be decided by the group itself. As long as good conversations are held (with the topics of the prompts) it can be very useful for the group as a whole. Participants were very enthusiastic about this method. Many stated that this form of team consult can work very well at the beginning of a project when many things are still open for discussion. A second session with another method, in which ideation takes place, would benefit from the amount of information gathered and shared in the previous S.C.A.M.P.E.R. session.

The use of extra materials for the prompts of *Adapt* and *Combine* can be of help for inspiration, but can also limit the further searching view of participants.

CHARACTERISTICS

- Group size of at least 4 participants;
- the method does not result in specific concepts and ideas per se, but opens discussions where knowledge and ideas are shared within the group. So, in a sense, it is more a fire starter, rather than a method that has the effect of creating tangible results;
- other (comparable) products need to be known. If they are not, for example Google can serve as inspiration. But knowledge of other participants needs to be grabbed first;
- the level of creativity is not determined, but more directed by this method. Participants are forced to think about the different levels of the product and other products.

RECOMMENDATIONS

- If the group feels like not sticking to the use of prompts in sequence, do not force them to do so. Treating the different prompts can be enough and forcing them in some way can kill the conversations and participants' creativity;
- encourage participants to draw down ideas on paper so others can react to that. Supplementing drawings with other ideas and/or views can start even more conversations;
- point out one participant for the entire session who makes sure every prompt is used at least once;
- use the method in a timespan of approximately 3 hours so everybody can get very familiar it.

Mind mapping

The sequential steps of this method are treated in paragraph 12.3.15, page 94. Mind mapping, used in two different pilots with different people, is a tool that is worth using when much about the problem is unknown and needs to be cleared up. The method creates a collective understanding of the problem at hand, something that can be beneficial during the rest of the project. A following brainstorm session (with the desired result of multiple concepts) is, with this collective understanding and knowledge in mind, more likely to succeed than a session where participants only have their own knowledge of the problem.

When the topic and/or problem statement is very broad certain software is available to map out the different parts of the mind map. A great benefit of using the software is that words can be relocated and towed to other words.

CHARACTERISTICS

- Group size of at least 5 participants;
- the method does not result in concepts per se but can serve as inspiration and a tool for further sessions;
- after using this method there is a collective knowledge about the topic and/or problem statement within the participants;
- the level of creativity is not determined, but more directed through this method since participants are forced to think about the different aspects of the problem.

RECOMMENDATIONS

- Allow participants to write down every word they think that is of influence. Some words might not be of use directly, but can inspire others;
- point out one participant that is in charge of creating the mind map, either on the wall with a marker or assembling the post-its, or within a piece of software;
- create conversations on the different topics so an even broader collective knowhow is assured;
- when the mind map is complete, create a top X of parts within the mind map which determine the focus for future sessions;
- use the method in a timespan of approximately two and a half hours. Spending more time will fill the mind map even more, but that does not necessarily mean it will be better.

Attribute Listing

The method of Attribute Listing, explained in paragraph 12.3.9 (page 89), is good when a team is treating a product that consists of more than one part. Through individual filling out the table they start thinking about the different parts, attributes, and values. Combining the individual work creates a general understanding of the product. However, filling in the table in team format can also be successful. Dissecting a product forces people to see all the different parts of a product which can be very useful when facing complex products. Adding attributes and values to it opens the way for thinking about possible solutions to problems.

CHARACTERISTICS

- Group size of at least 3 participants;
- the method is to be used as an introduction towards other brainstorming. It only clarifies the characteristics of the product and its underlying parts, and thus creates a good basis for a creative idea generation session;
- after using this method there is a collective knowledge about product with underlying parts, attributes, and values within the participants.

RECOMMENDATIONS

- Fill out the table in either group format or individual;
- make sure there are conversations about the table(s). Only stating the different parts, attributes and values can result in a not complete table when compared to a table filled in team effort with debates and discussions;
- when treating a very complex product with many parts, simplify the product in a given number of parts on forehand. Or mention that not, for example, every screw needs to be inserted in the table;
- use the method in a timespan of approximately one hour. Spending more time will fill the table even more, but that does not necessarily mean it will be more complete.

BPR

A general description of this method can be found in paragraph 12.3.11 (page 91). Even though the method was not tested in a complete brainstorm session due to the lack of time at that moment, participants found the different questions treated in it very useful. It forced them to look at the different parts, attributes, and values from different angles, and even more important: they were thinking more critical at the current conditions. In other methods participants are steered to think broad but not critical per se. For instance, Mind mapping creates a great overall understanding of the problem and Post-Up lets people think about possible solutions. For that matter, BPR is unique.

CHARACTERISTICS

- Group size of at least 4 persons;
- starting this session is best done when all the different parts of the product are laid out. To do so, use, for example, the method of Attribute Listing;
- allow the team to use the 20 questions as a reference tool, rather than following them in sequence;
- the method allows participants to look very critical at an existing product or elaborated idea.

RECOMMENDATIONS

- create conversations within the different questions. Not all questions are easily treated with an one word answer;
- after completing the session, create a top X of parts which will determine the focus for future sessions;
- use the method in a timespan of approximately two hours.

Reframing the problem

This particular pilot treated a total of four methods, consisting of Rewording the problem (see paragraph 12.3.1, page 84), Breakdown (see paragraph 12.3.2, page 84), PSI (see paragraph 12.3.3, page 85), and Questioning Assumptions (see paragraph 12.3.7, page 87). In it was found that asking different questions to the customer about the given problem statement result in an overall understanding about that what is asked. Eventually it became clear that the question did not contain all the information about the future product. The session started with the problem statement of “*What could a disposable instrument set for a given product with attached pedicle screw look like?*” At the end of the session the problem statement was formed as: “*How could a single-use (modular) treatment system for type A, B, and C vertebral fractures, in line with the given product’s philosophy, look like?*” Also, there was a shared knowledge about all the different components of the problem.

CHARACTERISTICS

- Group size of at least 4 persons;
- the method allows participants to look very critical at the existing problem statement and results in a better knowledge on what the customer really wants, and a more complete problem statement;
- start the session with either a complete problem statement, or with an idea on what this problem statement should contain.

RECOMMENDATIONS

- Combine multiple methods which treat the problem statement. Some parts of methods are usable in one problem and not in another;
- use the methods in a timespan of approximately one and a half hours.

6.5 Conclusions of the pilots

Already narrowed solution areas

A first conclusion which can be drawn from all the pilots combined is that projects within BAAT Medical are limited in their solution areas. The first reason lies in the medical market which is somewhat conservative and mostly not keen on very disruptive concepts. Especially surgeons rely on techniques which they are familiar with and making them use new, very innovative, instruments is not that common. Participants were always aware of this and acted upon it. Secondly, the technical possibilities for solutions of problems are limited. For instance, the numbers of materials that can be used are limited. Also the production techniques (e.g. 3D printing) impose some limitations to what can be done. Thirdly, customers have certain demands and wishes in the projects. Allowing BAAT Medical to go beyond these limitations requires effort in which the customer is made aware that his problem statement and proposed solutions limit the creative machine of BAAT Medical. Fourthly, employees of BAAT Medical are (except for a few) all technical educated and trained to think like that. Using methods which make them think outside their comfort zone are only useful in a limited amount. Additionally, they have a large knowledge on medical problems which can solve most of their new problems, but that only limits their thinking. As mentioned in lunch lecture I, this is called *convergent information* (“we know how things are, since we have already been there”).

Asking is knowing

In order to eliminate these negative influences on the level of creativity it became clear that there is one solution that works almost always: asking questions. Not only the meta-cognition of ‘thinking about how you think’, but also asking questions treated in the different methods (for example in BPR) forced people to go outside their comfort zone. Also asking questions on the topics of assumptions that are made, and the influences of conditioning need to be treated. In a way, asking questions can be seen as the ‘X’ in the first lunch lecture (see page 48). This ‘X’ stands for the ingredient that is added to the equation for thinking outside the box.

Division of methods in phases of the design process

One of the most important conclusions is that it has become clear that all methods have different characteristics when it comes to what problems can be solved with them. Moreover, they are used in different stages during the project. Firstly, at the start methods which analyze and reframe the problem statement (e.g. Rewording the Problem, Breakdown, and Problem Statement Analysis). Secondly, methods like Mind mapping or S.C.A.M.P.E.R. can be used as a firestarter to create, for example, an overall understanding of the problem and comparable products. Then, when the team wants to think critically about these existing products and their designs, use the method of Attribute Listing. When all is clear, start thinking about possible solutions with idea generation methods like Post-up and Brainwriting. During (or after these sessions) use the method of BPR to make sure that your ideas are thought through well. This four stage approach can be seen as somehow over-enthusiastic and not feasible in the time given for each project, let alone with the budget assigned to it. For a more practical approach, instructions need to be created so team leaders and problem initiators can pick the different methods themselves. These instructions should indicate what the

different characteristics of the methods are (including the phase for which the method is designed) and for what problems they can be used. For example, a project with many comparable products of competitors lends itself for S.C.A.M.P.E.R. and Attribute Listing. When there are no comparable products, then especially the primary can be found not that useful.

Alter sequences

Another lesson that is learned the hard way is that methods that dictate a certain path to follow are altered almost always. Following predetermined steps and/or questions in sequence was impossible. So, when future sessions are held with the help of methods, the latter should be formulated in a way that altering their sequence should be possible. A method which needs to be followed by the letter is not well received and will, possibly, end up in the trash or in a dark corner. This is encouraged in earlier chapters: giving participants freedom strengthens creativity. Setting up blockades in the form of rules and limitations can limit that creativity.

Better one method than no method at all

According to the reviews, almost all pilots were a success and were embraced by the participants. However, one can also say that not the form of the method is the factor that determines the success, but that the presence of a method in general leads to success. Since the different methods were only treated in a maximum of two different sessions, no clear conclusions on this part can be drawn. Yet, it can be assumed that the latter argument for success is true.

7 CREATING INSTRUCTIONS

In this chapter the translation of tested pilots towards instructions will be treated. Different concepts, created in sequence of each other, are treated and explained. At the end of this chapter the final concept will be elaborated and shown. To answer questions like *“How will be made sure that these instructions will be used in practice?”* the reader is directed to chapter 8 ‘Recommendations on C&I’, page 65.

“Creativity is a great motivator because it makes people interested in what they are doing. Creativity gives hope that there can be a worthwhile idea. Creativity gives the possibility of some sort of achievement to everyone. Creativity makes life more fun and more interesting”

- Edward de Bono

From the start of the assignment it was determined that the focus (where to enhance the level of creativity and innovation) should be directed at the first two stages of the design process. After testing the methods in the different pilots it became clear that every method added value in some or multiple phases of this design process. Now these results needed to be translated to the instructions which were the primary deliverable of this assignment. However, along the way it became clear that in order to enhance the level of creativity and innovation, more than the introduction of different methods with their instructions should be done. More of this in chapter 8 '*Recommendations on C&I*', page 65. The future instructions should contain at least the following information:

- information from the literature review;
- wishes and demands of both management and employees of BAAT Medical;
- results from the lunch lectures;
- results from the pilots.

Since the amount of time, planned for creating the instructions, was set short, no extensive design process for the creation of these instructions was run through. However, a number of concepts have been created and reviewed. In the following paragraphs these concepts will be explained.

7.1 Sketching

Early on it was decided that the instructions would be presented in the form of separate cards, each containing one method. The benefit of using cards is that they can be picked and used separately. Instructions in the form of a bundle of papers do not have this benefit. Moreover, for example a book cannot be modified without printing it again. By using cards and creating an underlying design which will be available on the computer server of the company, BAAT Medical should be able to add even more cards in the future. These additional cards with other methods can then still match the design of the cards created for this assignment.

The basis of the instructions was found through sketching multiple designs and reviewing those ideas. First a basic design needed to be established in which the form of the cards was secured.

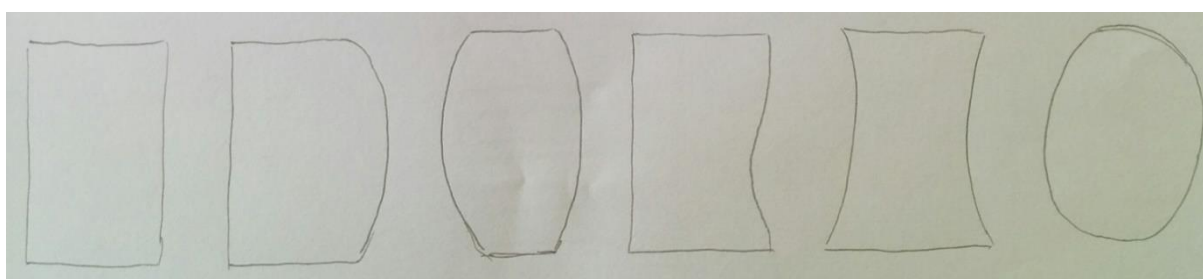


Image 9: Shape analysis of the overall shape of the cards

At first it was thought that using cards in a rectangular shape with rounded edges would suffice. However, adding a curve to one of the outer edges would create a more loose and creative design. Since the instructions, and thus the cards themselves, were to establish an enhancement of the level of creativity, creating 'boring' and 'dull' cards was out of the question. Very quickly the design of shape 2 within image 9 was chosen. In addition, this shape has the advantage of letting the user know in one look what the front of the card is.

Next up was the design of how to present the information within the cards. Printing only black letters on a blank piece of paper with a rounded outer edge would not be attractive to future users. Within the cards there are five distinctive parts that need to be separated from each other:

- title of the method;
- characteristics of the method (e.g. number of participants, time span, and expected results);
- general description of the method;
- execution of the method;
- time span per method.

