Knowledge management in creativity

A perspective on the Connection between knowledge and creativity

Byrge, Christian; Hansen, Søren

Publication date:
2011

Document Version
Early version, also known as pre-print

Knowledge Management in Creativity:

A Perspective on the Connection between Knowledge and Creativity

C. Byrge & S. Hansen

Christian Byrge (Corresponding author), Aalborg University, Department of Planning and Development, Fibigerstraede 13, 9220 Aalborg, Denmark, byrge@plan.aau.dk

Ph. D. Søren Hansen, Aalborg University, Department of Planning and Development, Fibigerstraede 13, 9220 Aalborg, Denmark, sh@plan.aau.dk

ABSTRACT:

Is it possible to predetermine what kind of ideas that comes out of creativity by using knowledge management? Is it possible to decide beforehand what ideas we want to generate and the direction in which an idea takes in the further development? This paper deals with knowledge management in creativity. The point of departure is taken in the connection between knowledge in a cognitive sense, and creativity focussing on ideas. The paper gives a perspective on how knowledge management can be part of creativity. It develops a concept of horizontal thinking and combines it with the fuzzy set theory in order to introduce a structured method for knowledge management. This combination makes it possible to determine the output of idea generation and of further development of an idea, by using knowledge management. Potential translations into practice are suggested and one example is given to show the impact this knowledge management could have for practitioners
The paper is a conceptual paper based on a literature review and ideas from an ongoing research project.

KEYWORDS: Management, Creativity, Knowledge, Concept, Idea

1.0 INTRODUCTION

This paper is a conceptual paper with a perspective on the connection between knowledge and creativity. This perspective is based on literature review and ideas developed in an ongoing research project. The perspective presented is called horizontal thinking, and the ideas new to this perspective are a metaphorical understanding, a model and the use of horizontal thinking in order to understand knowledge management in creativity.

The focus is on the cognitive understanding of the use of knowledge in creativity. The paper accepts that social, motivational, intellectual and personal factors also affect creativity. However, it does not try to give an all-inclusive model of creativity and knowledge. The point of the paper is solely to give a perspective on the connection between creativity and knowledge from a cognitive standpoint. Rhodes found that there are four categories within the field of creativity, which vary in the focus they have. There is product, person, process and press (often referred to as the four P's of creativity). This paper gives a perspective on the how the person's knowledge composition determines the product. From this the paper constructs a perspective on knowledge management in creativity.

Part 2 of this paper will give a metaphorical explanation of horizontal thinking; part 3 will explain the use of principal knowledge, which is essential to horizontal thinking; part 4 will go through the model of horizontal thinking; and part 5 will combine horizontal thinking with the fuzzy set theory to create an understanding of knowledge management in creativity. Part 6 will show an attempt to translate the findings into a practical example.

Due to time limited non-disclosure agreements, it is not possible to use examples of ideas from the research project in this paper. Therefore part 3 will use everyday examples for illustration, while part 4, 5 and 6 will use historical anecdotes for illustration.

Horizontal thinking is to combine diverse knowledge in a new knowledge-construction understood as a new idea. It is to cross the limiting boundaries of subjects, professions, scientific knowledge, non-scientific knowledge and understandings. It is a systematically use and combining of *all* the knowledge available to a problem solving team. On this basis, creativity will be defined as the *unlimited application of knowledge* for problem solving or

possibility searching. In this definition knowledge includes information, expertise, subjects, know-how or whatever other sources our thoughts might have (Schön, 1974). In such a definition of creativity ideas are *knowledge in action* put together in a construction or a reconstruction.

1.1 Contribution of this Paper

The traditional discussion about creativity and knowledge seems to take the point of view of either a negative relationship or a positive relationship.

The “negative relationship” is dominated by the inverted U. This suggests that too much knowledge about the problem area decreases the chance of creativity (Simonton, 1984). On this view we also find De Bono saying, “too much experience within a field may restrict creativity” (de Bono, 1968).