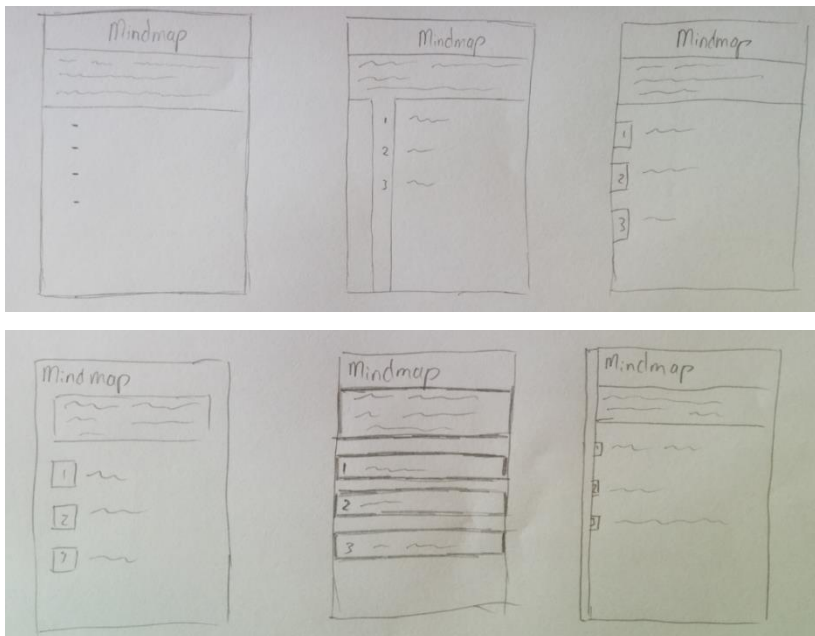


Image 10: Sketches of how the information on the cards should be presented

Adding a bar to the design creates the possibility to create a clear structure within each card. As seen in image 10, sketch 6, the bar can serve as some sort of glue for all the different parts that need to be included, but still allows those parts to be seen as separate components. All the different parts floating around in the document (as seen in sketch 4 of image 10) can create chaos and disorder while the instructions should be clear and plain in order to be easily read and used.

The location of the title can be either right next to the bar or in the middle of the piece. It was chosen to place this right next to the bar in order to create a consistent whole: all is aligned from the bar.

Then the question of how to separate the different phases with their respective cards came to mind. Sure, giving the cards of each phase a separate colour creates distinction, but when the cards are put together on a pile the coloring serves no function. It was decided that the cards of each phase should have a part that would stand out. The location of this appendix should differ for each phase so the total pile of cards should create a sequence of appendices.

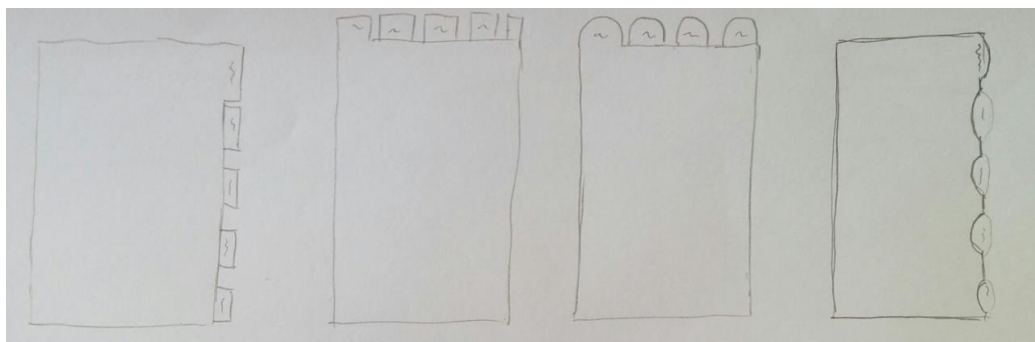








Image 11: sketches of appendices to indicate the separate phases

7.2 First design

The different methods which were selected for being included in the instructions now needed to be translated into instruction cards. In addition, there was the need for a card which would serve as a play guide for the rest of the cards. This card should contain the information of which color of cards to use for which situation/phase, overall guidelines, and maybe some tips from the author. Furthermore, the total of all cards should be guided by additional cards which cite the overall guidelines for brainstorming. These cards should contain information like the influence of assumptions that participants make, and the Creativity and Innovation Model so they were able to find even more influences on their level of creativity during a session. With this information, supplemented with the information and results of previous chapters, there was a need for a total of six different cards. To separate the different kind of cards a coloring system was added in addition to the appendices which indicate for which phase the card can be used.

-  Play guide
-  Overall guidelines for brainstorming
-  Analyzing and redefining the problem statement
-  Create an overall understanding of the problem
-  Idea generation
-  Critically analyzing your ideas

With this system to distinguish the different phases of the cards, supplemented with the decisions previously made, the first concept of instruction cards was made. A card of each phase can be found in the 'Annex', paragraph 12.8, page 108. Overall components of the cards can be seen in image 12.

Appendix indicating the phase		Rewording the Problem
Title of the method		Rewording the Problem
Characteristics of the method	Duration (min)	<p>Minimum number of participants: 4</p> <p><u>Work method</u>: team format</p> <p>Materials: written problem statement, pen, paper</p> <p>Result: redefinition of the problem statement and</p> <p>Time span: 60 minutes</p> <p>It often happens that the problem for which solu that can set people in the wrong dire It is imperative that this method is conducted in problem statement (the customer). Only then th member of the group.</p>
General description of the method		
Duration per stage of the method	5	Break down Break the sentence of the problem statement dc separate words of the following problem statemei <i>product <u>be</u> linked together?"</i>
Execution of a stage the method	15	Value of words Underline the most important words of the pr directed by its value for the solution. So, in the e

Image 12: Elements of a card in general

7.3 Reviewing the first design

In association with multiple people the first design was reviewed. Some observations of this design that should be included in the improved design are:

- some textual changes need to be made;
- the numbers, indicating the duration per stage, need to be enlarged since they are hard to read at this time;
- overall there needs to be more 'breathing space' for the pieces of text. The boarder between text and, for example, the bar needs to be increased;
- on first sight it still remains one piece of text: no clear distinctions between the different elements of the cards are visible;
- applying changes to the cards should be done within all cards so there still remains consistency.

The final form of the instruction cards can be seen in the 'Annex', paragraph 12.9, page 110. Overall components of the cards can be seen in image 13.

Title of the method is clarified with a background in the color of the phase

Characteristics and the general description of the method are highlighted with a background with, again, the color of the method. However, this background colour is a bit lighter than the previous so it discernable

Duration-number is enlarged by 14%

Steps of the method have an alternating coloured background to distinguish them more

Rewording the Problem

Rewording the Problem

Minimum number of participants: 4
 Work method: team format
 Materials: written problem statement, pen, paper
 Result: redefinition of the problem statement and overall understanding of it
 Time span: 60 minutes

It often happens that the problem for which solutions need to be found is not well formulated and that can set people in the wrong direction when confronted with the problem. It is imperative that this method is conducted in group format, including the party that formed the problem statement (the customer). Only then the problem statement can become clear for every member of the group.

5 Break down
 Break the sentence of the problem statement down into separate words. For example, write the separate words of the following problem statement below each other: "How can the two parts of the product be linked together?"

15 Value of words
 Underline the most important words of the problem statement. The importance of a word is directed by its value for the solution. So, in the example stated before, the words 'parts' and 'linked' are of a higher value then the word 'product'.

Breathing space is improved

Image 13: Results of the second review of the instruction cards put into practice

7.4 Printing instructions

The instruction cards were then printed on A4 paper and provided with a plastic front and cover through plasticizing. This was done to make sure that, for example, spilled coffee would not destroy the instruction. Even more it would make the cards clearly distinguishable from other papers that are spread out on the table during a brainstorm session.

There already exist other cards which can be used to guide brainstorm sessions. For example, the cards of IDEO (see image 14) and those of SILK (see image 15) serve this purpose. Both of these cards contain little textual information and consist mainly of images. For this reason they are not that big, mostly A6 size (10.5x14.8cm). Since the instruction cards, presented in this assignment, contain much textual information they needed to be bigger in size. However, printing them on, for example, A3 paper would make them too big to handle with.



Image 14: IDEO Cards for brainstorming



Image 15: SILK for brainstorming

In the end the 18 cards were printed, cut out to a size of 25.5cm x 18.5cm, and plasticized. This specific size was set to meet the desire to keep the text within the instructions readable, but make it still as small as possible. Further reduction of the amount of text is something that is treated in the recommendations of this report (see paragraph 8.4, page 67).

The cards were not yet presented to BAAT Medical within the time of this assignment since multiple employees were on holidays. A lunch meeting in September will be the time that they are made familiar with the different cards, supplemented with an introduction on how to use the cards. In addition, they will be made aware of the further actions they can perform in order to enhance their level of creativity even more. As mentioned earlier, only using the cards will not suffice. More of this in the following chapter which contain the recommendations of this assignment.

8 RECOMMENDATIONS ON C&I

After conducting the numerous pilots and translating them into instruction cards, there was still room for improvements and recommendations. In this chapter future efforts for enhancing the level of creativity and innovation are mentioned.

“Every human has four endowments: self-awareness, conscience, independent will, and creative imagination. These give us the ultimate human freedom... the power to choose, to respond, to change”

- Stephen Covey

The results of this assignment consist of multiple different components. Firstly, a model is provided which points out the different elements that influence the level of creativity and innovation within a company. Secondly, employees of BAAT Medical are made aware of some overall shortcomings in their creative thinking by appointing the fact that they make, for example, unconsciousness assumptions. Thirdly, multiple pilots have been conducted in which several methods have been tested and reviewed. Fourthly, instruction cards have been created from the conclusions of the previous components. For all of these components several recommendations are formed.

8.1 Creativity and Innovation Model

The model points out that there are 15 different elements that influence the level of creativity and innovation within a company. Throughout this assignment several of these elements have been treated, but the main focus was the introduction of new methods since that was the description of the assignment. It is recommended that BAAT Medical uses this model to point out future developments. For example, they can affect the element of *Environment* by hanging up posters on the wall. The element of *Wherewithal* can be affected by purchasing a whiteboard with a build in touchscreen. On this screen people can draw down ideas and they are then easily transformed into files that can be accessible on every computer for both inspection and alteration. The element of *Person* can be further amplified by allowing employees to participate in an online creativity course like the ones available on EdX.

To point out the most influential element a future study must be conducted. However, with the knowledge that is now available, it is recommended that BAAT Medical first treat the following elements in the near future:

- *Person*

Make people aware of what influences their creativity. Allow them to, for example, follow online courses to enhance their level of creativity and innovation so they can act on this newly gathered information.

- *Team*

Also an aspect of the element *Structure*, but appointed here now: involve other people within brainstorm sessions. Not only use the knowledge and experience of all employees of BAAT Medical, but go beyond the company. For example, invite people of the University of Twente to participate in brainstorm sessions. Their fresh look on a problem can form new paths to follow.

- *Environment*

Alter the direct environment of BAAT Medical so employees can work in a more inspiring workspace. The building in which BAAT Medical is currently located is truly of great beauty, but has the potential to do even more. What should be done in detail is something for a future study.

- *Wherewithal*

The amount of resources available at this moment is of an average level: the basic requirements like computers and meeting rooms are already there, but there is no freedom in choosing other resources since there are no more. In order to let employees be creative with the result of, for example, radical innovation they need to have even more resources at their disposal. Resources like

the touchscreen mentioned earlier can do much, but smaller investments like the presence of Lego-bricks or even clay can do much as well.

• Method

The instruction cards created throughout this assignment should be used in future brainstorm sessions. However, some of the methods can become less important or attractive than other. To create the possibility to enlarge the number of cards, a blueprint of the cards has been provided. With this blueprint new cards can be created in the future. The methods described in the cards may not be 'the best', so keep looking for other methods that can be successful within BAAT Medical and use them, even if they seem radical or absurd at first.

8.2 Awareness

We are all conditioned to take an analytic approach to solve a problem or answer a question (see paragraph 3.2 '*Education as a limitation to creativity*', page 16). Appointing this conditioning can be used as an eye-opener. This also applies for other things like the assumptions we make. Surely this recommendation can be seen as a factor within the element *Person*, but it should be treated in even more depth. Making people aware of what thinking processes can limit their creativity is something that should not be limited to the first two stages of the design process. To enhance this meta-cognition it is recommended that future brainstorm session commence with a test/task comparable to those treated in lunch lecture 2 (see Annex, paragraph 12.6, page 98).

8.3 Pilots

The cards presented in this assignment contain much information. Problem initiators of future brainstorm sessions should prepare the methods by studying the matching cards. Then, in the introduction (during the session) participants can be made familiar with the method through briefly treating the different steps of the method(s). Creating the need for every participant to read the card individually is too time consuming. So problem initiators: prepare your session well!

8.4 Instruction Cards

Of course, not every employee of BAAT Medical will look at the cards and think "*These cards will be of great help!*" Surely this opinion needs to be avoided, but it is impossible to assume that everyone will use the cards all the time. This is okay, as long as others do use the cards to enhance their level of creativity. They can then translate this to more ideas or ways of thinking about a problem in brainstorm sessions with the entire team. Herby the level of creativity of a team as a whole is enhanced, which can have the result of more concepts and ultimately more innovations.

As mentioned in paragraph three of this chapter, the instruction cards contain much information. When all team leaders (often functioning as problem initiators) are familiar with all the cards, the latter can be expanded by the introduction of smaller instruction cards. When created in the near future, these 'cheat cards' can also serve as handout to the participants of brainstorm sessions. Then the introduction does not have to contain this information per se.

9 CONCLUSIONS

To increase the level of creativity and innovation within a company one needs to understand that there are many elements that can be affected. Within a model, created throughout this assignment, a total of 15 elements with underlying factors were nominated. At the *Source* level, containing the elements required in any purposeful creative act, we have the elements of *Job Skills*, *Devotion*, and *Method*. At the *System* level, describing the organizational context in which creativity and innovation happens, there are five elements, consisting of *Person*, *Team*, *Wherewithal*, *Aim*, and *Structure*. At the last level, named *Culture* we find the elements of *Ideas*, *Freedom*, *Humor*, *Environment*, *Company*, *Risk*, and *Growth*.