The “positive relationship” (also referred to as the foundation view) is dominated by the “10 years rule” (Hayes, 1989). He found that creative individuals require extensive time in a field before coming up with something new to this field. From his study it seemed that “10 years of experience” is to be a critical point for creative new ideas to be produced (Hayes, 1989). Csikszentmihalyi, Gardner and Gruber have found evidence of the same critical point (Csikszentmihalyi, 1996; Gardner 1993; Gruber, 1981). In this line of research one of the major views on knowledge is of the recently activated knowledge, and its influence on the ideas produced. This perspective tries to explain the connection between knowledge and creativity in a historical perspective, being that the knowledge that has recently been used is likely to appear in the ideas produced, thus also limiting the use of “older knowledge” This is generally termed as recently activated knowledge (Smith et al, 1993; Marsh, 1996).

This paper will not discuss whether knowledge is good or bad nor will it discuss the effects knowledge has on the level of creativity. This paper will only focus on how knowledge is used in the creation of ideas.

In this area of focus perspectives on the connection between knowledge and creativity has been found in the research on concepts. Here Thagard have outlines how conceptual combination is done either in a coherence-driven mode or in an incoherence-driven mode.

Coherence-driven conceptual combination is when two concepts that have a logical relation are combined. The incoherence-driven conceptual combination is when two concepts that have no logical relation are combined and is being given logic. Thagard finds that making incoherence-driven conceptual combination is to be creative (Thagard, 1997). The prototype theory (Hampton, 1987) and the fussy set theory (Zadeh, 1965) both consider new concepts as a combinational construct of 2 or more other concepts. More existing research will be presented throughout part 2, 3, 4, and 5.

Weisberg speculates on the importance of knowledge in creativity. He finds that the core difference between creative people and non-creative "is the knowledge that they can bring to the situation" (Weisberg, 2007). However, Weisberg does not specify what kind of knowledge the creative person brings and what kind the non-creative person brings. Weisberg suggests to do research on how knowledge is used in creative thinking" (Weisberg, 2007). This paper goes in line with the interesting question proposed by Weisberg in an attempt to bring a perspective on how knowledge is used in creative thinking (creativity).

The contribution of this paper lies primarily in the metaphor of *the mind as a mental library*, in the model of horizontal thinking and in the combining of horizontal thinking and fuzzy set theory for developing an understanding of knowledge management in creativity.

2.0 THE MIND AS A MENTAL LIBRARY

In order to understand horizontal thinking it is useful to use the metaphor of the mind as a mental library.

Imagine the mind as a mental library similar to a physical library. The physical library contains physical books of authors from many different disciplines and cultures, while the mental library contains mental books of all the experiences and all the knowledge that a person has obtained through his/her life. Any idea, emotion or thought is based on the knowledge we have obtained through our life (Kohonen, 1984). Therefore our application of knowledge is limited to the knowledge we have obtained as individuals. In teams the application of knowledge will be expanded to more mental libraries, eventually making the total number of mental books much higher and potentially more diverse. There will, however, be overlapping books from one mental library to another. For the understanding of horizontal thinking it is

necessary to consider more individuals working together as one combined mental library. It makes no difference if there are 1 or 10 persons; it is the knowledge in the books in the combined mental library that matters.

The construction of the total mental library determines the possibilities for application of knowledge into ideas. From this perspective it would be optimal to have as many different kinds of mental books and as extensive books as possible available in the team, thus giving the team most potential knowledge to develop ideas from.