The main goal of this assignment was to find and introduce new brainstorm methods that were to be tested in pilots in order to enhance the level of creativity and innovation. However, some other elements and factors of the model were treated as well, namely *Risk*, *Structure*, *Team*, *Criticizing*, and *Interaction*.

The study found that almost all of the methods resulted in either a better understanding of the underlying problem, and/or in multiple concepts solving the problem. To measure the level of creativity, each pilot was reviewed with the participants since not all brainstorm sessions resulted in a number of concepts. In these reviews participants were asked to critically analyze the method(s) with which they worked that day. These improvements could later on be used in the creation of instructions.

To make the employees of BAAT Medical more aware of the different influences on creativity and innovation, a number of cognitive thinking processes were explained and tested with their participation. In combination with the pilots this resulted in an overall understanding of which elements and factors could influence the level of creativity and innovation within their brainstorm sessions. To make sure that this creativity-grow would persevere, a total of 18 instruction cards have been created. These cards are now available as guidance throughout their future brainstorm sessions and should assist them to realize more innovations.

In conclusion it can be said that to enhance the level of creativity and innovation, employees of BAAT Medical should be encouraged to make use of the established instruction cards. Which cards are used is, of course, an important factor, but the pilots indicated that the choice of which method to use is not determinative for success. Using a method in comparison to using no method is more determinative. In addition, the company of BAAT Medical should treat other elements of the Creativity and Innovation Model as well in order to make the company more creative as a whole. Only treating one element of the model will not suffice. Thirdly, it is recommended to undertake one or more additional studies to determine which elements should be treated next. In this study it is found that treating the elements of *Person*, *Team*, *Environment*, and *Wherewithal* should be done first.

10 REFLECTION

This assignment was done in a total duration of 14 weeks. During that time period I had the full support of all of the employees of BAAT Medical and their management. The fact that I had the opportunity to set up my own brainstorm sessions with these people was of great value to my research. If I had to wait for invitations for sessions it was impossible to conduct as many pilots as I did now. Working from that, employees always gave their best when participating in those pilots. They were always focused and worked with the methods I recited. I am really thankful for their efforts and participation! During the 14 weeks of this assignment I had the help of my mentors of BAAT Medical (R. de Wit and H. Christenhusz) at my disposal. At the start of my project the latter was of great inspiration and guided me through the first stage, consisting of the literature review and becoming acquainted with the company. From June I had R. de Wit as my direct mentor within the company and she helped me through the following stages of my assignment. Both mentors were of great help and I think I would not have come where I am now without them. The University also provided me with a mentor, namely Dr. Ir. J. Garde. She was able to help me with multiple questions and guided me through the creation of the instructions.

I am satisfied with the way this assignment went. Surely some aspects should have been altered since they were not that influential for the rest of the study. For example, much time was spent on finding ways to measure the level of creativity, only to find out that none of them were usable in my research. Additionally, elaborating the results of the sessions/pilots with the teams would have been great, but most projects are spread out over a time period of multiple months, or even years. I think that finding out what happens next with the ideas, generated in the pilots, would have created more quantitative data, but again: I did not have that much time.

What I would really like to see is that my work is used in practice at BAAT Medical. I hope that future brainstorm sessions will take place with the help of my instruction cards and things I have learned the people of BAAT Medical. I think that the amount of knowledge I have gathered throughout this assignment is really substantial, and I hope that I have enlightened people with that information (and remain doing so through this report). However, I could have done more if I had more time. As can be read in the recommendations, future studies should yield even more results on the level of creativity and innovation. I hope BAAT Medical will do so, because this assignment is only the start of something bigger.

11 BIBLIOGRAPHY

- Acikgoz, A & Gunsel, A. (2016). *Creativity and Innovation Management*. New York, NY: John Wiley&Sons
- Anderson, J. (2014, May 23). *Professor Jamier Anderson – Boosting Creativity*. Retrieved from <https://www.youtube.com/watch?v=x5Wqquituss>
- Anderson, J. (2015, December 18). *Jamie Anderson – Creative Parenting*. Retrieved from <https://www.youtube.com/watch?v=113fs1vRnJg>
- Anderson, J. (2016, June 16) *Jamie Anderson – Creativity & Innovation*. Lecture at UvA, Amsterdam
- Chryssochoidis, G. (2003, January). Factors affecting products innovations: A literature review. *Agricultural Economics Review*, 4(1), 47-62
- Csikszentmihalyi, M. (2014). *The Systems Model of Creativity: The Collected Works of Mihaly Csikszentmihalyi*. Claremont University, CA: Springer
- Dijk, van, V. (2016). Professionele eigenschappen van creativiteit. Retrieved from <http://www.carrieretijger.nl/functioneren/professionele-eigenschappen/creativiteit>
- Dorta, T., Kalay, Y., Lesage, A. & Perez, E. (2011, May). Design conversations in the interconnected HIS. *EuropaIA – Collaborative Management and Modelling for Design*, 13, 83-93
- Eveleens, C. (2010, April). *Innovation management; a literature review of innovation process models and their imply*
- Fagerberg, J., Mowery, D.C. & Nelson, R.R. (2005). *The Oxford Handbook of Innovation*. New York, NY: Oxford University press.
- Franken, R.E. (2004). *Human Motivation*. Brooks&Cole
- Gray, D., Brown, S. & Macanufo, J. (2010, August). *O'Reilly Gamestorming – A Playbook for Innovators, Rulebreakers and Changemakers*. O'Reilly Media, Inc. USA
- Ireland, R.D. & Web, J.W. (2007). Strategic entrepreneurship: creating competitive advantage through streams of innovation. *Business Horizon*, 50, 49-59
- Isaksen, S.G. (2013). The Creative Problem Solving Group, Inc – Working to unleash the full spectrum of creative talent in organizations. Retrieved from <http://www.cpsb.com/research/fellows/isaksenS.html>
- Johnson, C.D. (2005, May 12). *International Journal of Design Sciences and technology*, 5 - 66
- Kaufman, A.B., But, A.E., Kaufman, J.C. & Colbert-White, E.N. (2011, August). Towards a neurobiology of creativity in nonhuman animals. *Journal of Comparative Psychology*, 125(3), 255-272.
- Kelley, T. & Kelley, D. (2003, October). *Creative Confidence: Unleashing the creative Potential within us all*. Crown Business.
- Koops, B.J., Oosterlaken, I., Romijn, H., Swierstra, T. & Hoven, van den, J. (2015). *Responsible Innovation 2*. Tilburg University: Springer
- Lemon, P. & Sahota, S.P. (2004). *Organizational culture as a knowledge repository for increased innovative capacity*. Cranfield University

- McLeod, S. (2007). Skinner – Operant Conditioning, *SimplyPsychology*. Retrieved from <http://www.simplypsychology.org/operant-conditioning.html>
- Michaelides, D. (2012, December 23). *The Art of Innovation: Dimis Michaelides ate TEDxGramercy*. Retrieved from <https://www.youtube.com/watch?v=PIRUWa8pC0k>
- Ouden, van, E. (2012). *Innovation Design – Creating Value for People, Organizations and Society*. Springer London
- Owens, D.A. (2012, September 12). *Leading Strategic Innovation and Creativity in Organizations with david A. Owens, PhD*. Retrieved from <https://www.youtube.com/watch?v=M3hTB0S1Gts>
- Pavitt, K. (2003, August). *The Process of Innovation*. Oxford: Oxford University Press.
- Piirto, J. (2011). *Creativity for 21st Century Skills: How to Embed Creativity into the Curriculum*. Ohio:Sense Publishers
- Pirola-Merlo, A. & Mann, L. (2004). The relationship between individual creativity and team creativity: aggregating across people and time. *Journal of Organizational Behavior*, 25, 235-257
- Plsek, P. (2013). What is directed creativity? Retrieved from <http://www.directedcreativity.com/pages/WhatsDCFrameset.html>
- Seelig, T. (2014, February 6). *Tina Seelig: The 7 Characteristics of Truly creative People*. Retrieved from <https://www.youtube.com/watch?v=CgCdsERkqrc>
- Smith, M., Busi, M., Ball, P. & Meer, van der, R. (2008). Factors Influencing an Organizations Ability to Manage Innovation: a Structured Literature Review and Conceptual Model. *International journal of innovation Management*, 12(4), 655-676
- Stillman, J. (2014, October 1). The 4 Stages of Creativity. *Inc.*. Retrieved from Today's must reads database of Inc.
- Tan, A.G. & Perleth, C. (2015), Creativity, Culture, and Development, *Creativity in the Twenty First Century*: Springer.
- Thamhein, H.J. (2003, June). Managing Innovative R&D Teams, *R&D Management*, 33, 297-311.
- Vozza, S. (2015, October 5). 8 Habits of People Who Always Have Great Ideas. *5 Minute Read*. Retrieved from fastcompany.com database
- Waters, P. (2013, January 8). Why Creativity Is The Most Important Quality You Have [Electronical version]. *Elite Daily*. Retrieved from <http://elitedaily.com/money/entrepreneurship/creativity-important-quality/>

12 ANNEX

In this chapter extra materials and examples of this assignment, which were left out of the main part of the report, can be found. The underlying paragraphs are referenced throughout the main part of the report and do not serve as must-read material per se. In addition, they have no argumentation themselves since they only serve as extra material.

*You can't use up creativity. The more you use,
the more you have"*

- Maya Angelou

12.1 Plan van Aanpak

Inleiding

In dit rapport wordt het plan van aanpak besproken voor een bacheloropdracht die uitgevoerd gaat worden bij Baat Medical in Hengelo. Deze bacheloropdracht richt zich op het verhogen van de *creativiteit*⁴ en *innovativiteit*¹ van medewerkers van Baat Medical gedurende de eerste twee fases van het ontwerpproces⁵. Binnen Baat Medical wordt vastgehouden aan een ontwerpmethode die bestaat uit vijf verschillende fases, bestaande uit ‘*explore*’, ‘*design*’, ‘*engineer*’, ‘*validate*’ en ‘*transfer*’⁶. Binnen Baat is het opgevallen dat het werken volgens deze ietswat vastgeroeste en procesmatige werkmethode heeft geleid tot een stagnering van de innovativiteit en creativiteit van haar werknemers gedurende meerdere fases van het ontwerpproces. Er is daarom vraag naar een ‘frisse blik’ die deze stagnering een halt kan toeroepen. Deze groei zou tot stand moeten komen door gebruik te maken van, onder andere, nieuw toe te voegen ontwerp- en brainstormmethoden. In deze bacheloropdracht worden deze *methoden*¹ gezocht, getest en uitgewerkt tot een voorstel tot implementatie. Het zal hier vooral gaan om het zoeken naar de meest geschikte *methoden*. De werkelijke implementering van de te gebruiken methoden in projecten zal door Baat Medical worden gedaan. |

Actoranalyse

Baat Medical

De opdrachtgever is Baat Medical, gevestigd in Hengelo. Dit bedrijf is een specialist op het gebied van orthopedische productontwikkeling. Hierin bieden zij diensten aan, reikend van het adviseren op het gebied van orthopedische producten tot het werkelijk produceren ervan in samenwerking met partners in het binnen- en buitenland. Door een recent verkregen certificaat zijn ze in staat tot het maken van klasse IIB medische producten⁷ en mogen ze hier vervolgens het CE-merk op zetten⁸. Klanten van Baat Medical variëren van losse particulieren tot grote medische bedrijven. Binnen deze opdracht is niet één enkele klant aan te wijzen, maar dient de overall *creativiteit* en *innovativiteit* naar klanten en hun opdrachten die hiervoor kiezen te worden verbeterd. Door de te ontwikkelen methoden toe te passen zullen de producten en diensten van Baat Medical verder kunnen worden geoptimaliseerd op het gebied van creativiteit en innovativiteit. Ook de medewerkers van Baat Medical hebben voordeel bij de implementatie van deze nieuwe methoden. Waren zij voorheen beperkt in creativiteit door het vasthouden aan een bestaand (vastgeroest) model, straks krijgen zij meer inbreng en inspraak in het ontwerpproces wanneer methoden worden toegepast.

Klanten van Baat Medical

Bij deze opdracht gaat het om *methoden* die geïmplementeerd worden tijdens de eerste twee fases van het ontwerpproces. De klant heeft de mogelijkheid te kiezen voor een ontwerptraject met extra aandacht voor creativiteit en innovatie (*methoden* zullen worden toegevoegd) of het ontwerptraject

⁴ Zie begrippenlijst

⁵ Opdrachtoomschrijving ‘Stageopdracht Baat Medical’

⁶ <http://www.baatmedical.com/clients-cases/>

⁷ www.baatmedical.com/about-baat/

⁸ <https://www.gov.uk/guidance/medical-devices-conformity-assessment-and-the-ce-mark>

te volgen zoals hij was. Bij deze laatste keuze zal dus de originele ontwerpmethode worden aangehouden zonder extra aandacht voor creativiteit en innovativiteit in de eerste twee fases. Deze keuze kan van invloed zijn op het product (of de dienst) op het gebied van ontwikkeling, marketing en acceptatie in de medische markt. Ook gevolgen op het tijd- en kostenplaatje moeten worden meegerekend. Het uiteindelijke doel van de klanten van Baat Medical is een product (of dienst) die voldoet aan alle eisen en wensen, gedaan voor een bepaalde prijs in een aangegeven tijdsbestek. Deze opdracht vervult hier de taak van het optimaliseren van het productontwerp gedurende de eerste twee fases van het ontwerpproces.

Klanten van klanten van Baat Medical

Veel klanten van Baat Medical verkopen de producten (welke zijn ontwikkeld en/of gemaakt door Baat Medical) door aan hun klanten zoals verzekeraars en ziekenhuizen. Uiteindelijk leveren (en betalen) deze instanties het product aan de patiënt, maar de keuze voor een product wordt vrijwel altijd gedaan door iemand binnen het ziekenhuis of de verzekeraar. Mede daarom is de patiënt niet een actor binnen deze opdracht.

Deze actoren zijn erbij gebaat dat het product zijn doel bereikt en de patient zo snel mogelijk geneest, dan wel zo lang mogelijk ondersteund. Toegevoegde creativiteit en innovativiteit in het ontwerpproces kunnen deze belangen behartigen.

Student

Ervaring opdoen in het bedrijfsleven en de inhoud van de opdracht zelf zijn grote leerpunten voor de student binnen deze opdracht. Zo leert hij meer over *innovativiteit*, *creativiteit* en de invloed hiervan binnen meerdere fases van het ontwerptraject. Ook het opzetten van een onderzoek en het leren samenbrengen van meerdere mensen (met verschillende disciplines) binnen een bedrijf behoren tot de leerpunten. Bovendien is het voltooien van de bacheloropdracht essentieel voor het afronden van de bachelor Industrieel Ontwerpen.

Universiteit

De universiteit wil graag dat haar studenten een opdracht doen die representatief is voor de opleiding en voor dat wat de student er heeft geleerd. Daarnaast moet elke opdracht de universiteit een goede naam leveren om toekomstige opdrachten te kunnen garanderen.

Projectkader

Baat Medical levert diensten aan tientallen bedrijven, artsen en particulieren, zowel in Nederland als daarbuiten. Wanneer Baat Medical orthopedische producten ontwerpt, houden ze vast aan een ontwerpmethode die bestaat uit vijf sequentiële fases⁹. Om een betere kwaliteit van deze producten en diensten te kunnen leveren is meer *creativiteit* en *innovativiteit* gewenst sinds hier een tekort in is te zien¹⁰. Dit heeft tot gevolg dat niet het maximale uit de medewerkers van Baat Medical wordt gehaald, terwijl daar wel de tijd en ruimte voor gemaakt kan worden. Een 'frisse blik', in combinatie met een aantal te ontwikkelen *methoden* moet hier verandering in aanbrengen.

Baat Medical wil haar klanten de mogelijkheid bieden tot het invoeren van meer *creativiteit* en *innovativiteit* in de eerste twee fases van het ontwerpproces. Dit kan gevolgen hebben voor de

⁹ <http://www.baatmedical.com/clients-cases/>

¹⁰ Opdrachtomschrijving 'Stageopdracht Baat Medical'

ontwikkeling (tijd- en kostenplaatje), evenals voor de marketing en de acceptatie van het product binnen de medische markt. Zijn bijvoorbeeld ziekenhuizen en verzekeraars niet enthousiast dan is het weggegooid geld. Zijn ze wel enthousiast dan kan het financieel aantrekkelijk zijn.

Doelstelling

Het doel van deze bachelor opdracht is het creëren van *instructies*¹¹ voor in te voeren *methoden* die de mate van *creativiteit* en *innovativiteit* kunnen verhogen tijdens de eerste twee fases van het ontwerpproces. Er dient ook een overzicht te worden gemaakt van de resultaten en gevolgen van deze methoden. Dit kan dan worden door gecommuniceerd aan (potentiële) klanten om hen zo een gegronde keuze te kunnen laten maken over het wel of niet toepassen ervan.

De *methoden* dienen aan te sluiten bij de (bedrijfs-)cultuur van Baat Medical en moeten daarnaast ook als inspirerend worden bevonden door haar werknemers om gebruik in de toekomst te kunnen garanderen. Het werkelijk implementeren van de *instructies* en erop naleven dat alle *instructies* juist worden opgevolgd valt buiten het bereik van de opdracht.

Het resultaat zal bereik worden door een onderzoek te doen naar in ontwikkeling zijnde- en bestaande (werk)methoden voor het verhogen van de mate van *creativiteit* en *innovativiteit*. Daarnaast dient er een analyse te worden gedaan naar de drijfveren en remmingen voor meer *creativiteit* en *innovativiteit* binnen Baat Medical. Het meten van deze graad van *creativiteit* en *innovativiteit* heeft namelijk invloed op de keuze van de te testen werkmethode in de zogenaamde *pilots*¹², wat de stap is na het selecteren en uitwerken van deze *methoden* (conceptvorming). Deze *pilots* zullen worden uitgevoerd binnen bestaande projecten van Baat Medical. Vervolgens dienen de *pilots* te worden geëvalueerd om zo tot een selectie van *methoden* te komen die worden uitgewerkt in de vorm van *instructies*. Deze *instructies* kan Baat Medical dan hanteren bij het gebruiken van de gekozen methoden. Tot slot zullen de gevolgen en resultaten van de *methoden* in kaart worden gebracht. Hiermee kunnen klanten van Baat Medical een compleet beeld krijgen van de voor- en nadelen van het gebruiken van *methoden*.

Dit alles zal in een tijdsbestek van 3 maanden plaatsvinden, uitgevoerd door de student. Hierin zal hij begeleidt worden door een medewerker van Baat Medical en een docent van de Universiteit Twente. Voor een gedetailleerde planning, kijk op pagina *** van het Plan van Aanpak.

Alle stukken volgend na dit document zullen worden aangeleverd in de Engelse taal, hetgeen naar wens van de werkgever is.

Vraagstelling

I. Welke verwachtingen en eisen worden er gesteld aan *methoden*³ ten behoeve van het verhogen van het niveau van *creativiteit*¹ en *innovativiteit*² (C&I)?

- I.1 Welke methoden zijn er voor het verhogen van het niveau van *creativiteit*?
- I.2 Welke methoden zijn er voor het verhogen van het niveau van *innovativiteit*?
- I.3 Welke eisen worden er aan deze methoden gesteld?

¹¹ Zie begrippenlijst, pagina 11

¹² Zie begrippenlijst, pagina 11

- 1.4 Wat zijn de randfuncties van deze methoden?
- 1.5 Wat zijn de gevolgen van de methoden op het gebied van *creativiteit*?
- 1.6 Wat zijn de gevolgen van de methoden op het gebied van *innovativiteit*?
- 1.7 Waar overlappen de methoden elkaar op het gebied van C&I?
2. Welke verwachtingen en eisen worden er gesteld aan de *methoden* vanuit Baat Medical?
 - 2.1 Wat zijn de drijfveren voor C&I binnen Baat Medical?
 - 2.2 Wat zijn de remmingen voor C&I binnen Baat Medical en waar ligt de oorzaak?
 - 2.3 Welk nut ziet Baat Medical bij het invoeren van de *methoden*?
 - 2.4 Welke aspecten ziet Baat Medical graag in de *methoden*?
 - 2.5 Hoe wordt het gewenste resultaat gedefinieerd?
3. Welke *methoden* zijn geschikt om in de praktijk te testen (*pilots*)?
 - 3.1 Welke eisen worden gesteld vanuit de analyses in de vragen 1 en 2?
 - 3.2 Welke *methoden* zijn toepasbaar binnen Baat Medical?
 - 3.3 Welke *methoden* zijn geschikt volgens Baat Medical?
4. Wat zijn de bevindingen en resultaten van de *pilots*?
 - 4.1 Hoe hebben de gebruikers de *methoden* ervaren?
 - 4.2 Wat zijn de gevolgen van de *pilots* op het gebied van *creativiteit*?
 - 4.3 Wat zijn de gevolgen van de *pilots* op het gebied van *innovativiteit*?
 - 4.4 Welke *methoden* worden aanbevolen uit het oogpunt van de gewenste resultaten?
 - 4.5 Welke *methoden* hebben de voorkeur van Baat Medical?
5. Hoe worden de gekozen *methoden* geïmplementeerd?
 - 5.1 Waaruit dient een goede *instructie* te bestaan?
 - 5.2 In welke vorm dient de *instructie* te worden geleverd?
 - 5.3 Waar moet Baat Medical op zijn voorbereid bij het implementeren van de *methoden* en haar *instructies*?
 - 5.4 Wat is er voor nodig om de *methoden* toe te blijven passen en te onderhouden na het afronden van de opdracht?
6. Hoe kan het gebruiken van *methoden* aan klanten van Baat Medical worden gepresenteerd?
 - 6.1 Wat zijn de drijfveren en remmingen voor C&I van klanten van Baat Medical?
 - 6.2 Welke informatie hebben klanten van Baat Medical nodig voor het maken van een gefundeerde beslissing voor het wel of niet gebruiken van *methode*?
 - 6.3 Wat zijn resultaten en gevolgen van het kiezen voor het gebruiken van *methoden*?

Strategiebepaling

Strategie	Bronnen	Soort	Ontsluiting
1.1 Welke methoden zijn er voor het verhogen van het niveau van <i>creativiteit</i> ?			
Bureauonderzoek	Media literatuur	(internet), Documenten fragmenten over creativiteit en methoden om dit te verbeteren	Inhoudsanalyse
1.2 Welke methoden zijn er voor het verhogen van het niveau van <i>innovativiteit</i> ?			
Bureauonderzoek	Media literatuur	(internet), Documenten fragmenten over innovativiteit en methoden om dit te verbeteren	Inhoudsanalyse
1.3 Welke eisen worden er aan deze methoden gesteld?			
Bureauonderzoek	Media literatuur	(internet), Documenten fragmenten over I&C en methoden om dit te verbeteren	Inhoudsanalyse
1.4 Wat zijn de randfuncties van deze methoden?			
Bureauonderzoek	Media literatuur	(internet), Documenten fragmenten over I&C en methoden om dit te verbeteren	Inhoudsanalyse
1.5 Wat zijn de gevolgen van de methoden op het gebied van <i>creativiteit</i> ?			
Bureauonderzoek	Media literatuur	(internet), Documenten fragmenten over creativiteit en methoden om dit te verbeteren	Inhoudsanalyse
1.6 Wat zijn de gevolgen van de methoden op het gebied van <i>innovativiteit</i> ?			
Bureauonderzoek	Media literatuur	(internet), Documenten fragmenten over innovativiteit en methoden om dit te verbeteren	Inhoudsanalyse
1.7 Waar overlappen de methoden elkaar op het gebied van C&I?			
Bureauonderzoek	Media literatuur	(internet), Documenten fragmenten over I&C en methoden om dit te verbeteren	Inhoudsanalyse
2.1 Wat zijn de drijfveren voor C&I binnen Baat Medical?			
Case Study	Personen	Medewerkers van Baat Medical	Face-to-face interview Enquête ¹³

¹³ Soort enquête zal later worden bepaald, afhankelijk van de resultaten uit vraag 1

Strategie	Bronnen	Soort	Ontsluiting
2.2 Wat zijn de remmingen voor C&I binnen Baat Medical en waar ligt de oorzaak?			
Case Study	Personen	Medewerkers van Baat Medical	Face-to-face interview Enquête ¹⁴
2.3 Welk nut ziet Baat Medical bij het invoeren van de <i>methoden</i>?			
Case Study	Personen	Medewerkers van Baat Medical	Face-to-face interview Enquête ⁹
2.4 Welke aspecten ziet Baat Medical graag in de <i>methoden</i>?			
Case Study	Personen	Medewerkers van Baat Medical	Face-to-face interview Enquête ⁹
2.5 Hoe wordt het gewenste resultaat gedefinieerd?			
Case Study	Personen	Medewerkers van Baat Medical	Face-to-face interview
3.1 Welke eisen worden gesteld vanuit de analyses in de vragen 1 en 2?			
Bureauonderzoek	Media (internet), literatuur	Documenten en fragmenten over I&C en methoden om dit te verbeteren	Inhoudsanalyse
Case Study	Personen	Medewerkers van Baat Medical	Face-to-face interview Enquête met open- en/of gesloten vragen
3.2 Welke <i>methoden</i> zijn toepasbaar binnen Baat Medical?			
Case Study	Personen	Medewerkers van Baat Medical	Face-to-face interview
	Documenten	Cases (dossiers)	Inhoudsanalyse
3.3 Welke <i>methoden</i> zijn geschikt volgens Baat Medical?			
Case Study	Personen	Medewerkers van Baat Medical	Face-to-face interview
4.1 Hoe hebben de gebruikers de <i>methoden</i> ervaren?			
Case Study	Personen	Medewerkers van Baat Medical	Face-to-face interview Enquête met open- en/of gesloten vragen
Bureauonderzoek	Werkelijkheid	Analyseren pilot	Observatie
4.2 Wat zijn de gevolgen van de <i>pilots</i> op het gebied van <i>creativiteit</i>?			
Case Study	Personen	Medewerkers van Baat Medical	Face-to-face interview Enquête met open- en/of gesloten vragen
Bureauonderzoek	Werkelijkheid	Analyseren <i>pilot</i>	Observatie
4.3 Wat zijn de gevolgen van de <i>pilots</i> op het gebied van <i>innovativiteit</i>?			
Case Study	Personen	Medewerkers van Baat Medical	Face-to-face interview Enquête met open- en/of gesloten vragen
Bureauonderzoek	Werkelijkheid	Analyseren <i>pilot</i>	Observatie

¹⁴ Soort enquête zal later worden bepaald, afhankelijk van de resultaten uit vraag 1

Strategie	Bronnen	Soort	Ontsluiting
4.4 Welke methoden worden aanbevolen uit het oogpunt van de gewenste resultaten?			
Case Study	Personen	Medewerkers van Baat Medical	Face-to-face interview
Resultaten samenvoegen	Materiaal uit vraag 2 en 3	2.4, 2.5, 3.1, en 3.3	Inhoudsanalyse
4.5 Welke methoden hebben de voorkeur van Baat Medical?			
Resultaten samenvoegen	Materiaal uit vraag 3 en 4 en de pilots	3.1, 3.2, 3.3, 4.1, 4.2, 4.3, 4.4 en uitwerkingen van de pilots	Inhoudsanalyse
Case Study	Personen	Medewerkers van Baat Medical	Face-to-face interview Enquête met open- en/of gesloten vragen
5.1 Waaruit dient een goede instructie te bestaan?			
Bureauonderzoek	Media (internet), literatuur	Documenten en fragmenten over het schrijven van instructies	Inhoudsanalyse
5.2 In welke vorm dient de instructie te worden geleverd?			
Bureauonderzoek	Media (internet), literatuur	Documenten en fragmenten over het schrijven van instructies	Inhoudsanalyse
Case Study	Personen	Medewerkers van Baat Medical	Face-to-face interview
5.3 Waar moet Baat Medical op zijn voorbereid bij het implementeren van de methoden en haar instructies?			
Bureauonderzoek	Media (internet), literatuur	Documenten en fragmenten over het schrijven van instructies	Inhoudsanalyse
Resultaten samenvoegen	Pilots en materiaal uit vraag 5	Uitwerkingen van de pilots en analyseren van 5.3	Inhoudsanalyse en observatie
5.4 Wat is er voor nodig om de methoden toe te blijven passen en te onderhouden na het afronden van de opdracht?			
Bureauonderzoek	Media (internet), literatuur	Documenten en fragmenten over het schrijven van instructies	Inhoudsanalyse
Resultaten samenvoegen	Materiaal uit vraag 4 (pilots) en 5	Uitwerkingen van de pilots en 5.3	Inhoudsanalyse en observatie
6.1 Wat zijn de drijfveren en remmingen voor C&I van klanten van Baat Medical?			
Case Study	Personen	Medewerkers en klanten van Baat Medical	Face-to-face interview Telefonisch interview
6.2 Welke informatie hebben klanten van Baat Medical nodig voor het maken van een gefundeerde			

beslissing voor het wel of niet gebruiken van *methode*?