The mental library is structured in a number of sections, e.g. a section for books on “how to take a shower”, “how to drive a car”, “how to brush the teeth” and “how to ride a bike”. But they are also structured in more general sections, e.g. a section for “electronically engineering”, “economics”, “cooking”, and “playing”. This structuring is what existing research has termed as disciplines, cultures, domains (Johansson, 2004), memes (Dawkins, 1976), fields (Barron, 1963), (Guilford, 1963), (Simonton, 1990), patterns (Maier, 1931), elements, products (Roe, 1952), objects, industries, technologies (Altshuller, Shulyak, Rodman & Fedoseev, 1997) rules (Dietrich, 2004) as well as directions of thinking (Karlsson, 1999). In the metaphor of the mind as a mental library these structuring are generalised into sections. Figure 1 shows the mind as a mental library with different sections of knowledge.

Whenever we need to solve a problem or use this knowledge for other matters, we need to think. From child and all the way through life most of the time we are trained in using vertical thinking. Vertical thinking is often defined as a synonym to convergent thinking or as the opposite of lateral thinking, however these are only indirect definitions. Colman has stated a direct definition: vertical thinking ”…involves finding methods for overcoming obstacles in the chosen line of approach” (Colman, 2001). Therefore vertical thinking is to use pre-existing knowledge from a specific section in the mental library in order to solve a particular problem from the very same section. In other words: vertical thinking is to look into the book on how to take a shower in order to solve a problem about how to take a shower. Vertical thinking is effective for solving problems that need an *existing* idea. However, vertical thinking cannot

offer a new idea to any problem. You will not find a new idea on how to take a shower by looking in the book that contains existing knowledge on how to take a shower. Here you will only find existing knowledge on how to take a shower, thus being old ideas.

Opposite of vertical thinking, we have horizontal thinking. Horizontal thinking is to cross the boundaries of the mental sections in order to develop a new idea that solves a particular problem related to one mental section. In other words: it is to looks into the books of e.g. cooking in order to solve the problem on how to brush the teeth. Other researches have found that new ideas are created when crossing sections (Johansson, 2004; Dawkins, 1976; Barron, 1963; Simonton, 1990; Maier, 1931; Roe, 1952; Altshuller, Shulyak, Rodman & Fedoseev 1997; Dietrich, 2004; Karlsson, 1999; Thagard, 1997). In 1984 Hausman stated that new ideas "appears to be unaccounted for by its antecedents and available knowledge, and it is thus disconnected with its past" and he explained this by discontinuity (Hausman, 1984). New ideas are developed when we cross the boundaries of the sections of knowledge and combine knowledge from 2 or more section. Horizontal thinking is the thinking activity that crosses these mental sections of knowledge.

The line between vertical thinking and horizontal thinking is dynamic and is always dependent on the problem at hand. This means that the problem determines the boundaries between the sections in the mental library. The construction of a boundary is dynamically set so that all the *existing* ideas to solve a problem are within a specific section A. Vertical thinking is to go through section A to look for an idea to solve the problem. Outside of section A there are no existing ideas to the problem. Horizontal thinking is to go through these other sections in order to find an idea to solve the problem. If the problem is that you want to clean your teeth, then section A would contain all the ideas on how to clean your teeth that you have seen, heard off, tried yourself, read about or similar. All other sections might contain principles that can be used for cleaning your teeth, but they do not contain any existing ideas on how to do it.

A historical example of horizontal thinking is coming from the Tefal Company. In the early 1950's, a man in Paris, named Marc Gregoire, learned of Polytetrafluorethylene (often referred to as Teflon) and devised a way to apply the Teflon to his fishing tackle to minimize tangling. His wife got the idea to apply the Teflon to pots and pans. Gregoire applied the Teflon to one of her frying pans with great success. Within a number of years, he was selling more than a million Teflon coated pans a year (commercially known as Tefal) (Teflon History - Retrieved October 15, 2007).

In the story of how Tefal was developed, Gregoire and his wife used knowledge from the section on how to minimize tangling of fishing tackle and applied this knowledge to the problem from another section on how to avoid the food sticking to a pan. In fact, Gregoire also used horizontal thinking when he first applied Teflon to his fishing tackle.