Case Study	Personen	Medewerkers klanten van Medical	en Baat	Face-to-face interview Telefonisch interview
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6.3 Wat zijn resultaten en gevolgen van het kiezen voor het gebruiken van *methoden*?

Resultaten samenvoegen	Materiaal uit vraag 1,3, 4 (pilots) en 6	1.4, 1.5, 1.6, 1.7, 3.2, 3.3, 6.1, en 6.2.	Inhoudsanalyse en observatie
Bureauonderzoek	Media (internet), literatuur	Documenten over de gevolgen van C&I	Inhoudsanalyse

Knelpunten en mogelijke oplossingen

Personen zijn niet beschikbaar

Op tijd afspraken maken, zorgen voor een database met meer projecten en mensen zodat anderen gevraagd kunnen worden.

Documenten zijn niet aanwezig

Expert op het betreffende gebied interviewen, maar in eerste instantie zoektermen uitbreiden.

Milestone¹⁵ wordt niet gehaald doordat een (deel)vraag of een onderdeel meer tijd kost dan gepland

Onderzoeken of het mogelijk is om ergens anders tijd te besparen. Wanneer er echt tijdproblemen ontstaan moet er overlegd worden met de begeleiders. Samen met hen kan gekeken worden naar hoe de doelstelling kan worden aangepast.

Planning

Op de volgende pagina is de planning te vinden.

Horizontaal is de doorlooptijd van een bepaalde activiteit weergegeven, verticaal de werktijd in dagen. Binnen één week kunnen meerdere activiteiten ingepland staan, hetgeen aangeeft hoe de verdeling van de uren die week ongeveer verdeeld is.

In de doorlooptijd van de verslaglegging is niet elke week een waarde gegeven. Het is belangrijk dat er ook tijdens het proces onderdelen worden vastgelegd in het verslag, al kan het voorkomen dat dit niet elke week evenveel aandacht en tijd krijgt. Omdat dit anders te specifiek is, zijn de werktijden voor de verslaglegging veelal bepaald aan het einde van een specifieke fase en aan het einde van de opdracht.

Er is één week waar één dag minder ingepland staat. Dit heeft te maken met de vaste feestdag van Pinksteren (maandag 16 mei 2016).

¹⁵ Zie begrippenlijst

	9-mei	16-mei	23-mei	30-mei	6-jun	13-jun	20-jun	27-jun	4-jul	11-jul	18-jul	25-jul	1-aug	8-aug
Voorbereiding														
Plan van Aanpak	4,5													
Inventariseren van lopende projecten	0,5	1												
Plan interviews* en pilots opstellen		2,5												
Analysefase														
Analyse bestaande methodes		0,5	4,5	4,5	4,5	1+uitloop								
Interviews afnemen					2									
Interviews verwerken						2								
Ontwerpfase														
Pilotconcepten vormen							5							
Onderzoek met pilots opstellen								2,5						
Pilots uitvoeren								1	3	2				
Resultaten pilots verwerken									2	1,5				
Methodes kiezen en uitwerken										1	4			
Resultaten en gevolgen indexeren											1	2		
Instructies creëren												2	2,5	
Verslaglegging														
Verslaglegging			0,5	0,5	0,5			1,5		0,5		1	2,5	5
Totaal aantal dagen:	5	4	5	5	5	5	5	5	5	5	5	5	5	5
	69 dagen													

*De vorm van interviews wordt bepaald na de inventarisatie van lopende projecten en de hoeveelheid respondenten die hieruit voortvloeien.

Begrippenlijst

Creativiteit: het vermogen tot het vinden van originele en nieuwe ideeën, oplossingen en methoden binnen een vraagstuk (een 'creatie').

Innovativiteit: het vermogen tot het realiseren en/of uitvoeren van een creatie.

Methode: een op zichzelf staande of een in een andere opgaande stap tijdens de explore- en/of designfase van het ontwerpproces die als doel heeft de innovativiteit en/of creativiteit van het ontwerpproces te verhogen.

Instructie: richtlijnen en/of onderwijs in hoe personen geacht worden te handelen.

Pilot: onderzoek dat is bedoeld om een methode uit te proberen, een proefproject.

Milestone: een vastgelegd moment (een dag of specifiek tijdstip) waarop een onderdeel afgerond dient te zijn.

12.2 Employees mind map

Employees of BAAT Medical Participated in a brainstorm session in which they were asked to name different influences of creativity and innovation in order to create a mind map of it. Some observations from the created mind map, visible in picture 6 of the report, are:

- A total of 16 factors and attributes were named more than once on post-its.
- Participants named two out of three factors of the *Source* section of the C&I model, three out of five factors from the *System* section, and 6 out of 7 factors of the *Culture* section. That makes 11 out of the 15 factors in total, so a percentage of 73.3% of the Creativity and Innovation Model.
- Factors that were not noted by the employees were (with the related section in parentheses): *Devotion (Source)*, *Aim (System)*, *Structure (System)*, and *Growth (Culture)*.
- Factors with the most allocated attributes are (ranking from most to least):
 - Company* with 31 factors;
 - Person* with 23 factors;
 - Method* with 21 factors.
- Factors with the least amount of allocated attributes are (from least to more):
 - Resources* with 0 factors;
 - Risk* with 3 factors;
 - Humor* with 3 factors.
- Employees mostly see *Team* (7 out of 14 attributes), *Method* (5 out of 21 attributes), and *Environment* (4 out of 9 attributes) as factors that can enhance creativity and innovation.
- Attributes of factors that are marked with multiple curls are (the related factor in parentheses):
 - No criticizing (Team)* with 3 curls; *Mood (Person)* with 2 curls;
 - Money (Company)* with 2 curls; *Interaction (Team)* with 2 curls;
 - Environment (Environment)* with 2 curls; *Right tools (Method)* with 2 curls.
- Employees mostly see *Job Skills* (10 crosses within 12 attributes), *Company* (15 crosses within 31 attributes), *Freedom* (8 crosses within 11 attributes), and *Person* (11 crosses within 23 attributes) as limitations to creativity and innovation. That makes one factor from the *Source* section (*Job Skills*), one factor out of the *System* section (*Person*), and two factors out of the *Culture* section (*Freedom* and *Company*).
- Attributes of factors that are marked with many crosses are (the related factor in parentheses):
 - Blockade (Company, Job Skills, Team, and Freedom)* with 4 crosses;
 - Assumptions (Person, Team, and Job Skills)* with 4 crosses;
 - Judgement (Team)* with 2 crosses;
 - Restrictions (Company, Risk, and Freedom)* with 2 crosses.
- Attributes or factors that were marked with both (one or more) curls and (one or more) crosses are (with the related factors in parentheses):
 - Education (Person and Job Skills)* with 1 curl and 2 crosses;
 - Team* with 2 curls and 1 cross.

12.3 Selection of Methods

12.3.1 Rewording the problem

This method is not a complete method on its own, but only forces one to look at the problem from different views. It often happens that the problem for which solutions need to be found is not well formulated. This can set people in the wrong direction when confronted with the problem. A great advantage of this method is that all group members can become aware of the actual problem. Were people 'just following the problem statement' earlier on, now they are more aware of what the problem consists of. It is possible that a problem statement is altered completely. By questioning some valuable words of the problem statement, it can become clear that the customer demand differs from the problem statement. The group needs to formulate a new problem statement and start again with 'break down'.

It is imperative that this method is conducted in group format, including the party that formed the problem statement (the customer). Only then the problem statement can become clear for every member of the group.

- 1 **Breakdown**
Break the sentence of the problem statement down into separate words. For example, write the separate words of the following problem statement below each other: "*How can the two parts of the product be linked together?*"
- 2 **Value of words**
Underline the most important words of the problem statement. The importance of a word is directed by its value for the solution. So, in the example stated before, the words 'parts' and 'linked' are of a higher value than the word 'product'.
- 3 **Alter words**
Find other words for each of the separate words in the context of the entire sentence. Especially the underlined words must be considered for alternation, since they can change the entire view of the problem.
For example, the word 'linked' can be changed to 'glued' or 'molded'. True, both are examples of linking parts together but it sets boundaries for the problem. An example that can alter the entire problem statement is changing the word 'two' into 'three'. Through this participants are forced to look for parts which can be added to the problem statement, rather than only finding solutions which contain the mentioned two parts.
- 4 **Formulate**
With the information, existing of new words and guidelines, the group is able to formulate a new problem statement.

12.3.2 Breakdown

This is a method for reframing the problem statement. Through breaking down the sentence and analyzing each word a team can find a new, and better, problem statement which can be more focused on the real demand of the customer.

- 1 *Breakdown of the problem*
Identify the primary descriptions of the problem statement. This can be single words or a combination of multiple words forming a description. All together they form the problem statement.
- 2 *Explore*
Look at each item individually and describe it as detailed as possible.
- 3 *Relationships*
Find relationships between the different items and their descriptions.
- 4 *Hierarchy*
Create a hierarchy between the different items by selecting those who are of a high value to a possible solution. You can create a top-down diagram, or a center-out spider diagram to create a more clear view of it all.
- 5 *Breakdown*
Remove 'unnecessary' descriptions until you are left with the items that form the problem statement. For a new problem statement, look at the areas in which your focus lies (see 4 'hierarchy') and add words to create a new one.

12.3.3 PSI (Problem – Stimulus – Idea)

The first phase of the method of PSI is great for reframing your problem statement. Looking critically at what defines success creates possibilities for changing the problem statement and thereby its focus for the project.

- 1 *Clear up the area*
Use one or multiple of the following methods for clearing up the area in which you want to find solutions.
 - Write down the problem in different ways;
 - use different words for the problem statement;
 - describe the problem statement from different points of view.
- 2 *Determining success*
Look at the newly formed problem statement(s) and try to answer the following questions:
 - When is there 'success'? So, when is there a solution?
 - When is there 'no success'? So, when is the problem statement not solved, and what is not possible within it?

12.3.4 Problem Statement Analysis

Within this method the team analyses whether the customer's demand (often given in the form of a single sentence or question) is really what the customer wants. It often happens that the customer thinks he wants a solution to a problem in the form of a product which works in a particular way. However, after asking (for example) some targeted questions, the product designer can discover the underlying problem in a way that he might be able to propose a new direction in which a solution can be found. This can differ a lot from the original customer's demand, but still tackles the entire problem statement for which the customer needed a solution.

This method is used through asking the following questions that examine the customer demand and underlying problem statement. One can say that this brings forward the assumptions made in the process. However, now it is done in a more result-focused view ('what should the result be like?'), rather than focused on the aspects that form the customer demand ('within which area can we operate?').

- 1 | *Problem Statement*
 - What are different ways to describe your problem?
 - Can you summarize the problem in 6 words?
- 2 | *Treated*
 - What functions should be performed?
 - What problems need to be countered?
- 3 | *Results*
 - When is this project a success?
 - When is this project a failure?
 - What makes this project successful when completed?

12.3.5 Morphological Analysis

Morphological analysis is an idea generation method that let participants find the structural aspects of a problem and study relationships within them. For example, take the problem of finding the right motorized/powered vehicle transport from location A to location B. The structural aspects of the problem are: the type of vehicle (car, motorcycle, scooter); the source of power (electrical motor, steam, engine); and the medium (air, tarmac, water). Combining those creates, for example, a scooter on water, driven by a steam engine. As the example states, some novel combinations are possible.

In the following elaboration of this method the example of "finding transport from A to B" is used to explain and supplement the different steps.

- 1 | *Formulate the problem statement in only a few words*
e.g. finding transport
- 2 | *Think of as many characteristics as possible*
e.g. vehicle type, power source, medium

- 3 | *List as many associations per characteristic as possible*
e.g. car, steam, engine, water
- 4 | *Make random combinations of characteristics*
Multiple associations per characteristic are possible
e.g. electrical motorcycle, riding on tarmac
- 5 | *Look for new ideas and/or directions within the created combinations*
e.g. 100% 'green' motorcycle

12.3.6 Reverse Thinking

Like the name suggests, instead of thinking about a problem in known and logical manners, here we reverse it and think about the opposite solutions and/or create the problem or worsen it. For example: “*How can I triple my sales?*” can be changed into “*How can I make sure I have no sales at all?*” It is found that the majority of participants find it easier to produce ideas for the ‘negative challenge’, simply because it is much more fun.