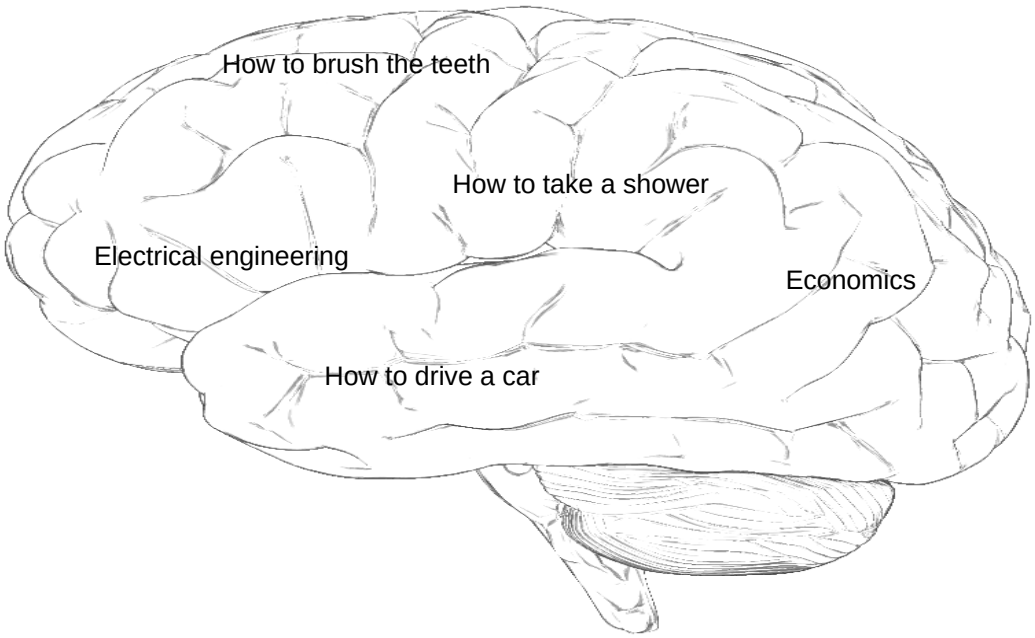

FIGURE 1. The Mind as a Mental Library.

3.0 PRINCIPLES

Horizontal thinking is to cross knowledge sections in the mental library. There are, however, borders around each section of knowledge, which makes it difficult to use knowledge unlimited across sections. Knowledge from how to brush your teeth is difficult to use for solving a problem on how to drive a car. In order to transfer this knowledge from one section

to another it is necessary to abstract the principles of knowledge and not the objects of knowledge.

A principle is similar to what de Bono defines as a fixed point (de Bono, 1970). He finds the fixed point as the thing that binds different ideas together. However, in horizontal thinking a principle is what binds knowledge areas together. Altshuller defines his 40 inventive principles as universal, and they are good examples of principles (Altshuller, Shulyak, Rodman & Fedoseev, 1997). However, in horizontal thinking there are many more principles on both higher and lower levels of abstraction.

Knowledge is not constructed as principles when found in a section in the mental library. The knowledge found is rather constructed in a system related to a particular situation or a particular problem (known as the network activation theory (Hayes-Roth & Hayes-Roth, 1977)). It is by abstracting principles from the system that horizontal thinking becomes possible. Let's say you want to improve a *cutting knife*, and you do horizontal thinking by using the section containing *USB flash drive knowledge*. The first idea might be to develop a multi-tool *pocket-knife with a USB flash drive* implemented. This idea must not be mistaken as being horizontal thinking. Rather this is to be termed as combining resources or attaching other elements. In horizontal thinking the principles need to be detached from the systems they are a part of. The USB flash drive is in a system that might include: used with a computer, easy to carry, memory of documents, pictures, music etc., traded in a computer store or a supermarket and much more. This system is what makes up the boundaries around the section of the USB flash drive, thus making it difficult to use horizontally. By detaching a key element from USB flash drive we might end up with the principle of *memory.* Transferring memory into the section of a cutting knife could result in the idea of a *CNC cutting knife* – a knife that remembers the last cut it made, being able to redo it over and over again. In this idea still there are elements that is being used from the USB flash drive, which is normal in horizontal thinking. However, it is important to distinguish the pocket-knife with a USB flash drive idea from the CNC cutting knife.