Creating about 10 to 15 ‘wrong’ ideas is fine, so don’t spend too much time on the reverse thinking method. After this you can either continue with the reverse thinking method with a new challenge, or do the reversal once more to make it even stronger. For example, change “*How can I make sure I have no sales at all?*” into “*How can I sell everything I’ve got?*”

12.3.7 Questioning Assumptions

The majority of industries have the unspoken and deeply held belief that everyone and everything works in order to get things done. By doing so, they fail to question assumptions during the process of product development. These assumptions restrict the possibilities and ideas.

This method can serve two goals. Firstly, it can determine whether the customer demand is really what the customer means in ways of: does his demand really treat the problem he wants a solution for? It is also possible that the customer was already too narrowed down onto a particular solution or solution area. This can later on limit the creativity, and thus the innovativeness of the product designs. To treat this particular goal, question each assumption (and thus word or combination of words) in the customer demand and mirror it to the underlying problem statement.

Secondly, it can be of influence when the design team is already busy coming up with ideas. In this situation, the customer demands are already clarified, but designers can create (somewhat false) assumptions when treating this problem statement. To treat this goal, let each designer clarify the assumptions he made when exemplifying his created designs. Even if these are sketches, it is good to question the assumption made since the team can benefit from it as a whole.

- 1 *Finding assumption*
Participants start by settling on the framework for the creative challenge. Then they should produce 20 to 30 assumptions as a group (unregarded of whether they are true or false). This can be done by finding a minimum of 10 assumptions per person and combining them in a short group-consultation.
- 2 *Using assumptions*
Select the most important assumptions from the list that limit the project and use them as idea triggers and thought starters to find and create new and fresh ideas

Examples of areas and things in which assumptions are made:

- Assumptions - beliefs that are not questioned;
- Boundaries - lines which are not crossed yet;
- Compromises - what is assumed to must happen;
- Concepts - broad ideas that are the basis of ideas;
- Dominant ideas - ideas that guide thinking ;
- Either-or thinking - replace it with 'and' thinking;
- 'Essentials' - things that are assumed to be in disposable;
- Functions - the way things use(d) to work;
- 'Impossible' - things that are assumed to be impossible/cannot happen;
- Limits - the 'space' in which to work;
- Operations - processes by where things get done;
- Paradigms - things that guide thinking;
- Patterns - e.g. patterns of behavior;
- Polarizing tendencies - things that push people to extremes;
- Sacred items - things that are used to be untouched due to unwritten rules.

12.3.8S.C.A.M.P.E.R.

Scamper is a mnemonic that stands for *Substitute, Combine, Adapt, Modify, Put to another use, Eliminate, and Reverse* and was created by Bob Eberle, based on the earlier work of Alex Osborn (credited as the originator of brainstorming). With this method one is able to improve an existing product to new needs or finding better solutions to this problem. It also can be used for the development of new products for newly stated problems. Using the tool requires asking questions about existing products, using each of the seven prompts above. This method mostly results in a session with many debates and discussions, rather than a number of designs through drawings.

Examples of questions for each of the prompts are as followed:

Substitute

Substitute components, materials, and/or people

- Is the product useable in another setting, or as a substitute for something else?
- What materials can be altered in order to improve the product?
- What other products could you use?
- What will happen if the feelings/attitude toward the product is changed?

Combine

Mix with other assemblies or services and integrate

- Is this product combinable with another product in order to create something new?
- How can talent and resources be combined in order to create a new approach?
- What can be combined to maximize the use of this product?

Adapt

Alter function, change function, or use part of another element

- How can the product be adapted to serve another purpose or use?
- Are there comparable products?
- Is there another context in which you can put your product?
- What other products can serve as inspiration?
- Who or what could be pursued in order to adapt this product?

Modify

Increase or reduce in scale, change shape, or modify attributes (colour, size...)

- How can the shape, look, and/or feel of the product be altered?
- What can be added to modify the product?
- What can create more value through emphasizing or highlighting?

Put to another use

- Can the product be used somewhere else?
- Is this product used by someone else (not limited to the intended user)?
- How would this product behave if it was put in another setting?

Eliminate

Remove elements and simplify or reduce the product to the core functionality

- How can the product be simplified?
- What features, parts, rules, assumptions, and/or aspects can be eliminated or altered?
- What would happen if you eliminate an essential part of the product? What could replace it?
- What can be done to make the product smaller, faster, lighter, more fun.....?

Reverse

Reverse turn – inside out, upside down

- What would happen if the process is reversed?
- Can the product be reorganized?
- What components can be added to change the order of the product?

12.3.9 Attribute Listing

Attribute listing is a de-compositional approach where a product is broken down into smaller parts that can be examined individually. Through this examination of all the different parts of a product the team is able to see into detail what the product consists of (both physical and their attributes with values) and what can be altered to serve the problem statement.

In the following elaboration of this method the example of a screwdriver will be used.

Divide into parts

When the product consists of multiple parts, break it down into constituent parts.
e.g. handle, shaft, tip

- 2 | *Attribute*
Create a list of as many attributes of the products as possible.
e.g. handle (hexagonal, comfortable), shaft (torque stable, straight), tip (fits screw, torque proof)
- 3 | *Consider value of attributes*
Ask for each of the attributes “what does it give?” in order to find the real value of the attribute. When doing so, it is possible that attributes have a somewhat negative value (they detract from the overall value of the object).
e.g. the hexagonal shape of the handle helps grip, but has sharp corners
- 4 | *Modify attributes*
Look for ways to modify the attributes in some way. When doing so, one can increase values, decrease negative values, or create new values.
e.g. sharp corners are reduced by adding soft material sleeves

12.3.10 The 5 Why's

A method developed by Sakichi Toyoda and used in the Toyota Motor Corporation during the evolution of its manufacturing methodologies. This method explores the cause-and-effect relationships underlying a particular problem since problems are tackled more sustainably when they are addressed at the source.

- 1 | *Setting up the area*
Provide each participant with 5 post it notes and number them (1 to 5).
- 2 | *First 'Why'*
Ask players to review the problem and let them ask themselves why the problem is a problem. Ask them to write down their first response on post it note 1.
- 3 | *Second 'Why'*
Tell the players to ask themselves why the answer on post it 1 is true and write that response on post it note number 2.
- 4 | *Third to fifth 'Why'*
Repeat the previous two steps until all post-its are filled.
- 5 | *Organize*
Organize the post-its of all participants in rows and columns: post-its with '#1' in the first row, '#2' in the second row, and so on. Put the post-its of each individual in a separate row so they are located beneath other.
- 6 | *Review*
Find commonalities and differences between the different 'Why's' of each row. If needed, participants should explain their findings to the rest of the group.
It is possible that the answers in rows differ a lot. This can create a broader understanding of the problem and can direct the group into possible solution areas.

12.3.11 Business Process Re-engineering (BPR)

The name, given to it in the 90's, states the process of re-thinking about *what* a business does, and how it does it. Within this method, all factors were involved (cultural, technical, skills, costs, outcomes ...). Many tools and techniques are associated with BPR, but one of the most powerful is the '20 questions tool', existing of (surprise surprise) 20 questions.

What is being done (what is *achieved*)?

- Why is it necessary?
- What else could be done?
- What else should be done?

Where is it being done?

- Why there?
- Where else could it be done?
- Where else should it be done?

When is it done?

- Why then?
- When else could it be done?
- When else should it be done?

Who does it?

- Why this person?
- Who else could do it?
- Who else should do it?

How is it done?

- Why this way?
- How else could it be done?
- How else should it be done?

12.3.12 Brainwriting

Originally given the name '6-3-5 method'. The name can be explained by its intended use. Originally designed to be treated in a group format of 6 people, but this method can be used in smaller or larger groups as well. The number 3 states the number of columns of a table which is to be filled in by the participants. Lastly, the number 5 is related to the amount of time (in minutes) that participants have for filling in each row.

The method is typical brainstorming method that is used to create multiple concepts within a session.

Setting up the area

Each participant receives a piece of paper with at least three columns and a number of rows equal to the number of people participating in this brainstorm session.

- 2 *First drawing opportunity*
Participants write and/or draw down ideas or solutions for the problem in the first row of the table. So, each participant will create as much ideas as there are columns in the table. When done, everyone hands their paper to the person on the right (or left).
- 3 *Second drawing opportunity*
Presented with the new ideas on the paper they just received, participants are to create new ideas. These ideas should be based on the writings/drawings in the first row and be addressed in the second row. So, each column will consist of one solution area. When done, everyone hands their paper to the person on the right (or left).
- 4 *Next drawing opportunities*
Repeat the previous three steps until every participant receives the piece of paper with in the first row his first initial ideas. Ideally this happens when the table is fully filled.
- 5 *Collect and review*
Create an environment where all the different tables are made visible. Allow participants to review the ideas and create, for instance, a ranking among them.

12.3.13 Post-up

The goal of this brainstorm method is to generate as much ideas as possible with the use of sticky notes. Designed by David Straker, idea generation starts with the declaration of the problem. The level of detail and number of specifications (and thus limitations in ideation later on in the session) are of influence to the potential level of creativity of the participants. For example, when participants are faced with a problem with many specifications, and thus limitations, they have to find solutions in a very narrow area. However, are they introduced to the problem with a low level of information, than they can think more freely and creative since there are fewer limitations.

- 1 *Abstraction level*
When presenting the problem, choose one of the following detail revealing levels:
 - *None*
Give a very abstract summary of the problem. In terms of common BAAT Medical problem statements: do not declare the location of the problem (e.g. spine or hip). Do not give information about the dimensions in which to work either, or information about other stakeholders like the customer with their wishes and demands.
 - *Minute*
Some information can be shared with the participants. For example, make clear in which physical area the problem takes place (e.g. spine or hip) and give information about the materials involved. However, do not limit the participants output by naming wishes and demands of the customer, nor involve other products.
 - *Nearly*
In this detail revealing level the participants are faced with almost all the information available. However, limit them in the amount of limitations specified by the customer and/or other stakeholders.

- *Full*
This level shows all there is known about the problem and the connected customer. Participants are made familiar with all the information and need to be creative while being limited by all specifications, wishes, and demands.
- 2 | *First drawing opportunity*
Participants individually draw, or write down, possible solutions on separate.
- 3 | *Organize*
Arrange all the post-its on the wall according to either of the following forms:
 - Affinity map – separate ideas are sorted into groups, based on their natural relationship like overlapping ideas and the direction in which a solution is sought;
 - Bottom-up tree - ideas are sorted by the amount of detail they contain. Ideas with little detail go on top and beneath them are comparable ideas with more detail.
- 4 | *Gathering information*
Participants can look at the different ideas presented on the post-its. When asked for, they should explain their idea(s) to the rest of the group.
- 5 | *Second drawing opportunity*
Working from the results of the first drawing opportunity, participants draw, or write down, possible solutions again. These ideas should be based on the ones already hanging on the wall.
- 6 | *Organize*
Again, arrange the post-its on the wall. They can be added to the structure already present.
- 7 | *Gathering and elaborating information*
Participants should not only explain their newest ideas, but together they can elaborate them. This should result in conversations and discussions about the presented ideas.

12.3.14 Image-ination

This is a method, based on 'Picture This!' from the Visual Icebreaker Kit from Visual Speak. It focuses on the use of (random) images. Images have the ability to create new relationships and associations. When faced with a problem, assemble a collection of images (without words) that are either related to the problem or have no relationship with the problem at all (random images). Try to collect 3 to 5 images per participant in order to create a great variance of possible relationships. If a picture is worth over a thousand words, what would 30 images be worth?

- 1 | *Constructing the area*
Put a large sheet of paper on the table or on the wall. In the center of it, write down the problem description in as few words as possible (one- to three-word description will suffice). Place the images face down around the edges of the paper and give each participant multiple post-it notes

- 2 *Finding relationships*
Have the participants select one of the images at the time and let them write down as many ideas as they can come up with about how the image relates or could relate to the topic. Each idea should be written on a separate post it and put randomly ordered on the big piece of paper. Repeat this process until all pictures are turned face up.
- 3 *Organize and naming*
Collect the post-its and re-arrange the ideas in clusters that relate to one another. For each cluster, ask the group to find an image to illustrate the idea. Name the image and write it under the image.
- 4 *Processing*
Discuss how the titled images can influence the thinking of individuals about the main problem. Create a list of possible actions they could take in response to the ideas.

12.3.15 Mind mapping

A mind map is a method to visually organize information, gathered by all participants. It is often created around one single concept/problem, positioned in the center, to which associated presentations of ideas (words and/or images) are added. The most important and major ideas are directly connected to the central concept. Other ideas branch out from those ideas. It results in a spider web of information in which all there is known about the concept is presented. The mind map can be made out of individual post-its, writings on a wall, or done with computer software (for example www.meindmeister.com).