Lets go back to our example of Teflon in order to go a bit deeper into the understanding of principles. Teflon is in a system, which for Gregoire and his wife might have included: *avoids tangling of fishing tackle* and *can be attached to fishing tackle*. In this system Teflon cannot be horizontally used for the frying pans. Let's look at the abstraction of principles from the Teflon section. We know that Gregoire was an engineer, so in this setting we assume that the team (Gregoire and his wife) had knowledge available of the basic understanding of physics. When fluorine atoms are part of the molecule C*n*F_2*n*, it will repel the molecules of most other elements thus making it non-sticky. Having this knowledge available it is possible to abstract the principle of *non-sticky* from the system of Teflon. Looking from another point of view Teflon has the second lowest coefficient of friction of any material. Having this knowledge available it is possible to abstract the principle of *low friction*.

The wife did the horizontal thinking, when she got the idea of applying the Teflon to her frying pans. This could have been done using either the principle of non-sticky or the principle of low friction. We don't know her background, but we assume that she had knowledge of cooking and thus knowledge of why the food sticks to the frying pans eventually making this horizontal thinking possible.

The example shows that horizontal thinking requires the ability to identify and to use principles. It also shows that the actual identification and the abstraction require both horizontal knowledge and vertical knowledge available: The horizontal knowledge of physics from the mental section of fishing tackle. This was needed in order understand how the non-sticky and the low friction attributes of Teflon.
The next part of this paper will go through a model of how horizontal thinking.

4.0 A MODEL OF HORIZONTAL THINKING

The model of horizontal thinking consist of three phases. Phase one is to turn a problem into a principal problemdefinition, which is possible to solve in the horizontal sections in the mental library. Phase two is to find a horizontal sections in the mental library that might contain a principle that can give a new ideas to the problem. Phase three is to transfer a

principle from a horizontal section into the section from where the problem originates from. This model transfers knowledge from one section in the mental library into another section to develop a new idea to solve a problem.

4.1 Phase One: Principal Problem Definition

This phase is about turning a practical problem into an abstract principal understanding. Hereby it will be possible to make a horizontal search. The practical problem definition is constructed in the system of knowledge of the particular section it derives from. In order to allow other sections of the mental library to understand the problem it is essential to abstract the problem from the sectional system and create a principal problem definition that can be understood horizontally across sections. This principal problem does not belong to any section of the mental library, but rather is a horizontal understanding of a problem that can be understood by any mental section.

In the example of Teflon, the wife had a problem with her frying. The practical problem might have been that *the food got stock to the pan when she was cooking using high temperatures*. Only the section about cooking with frying pans have existing ideas to solve this problem. Phase one turns this problem into a pricipal problem definition e.g. *stick together* or *too much friction*, and hereby other sections might have principles that can solve the same problem.

Accoding to the posivtive (fondation) view of the relationship between knowledge and creativity, there is evidence that deep immersion in one's chosen field is essential in order to be creative (Gardner, 1993; Gruber, 1981). This relates very much to the understanding of the section in order to define the problem. Therefore vertical knowledge is essential to phase one in horizontal thinking. Figure 2 shows phase one in the model of horizontal thinking. The figure also shows that there can be more principal problem definitions.