- 1 *Main Concept*
Write down or draw a concept for which you want to create a mind map. Draw a thick lined circle around it (with a marker) to make sure it will be seen as the main concept
- 2 *Major Concepts*
Ideas that are directly related to the concept are to be written around the center concept. Draw a circle (less thick lined than the main concept) around it to make sure it will be seen as the major concepts.
- 3 *Creating Branches*
Draw lines from the major concepts to the main concept. Make them curved to create a more playful look.
- 4 *Underlying Concepts*
Write underlying concepts (e.g. influences and aspects) of the major concepts around the latter. Concepts that lead to even more concepts (and thus have branches originating from them) should be encircled, other should only be underlined
- 5 *Creating Branches*
Draw lines from the underlying concepts to their respective major concepts. Make these curved as well
- 6 *Continue the process*
Creating additional concepts (either major- ore underlying ones) should be encouraged. A mind map is, in general, never finished or full

12.4 Observation sessions

Observation Session I

Treated method: straightforward brainstorm with only individual drawing in one session

Materials: pen, paper

Number of participants: 7

Pilot monitor: T. Bulstra

Problem initiator: T. Bulstra

Problem area: fractured pelvic

Problem statement: finding a (new) solution to repairing a fracture in the pelvic

The problem initiator (T. Bulstra) introduced the problem with the use of PowerPoint. After the presentation people were given the time (approximately 15-20 minutes) to individually write down and/or draw ideas. Afterwards, these ideas would be collected and presented to the entire group where they could be explained. After this the session would be over. Observations that were made, both positive and negative, are as follows:

Positive

Observation	Result
Declaration of the problem was clear and well defined	No indistinctness and thus a good view of the treated area
Multiple existing products were given in the presentation	Gives participants sources for inspiration and shows what is already available
Made clear that the customer wanted something new	Forced participants to find creative (and thus innovative) ideas
Mentioned that “all ideas are good, none are bad”	Deducted the feeling of failure
Silence when someone else was speaking	Full attention for the speaker and gives a feeling of respect to each other
Multiple questions were asked to all people	Made sure that all was clear and created a feeling of being heard

Negative

Observation	Result
Early on, the use of ‘screws’ was mentioned as a solution	Participants almost entirely were seeking solutions in the area of screws, rather than looking for divisive solutions
Cause of the problem was not mentioned	Maybe a way to prevent the problem?
Repeatedly rumble with software during the session	Loss of attention and looking unprepared
Unclear what materials to use in the sketching part	Both BAAT-books and A4 papers were used, which made scanning all materials devious
No clear time indication was given for the sketching part	Feeling of participating in an unprepared session
When explaining their ideas, people were either remaining seated or standing in front of the screen	Presenting while standing gives a more active attitude, where sitting down looks somewhat idle

Observation Session 2

Treated method: straightforward brainstorm

Materials: pen, paper

Number of participants: 5

Pilot monitor: R. de Wit

Problem initiator: R. de Wit

Problem area: ALIF cage¹⁵

Problem statement: designing a (new) ALIF cage

Within this brainstorm session a new instrument was to be designed for inserting a cage in the spine from the front, a so called ALIF (Anterior Lumbar Interbody Fusion). Reason for undergoing an interbody fusion of multiple vertebrae is to stop low back pain, caused by painful motion of the vertebrae. For this interbody fusion a cage needs to be inserted from either the front (ALIF) or the back (PLIF and TLIF) of the spine.

In this session it was made clear that BAAT Medical was often encountered with this design question. Even more, employees of the company mentioned that they worked with cages and their related instruments for so many times, they could hardly be creative within them anymore. In the session this came to light by the amount of new ideas and energy participants showed towards the problem and revealed ideas. They certainly were not bored, yet they lacked the energy and enthusiasm for being really creative. For future sessions it was imperative that this energy level was to be raised.

¹⁶ See 'Glossary', page 11

12.5 Model of the CPSB

Until about 20 years ago it was assumed that innovative products were created by people who work with a certain process in order to create a product. Within this process there was room for creativity and some tools should be available to do so. The overall question could be described as: How do we get a high performing team (People) that can apply these tools (Process) to deliver these results (Product). See image A.

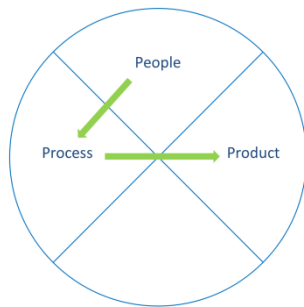


Image A: Previous model of how creativity works according to Creative Problem Solving Group (CPSG).

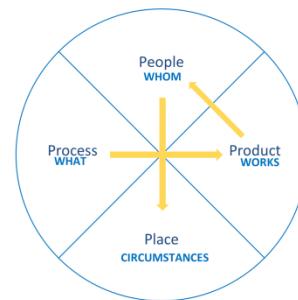


Image B: Newly formed model with the introduction of 'place' in the model.

Since the early 90's there has been a big change in this view with the introduction of a fourth factor: place. This factor contains influences of the environment and other circumstances where people work in. The new overall question for innovation became: What Works for Whom under what Circumstances (see image B). It was made clear that without well working circumstances, the other three factors would not work to their best potential. Also, the directions of the arrows are not determinative, or even conclusive. When looking at the big picture, it is stated that arrows can be drawn between all factors, going back and forth. By this it is meant that all factors have an influence on each other. Note that this model was the start of the model delivered in in paragraph 3.7 '*Model of Creativity and Innovation*', page 25, and can be seen as a great inspiration throughout the entire assignment.

12.6 Lunch lecture 2

In this paragraph the tests and information that was shared with the participants of the second lunch lecture will be elaborated.

Conditioning

All people are raised by either their parent(s) or guardian(s). With this raising come certain forms of conditioning which guides the child in a path with matching norms, values, and rules. Education also plays a big part in constraining the child in its creativity through conditioning (see paragraph 3.2 *'Education as a limitation to creativity'*, page 16).

Within the lunch lecture participants were made familiar with a number of forms and examples of conditioning in a do-it-yourself way in which they were asked to perform the following tasks:

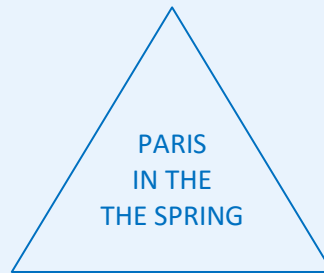
Example 1 : Read the following text:

"Aoccdrnig to a rscheearch at an Elingsh uinervtisy, it deosn't mtttaer in waht
oredr the ltteers in a word are, the olny iprmoetnt tihng is taht the frist and
lsat ltteer are at the rghit pclae. The rset can be a toatl mses and you can
still raed it wouthit porbelm. This is bcuseae we have lanreed to not raed
ervey lteter by itslef but the word as a wlohe."

As the text itself already states, one can read each word without any trouble. At least if you had some form of education where you learned to read in an analytic approach. Something which is the case in almost every western educational system. Like noted earlier in paragraph 3.2, children learn to find one correct answer in a minimal amount of time. Only then it is marked as adequate and sufficient in the educational system. The text here is a good example of finding the one true answer (the word that was intended to be written) under a given time (not really given here, but people tend to perform fast). However, this example is open for debate since people might say it has to do with psychology and the way a brain works, rather than having to do with conditioning. Well, maybe example 2 of conditioning in reading can make it even more clear.

This example is less suitable for reading on paper since the text is to be shown only a very short amount of time. It is mostly known when used on a computer. When turning to this page, you might have already seen the picture with text beneath, so to be honest: it will not work on you. However, you can try testing it on somebody else. To do so, put your hand on the text and tell someone to read the text during a total time of one second when you reveal your hand from the picture. After this second, put your hand back on the picture and ask the participant to tell you what he/she just read. It is important that he/she did not read it out loud when you lifted your hand!

Example 2

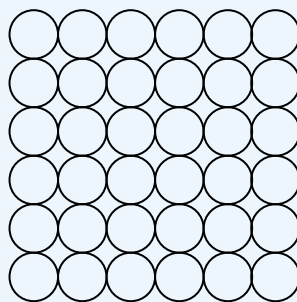


It might come to a surprise to you that the participant did not notice the double “the” in the text (read: “*Paris in the the spring*”) since he/she quoted the text as “*Paris in the spring*”. Again, this example works since we are conditioned to think and analyze this way. Our analytical approach to tasks like this makes it almost impossible to see something else than a logical sentence. Especially since only a short amount of time was given to read the text, we jump to conclusions rather than looking at the picture as a whole.

Linear versus non-linear thinking

As mentioned in paragraph 3.2, the level of creativity of children drops fast when they grow up and go to school. Also, thinking creative can be described as non-linear thinking while thinking not creative can be described as linear thinking (Anderson, 2016). These two realities can be combined in a simple test.

Example 3 : Each participant is given a piece of paper with on it a total of 36 circles, aligned in a 6x6 format (see picture beneath). Participants are asked to “fill in the circles till I say you can stop”, so they were not given a specific time frame in which they had to perform this task. Questions on how the circles should be filled in, or what materials they could use were not answered. They were told they only had to perform the task that was given to them, nothing more, noting less.



After a given amount of time they were told to lay down their materials and look at each other’s work. While looking at their work, a clear distinction could be made between the way they filled in the circles.

Note: the following examples really occurred during the lecture. However, the pictures connected to the different ways are reproduced by the author since the original materials were destroyed. Yet, the pictures only serve as examples and nothing conclusive has been drawn from it.

Way 1 (image C)

Just easily filling in the circles with crosses (or something alike) in order to make sure that the task is performed and thus completed if only a very short amount of time would be given. This means the person is performing the task with a very linear way of thinking, and thus not

Way 2 (image D)

Filling the circles with a more creative way like using the alphabet is more creative. However, it is still done with a very linear way of thinking and lacks real creativity. For instance, the alphabet is written down in a sequence working from left to right, from top to bottom (just like how most people in the west learn to read). Secondly, the letters are arranged in alphabetic order.

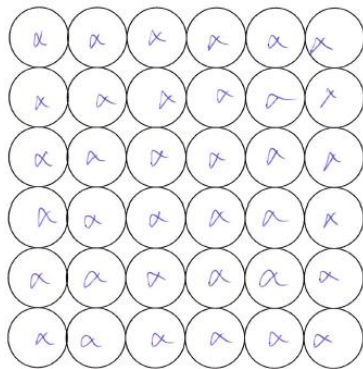


Image C: way 1 of example 3

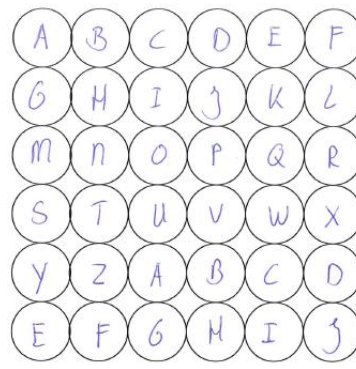


Image D: way 2 of example 3

Some differences were visible and not all participants filled in the circles in a unilateral linear way. However, it was clear that all were thinking of the task as a process with a step-by-step progression where a response to a step must be unveiled before another step was to be taken. With this “a response to a step must be unveiled” it is meant that only after filling a circle in some form, the next circle was to be treated. But why? They were only told to fill the circles. Nothing was said about the areas around the circles. Another remarkable fact is that the participants all saw the circles in some form of pattern and worked in a known way, and thus logic, to fill that pattern. This all describes a very linear way of thinking, which relies much on following on logic. The danger here lies in the determination of the starting point of fulfilling the task: once chosen, there are a limited number of solutions to the problem.

A very non-linear way of approaching this task is to only see the circles as blank areas to fill, not as figures with limitations within a certain pattern and logic. A child (with a high level of non-linear thinking) would see this task as some kind of coloring, rather than a 6x6 field of circles. A result of performing the task in a child-alike way of thinking can be like the image beneath (image E).

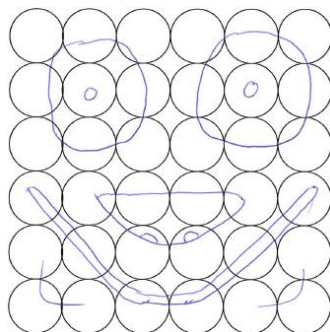


Image E: non-linear approach of example 3

Assumptions

Although not part of this particular lunch lecture, this part fits in best under this section. Prior to the first three brainstorm sessions ('Post-up', see page 51), employees of BAAT Medical were faced with the fact that all people make many assumptions, even in situations when doing so could harm their intentions. Without any information in advance they were given the following task:

Example 4: "Draw a cake and make a total of four cuts in order to create as many pieces as possible. You have two minutes".

The results comprised almost all of the following components:

- most people drew one cake, some two or three;
- the cake was drawn as a 2D circle;
- cuts were represented with straight lines;
- almost all pieces of a cake were of equal size.

These results show that even people of BAAT Medical make many assumptions when performing this task. For instance, they all drew round cakes since that form is commonly known as the shape of a cake. But not all cakes are round, right? Also, cutting up a cake is (in practice) done from the top view, and thus most people drew a 2D circle. However, this was not specified in the task. Even more, cuts were made by drawing straight lines within the drawn circle. But who says cuts need to be straight, rather than curved? And just like example 3, treating linear versus non-linear thinking, people tend to see the edges of lines as borders that may not be crossed. But who says one cut ends when the knife stops contacting the cake and thus the edge is reached? Even more creatively thought: it is an established thought that cutting is done with a knife with one blade. However, there are knives which have multiple blades, creating even more pieces with, for example, one straight cut.

From this point one can go on and on about the assumptions that are made. The most important lesson is that they need to let go of assumptions they made, both knowingly and unknowingly, in order to think and act creative. Saying 'something is just not allowed' can kill many ideas.

12.7 Pilots

In this paragraph the different pilots that were held are elaborated. Each pilot consists of a blue part consisting of the general information of the problem etc. Then the different events that occurred during the pilot are cited.