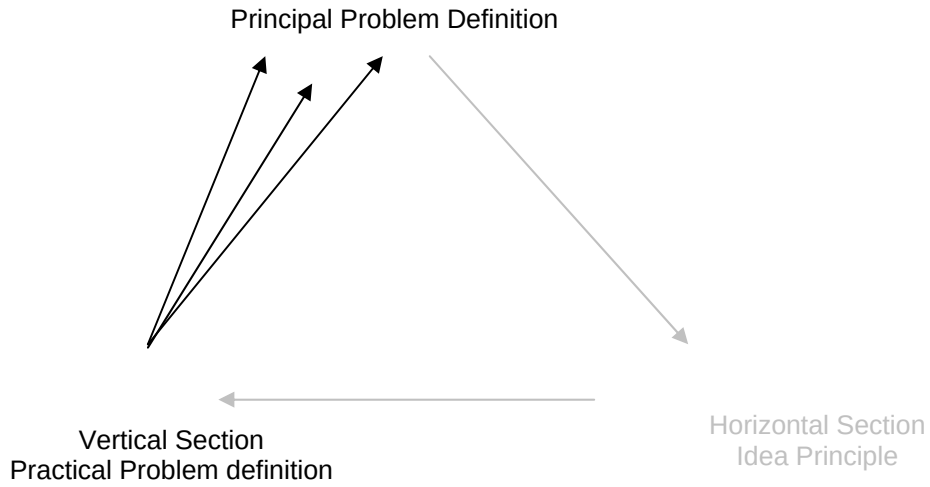

FIGURE 2. Principal Problem Definition.

4.2 Phase Two: Horizontal Search

This phase is about searching the entire mental library to find a section that might contain a principle, which can solve the principal problem definition. The horizontal search involves finding a horizontal section and identifying a principle in that section that solves the principal problem definition.

In the case of Teflon the principal problem definition of *sticks together* can lead us to the mental section of fishing tackle. The same can be the case for *too much friction*. The principle that is being identified in this mental section is Teflon. This principle behind Teflon is *a surface that decreases friction*.

The key here is that the fishing tackle section have a principle that can solve the principal problem definition of sticks together, but does not have any ideas for solving the practical problem that the food got stock to the pan when she was cooking using high temperatures.

Guilford explains this phase as divergent thinking. He stresses the importance to divert the thinking away from the section where the traditional ideas are placed (Guilford, 1950). A number of research have shown that it is in these other mental sections that principles are found for new ideas (Dawkins, 1976; Barron, 1963; Simonton, 1990; Maier, 1931; Roe, 1952). In phase two horizontal knowledge is therefore essential. The vertical knowledge is not relevant for this phase, since the objective is to search for other mental sections than the vertical one. In the case of Teflon, Gregoires wife had horizontal knowledge of the fishing

tackle from her husband. She also had vertical knowledge, but that is not of relevance to this phase. If Gregoire was aware of the pricipal problem definition of either *sticks together* or *too much friction*, he also could have found the same mental section and identified the same principle. Unfortunately we don't know how exactly it happened, therefore it could have been any of these two who did phase two.

There can be more idea principles within each section as well can there be more sections that are relevant to do horizontal search in. Phase two is shown in figure 3. The figure also shows how there can be more sections relevant to search through.

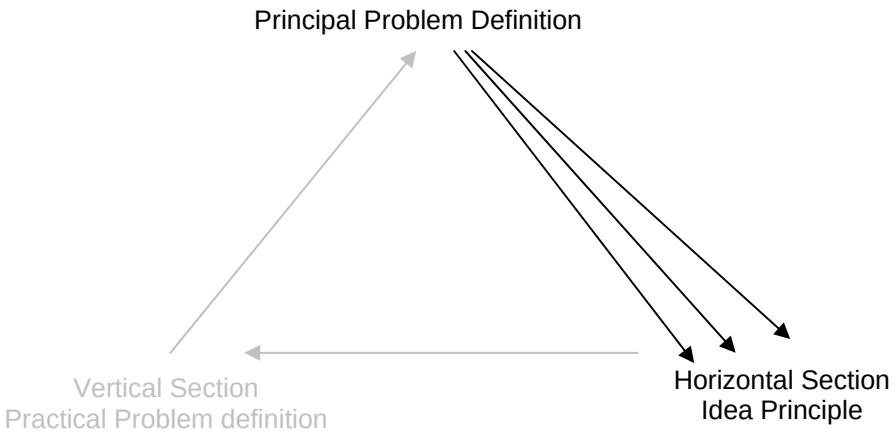

FIGURE 3. Horizontal Search.