12.7.1 Pilot 1 – Post-up

Treated method: Post Up (see paragraph 12.3.13, page 92)

Level of detail revealing: Full

Materials: post-its, pens, wall (to put post-its on)

Number of participants: 9 (including monitor and initiator)

Problem area: Minimal invasive cage (PLIF)

Problem statement: Design a *cage* which is to be inserted from the front side of the spine. This approach asks for an entrance in a narrow space which gets broader by entering the vertebrae. So, it is a space with the geometric specifications of a 90° clockwise turned pyramid with the top of the figure omitted (see image F)

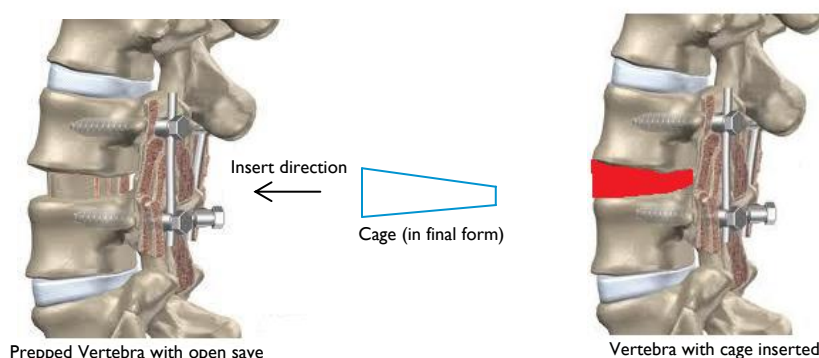


Image F: PLIF cage insertion with full detail revealing

In result, the first drawing opportunity resulted in a total of 85 different drawings (just short of an average of 9 drawings per participant). The ideas were all different, ranging from using pur (filling the space up with material) to mechanical structures like wedges, to driven translation. With the opportunity to ask questions about ideas and to elaborate on them came multiple questions. It became clear that all participants learned from the other ideas in a way that it gave them new insights and ideas for the second round of drawing. In this particular drawing opportunity a total of 20 new ideas came forward. True, this number is much lower than the number of post-its of the first session (85). However, one has to take into account that the second opportunity required ideas which were based on ideas of the first opportunity, so in a sense participants were converging. This was indicated by the participants. One said: “We tend to look at the examples on the wall and limit our thinking within the areas in which these solutions are found ... It is not easy looking further”. However, ideas of the first

opportunity varied widely, so even more diverging was not required per se. A participant even noted: “You tend to think and look differently at the ideas presented”.

12.7.2 Pilot 2 – Post-up

Treated method: Post Up (see paragraph 12.3.13, page 92)

Level of detail revealing: None

Materials: post-its, pens, wall (to put post-its on)

Number of participants: 7 (including monitor and initiator)

Problem area: Minimal invasive cage (PLIF)

Problem statement: Design some kind of padding for the area, as seen in image G. The padding needs to be inserted from a side, indicated by the arrow, and thus from the smallest area. From there the padding needs to fill the entire area. No forces are applied to any of the surfaces of the area.

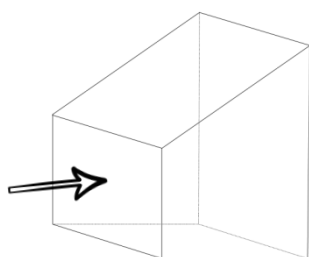


Image G: PLIF cage insertion with no detail revealing

This particular pilot differed, in relation to the previous one, on the level of detail revealing. Where pilot 1 mentioned the specific area within the body (vertebrae), pilot 2 mentioned only the geometric dimensions. Thus, it was much more abstract. In addition, participants of this pilot had results of pilot 1 present in the room. The ideas from this first pilot were to serve as inspiration for them.

In practice, the first drawing opportunity resulted in a total of 39 ideas (an average of over five per person). These ideas differed in variation when compared to the results of the first drawing opportunity of the first pilot. There were some more creative solutions as well, yet they were not really feasible. However, since the *Rules for Brainstorming* (page 39) state that feasibility comes later, these ideas should be welcomed as well. The second drawing opportunity led to a total of 34 new ideas. Most of them were even more different when compared to the ones of a few moments ago.

Even though the level of detail revealing was very abstract and did not reference to a specific medical issue, participants mentioned a few things. One said: “*From the start I already knew what the topic, and thus the application, was. I only searched for solutions within that specific topic*”. Another participant mentioned that he “*was already thinking of a medical device*”, rather than thinking for a more general solution. For instance, people were free to find solutions on a large and even absurd scale (e.g. filling it up with scaffoldings).

12.7.3 Pilot 3 - Brainwriting

Treated method: Brainwriting (6-5-3 method) (see paragraph 12.3.12, page 91)

Materials: pen, paper (with columns)

Number of participants: 6 (including monitor and initiator)

Problem area: Minimal invasive cage (PLIF)

Problem statement: Same as pilot 1, page 102

Participants of this session were confronted with all of the ideas of the previous two sessions. This had two advantages. Firstly, only new and 'fresh' ideas would be generated, rather than ideas that are equal or highly comparable to the ones of the first two sessions (hanging on the wall). Secondly, participants of this session did not have to work from scratch, but were able to ideate from the ideas already presented to them.

The pilot resulted in a total of 27 ideas in the first rows combined. These were further elaborated by participants in further parts of the session (each taking eight minutes). In the end, the participants created a total of 86 drawing. In some cases the result (last row drawing) of a column did not match the idea in the first row of that same column, but since it was a brainstorm at the start of a project that did not matter. *"As long as people are diverging and thus creating all kinds of ideas, it would truly benefit the project"* (T. Bulstra, problem initiator for this pilot).

12.7.4 Pilot 4 – S.C.A.M.P.E.R.

Treated method: S.C.A.M.P.E.R. (see paragraph 12.3.8, page 88)

Materials: pen, paper, printed outlining of the method, printed materials (with examples of other TLIF inserts, see 'Annex')

Number of participants: 5 (including monitor and initiator)

Problem area: TLIF inserter with broken tip

Problem statement: A TLIF inserter has returned with the tip of it broken of (see image H). How a TLIF inserter (with tip intact) is supposed to look can be seen in image I. Goal of this session is to find multiple solutions for how to prevent this breaking of from happening again. A restriction is the fact that the cage (TLIF) cannot be altered in its design.



Image H: TLIF cage inserter with tip broken off



Image I: TLIF cage inserter with tip intact

The results of the pilot cannot be indicated by a number of drawings since no real numbers of drawings were made. This method really lends itself for starting a debate and discussion about the different subjects of the prompts. Something that happened during this pilot.

12.7.5 Pilot 5 - S.C.A.M.P.E.R.

Treated method: S.C.A.M.P.E.R. (see paragraph 12.3.8, page 88)

Materials: pen, paper, printed outlining of the method

Number of participants: 5 (including monitor and initiator)

Problem area: TLIF cage

Problem statement: Current TLIF cages of BAAT Medical are inserted with different kind of tools, but all have a deficiency that can be described as: the cages turn too early when entering the vertebrae, or only turn when a lot of force is put onto them. Within this session both the cages and the inserters are open for discussion.

The session went less organized than the first one in which this method was used. The pilot monitor interfered more than once, but the participants did not treat the prompts in sequence. They surely used some of the questions, but the discussions went from the topics of *Substitute* to *Reverse* to *Adapt*. Even though the method was not used in a way as it was intended, the session resulted in multiple broad concepts and ideas which could be treated in a future session to become more specified. Moreover, participants discussed all the time and exchanged ideas and knowledge.

12.7.6 Pilot 6 – Mind mapping

Treated method: Mind mapping (see paragraph 12.3.15, page 94)

Materials: pen, paper, markers, wall, computer with internet (www.mindmeisters.com)

Number of participants: 5 (including monitor and initiator)

Problem area: TLIF cage

Problem statement: A customer of BAAT Medical came with a possible design for a TLIF cage. However, the problem initiator saw multiple issues with this specific design. Before confronting the customer with only these issues, he wanted to map out even more issues and supplement all the issues with possible solutions and/or areas in which solutions can be found.

Soon after the start of the pilot it became clear that the wall was not big enough for creating this mind map and things could not be altered without removing them first. Therefore a tool, usable on www.mindmeisters.com, was introduced. This website gives people the ability to create their own mind map with the use of some predetermined tools. During the session the mind map was filled with all kinds of properties, problems, solutions, and solution areas of the cage. The group participation resulted in an overall understanding of the problem in a mind map which could be easily communicated to the customer.

12.7.7 Pilot 7 – Mind mapping

Treated method: Mind mapping (see paragraph 12.3.15, page 94)

Materials: pen, paper, post-its, markers, wall

Number of participants: 15 (including monitor and initiator)

Problem area: Creativity and Innovation

Problem statement: What includes the terms ‘creativity’ and ‘innovation’ according to employees of BAAT Medical? And what are the most important aspects that influence this creativity and innovation both positive (enhancements) and negative (limitations)?

The pilot can abstractly be described as: finding solutions (properties) for a given problem (creativity and innovation). So, this session differed from the others. It was assumed that participants did not know that much about the topic and that creating a mind map would serve as a tool to start conversations and ideas (something that is desirable during other (mind map) sessions as well).

The session took place at the end of lunch lecture number two (see paragraph 0 ‘Lunch Lecture 2 – Make BAAT Innovative again’, page 49. The events that took place during this session and conclusions from this specific session can be found in paragraph 4.2.2 ‘Employees focus points’, page 33.

12.7.8 Pilot 8 – Attribute Listing

Treated method: Attribute Listing (see paragraph 12.3.9, page 89)

Materials: pen, paper, printed table of 3 columns

Number of participants: 5 (including monitor and initiator)

Problem area: screw driver for reduction screws

Problem statement: The current screw driver for reduction screws, used in spinal surgery, takes too much time when it comes to assembling screws to it. Surgeons, who worked with the screw driver, are complaining that the product is somewhat inexpert and they would like a new way to insert the existing pedicle screws. So the latter is not to be altered.

Participants were asked to fill out the table they were handed. In the next 15 minutes or so they distinguished many different parts of both the screws and screw driver. In the following 15 minutes the differences between the tables were brought to light and explained by their creators. At the end there was a general understanding of the different parts with their relative attributes and values.

12.7.9 Pilot 9 - BPR

Treated method: Business process re-engineering (BPR) (see paragraph 12.3.11, page 91)

Materials: pen, paper, printed outlining of the method (containing the 20 questions)

Number of participants: 5 (including monitor and initiator)

Problem area: screw driver for reduction screws

Problem statement: The current screw driver for reduction screws, used in spinal surgery, takes too much time when it comes to assembling screws to it. Surgeons, who worked with the screw driver, are complaining that the product is somewhat inexpert and they would like a new way to insert the existing pedicle screws. So the latter is not to be altered.

It was recommended to the participants that the different questions of this method were not to be treated in sequence, but that the questions could be seen as reference work. This lesson was learned in the second session with the use of S.C.A.M.P.E.R.. During the session, many different ideas were put forward and many conversations were held about these different ideas. Not all the different questions of the method were treated, but at least the main questions of each section ('A', 'B' etc.) were treated.

This session was not long enough in terms of time since the method was used for only one hour. Within that hour, people still needed to become familiar with the specific characteristics of the method. So at the end no noteworthy results were created. However, the method itself was reviewed.

12.7.10 Pilot 10 – Reframing the problem

Treated method: Rewording the problem (see paragraph 12.3.1, page 84), Breakdown (see paragraph 12.3.2, page 84), PSI (see paragraph 12.3.3, page 85), and Questioning Assumptions (see paragraph 12.3.7, page 87)

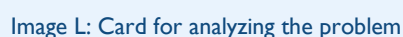
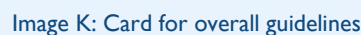
Materials: pen, paper

Number of participants: 6 (including monitor/initiator)

Problem area: Pedicle screws

Problem statement: The customer wanted a new disposable instrument set which could be used for another product of the customer with attached pedicle screws. So the latter is not to be altered.

This session was conducted with the customer present. However, the pilot monitor who was present during all the other sessions (B. Konjer) was at home ill, so no real clear proceedings of it were documented. Still, some conclusions were drawn and later communicated by the problem initiator, R. de Wit. In this session many different methods were used and combined. Generally there was a reframing of the problem statement by breaking it down into multiple parts (words) and then questioning the use and influence of each word. The goal of the meeting was to find out whether the problem statement of the customer really stated what they wanted.



Brainwriting

Brainwriting

Minimum number of participants: 5
 Work method: individual and in team format
 Materials: pen, paper (with columns)
 Result: multiple concepts and/or areas in which solutions can be found
 Time span: 120 minutes

1. **Setting up the area**
 Each participant receives a piece of paper with at least three columns and a number of rows equal to the number of people participating in this brainstorm session.
2. **First drawing opportunity**
 Participants write and/or draw down ideas or solutions for the problem in the first row of the table. So, each participant will create as much ideas as there are columns in the table.
3. **Passing on**
 Everyone hands their paper to the person on the right (or left). If required, the previous owner of the paper explains his drawings to the new owner.
4. **Second drawing opportunity**
 Presented with the new ideas on the paper they just received, participants are to create new ideas. These ideas should be based on the writings/drawings in the first row and be addressed in the second row. So, each column will consist of one solution area.
5. **Next drawing opportunities**
 Repeat the previous three steps until every participant receives the piece of paper with in the first row his first initial ideas. Ideally this happens when the table is fully filled.
6. **Collect and review**
 Create an environment where all the different tables are made visible. Allow participants to review the ideas and create, for instance, a ranking among them.




Image N: Card for concept generation

BPR

Business process re-engineering (BPR)/Frame it up

The name, given to it in the 90's, states the process of re-thinking about what a business does and how it does it. Within this method, all factors are involved (cultural, technical, skills, costs, outcomes, etc.). Many tools and techniques are associated with BPR, but one of the most powerful is the '20 questions tool', existing of (surprise surprise) 20 questions. Ask these questions when a concept is formed in order to think about it critically.

- What is being done (what is achieved)?
 - Why is it necessary?
 - What else could be done?
 - What else should be done?
- Where is it being done?
 - Why there?
 - Where else could it be done?
 - Where else should it be done?
- When is it done?
 - Why then?
 - When else could it be done?
 - When else should it be done?
- Who does it?
 - Why this person?
 - Who else could do it?
 - Who else should do it?
- How is it done?
 - Why this way?
 - How else could it be done?
 - How else should it be done?




Image O: Card for evaluating concepts

12.9 Final design of the cards

On the following pages the final version of the instruction cards are presented.