4.3 Phase Three: Horizontal Transfer

Having identified the idea principle in the horizontal section, horizontal transfer is to turn this principle into an idea that can solve the practical problem definition. The way to deal with horizontal transfer is to focus on the principle and apply it to the practical problem definition.

In the Teflon case, phase three is to do horizontal transfer on the principle *a surface that decreases friction* in order to deal with the practical problem that *the food got stock to the pan when she was cooking using high temperatures.* A solution can be to apply a surface to the pan that creates low friction. In the case of Teflon, this turned out to be possible using the

same material as was being used on the fishing tackle. Therefore the solution was to apply the Teflon to the pan in order to create a non-sticky pan.

Often more principles are part of making up the horizontal object. If the principles are part of a system of principles, all of these principles have to be part of the horizontal search.

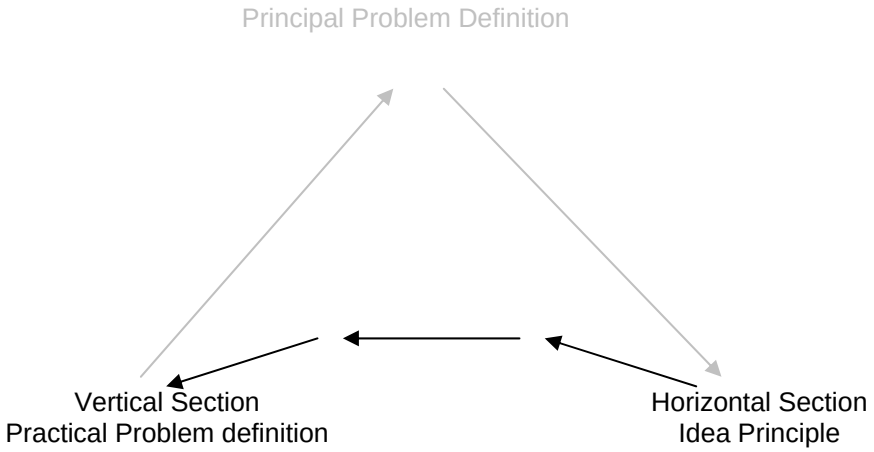

FIGURE 4. Horizontal Transfer.

Bailin argues for the need for vertical knowledge in new ideas with his postulate that there need to be a “reference to the past” (Bailin, 1988). He found that even radical new ideas has to be tied to the past (Bailin, 1988). In other words; there is a need for vertical knowledge for turning the horizontal principle into an idea that solves the practical problem. In phase three both horizontal and vertical knowledge is needed. It is essential for the horizontal transfer that there is knowledge available about the horizontal section in order to create the principle. In the case of Teflon, Gregoire was representing the horizontal knowledge while the wife was representing the vertical knowledge. Phase three is shown in figure 4.

5.0 KNOWLEDGE MANAGEMENT IN CREATIVITY

Horizontal thinking is not alone in trying to explain the connection between knowledge and creativity. A number of other models have been developed to explain how a concept (referred to as an idea in this paper) is constructed from a mix of different knowledge sections

(Thagard, 1997; Hampton, 1987; Smith & Osherson, 1984, Cohen & Murphy, 1984; Zadah, 1965).

Among those models is the fuzzy set theory (Zadeh, 1965). In the fuzzy set theory Zadah grades the membership of an idea according to the knowledge sections it is constructed from. This makes it possible to define how much a concept belongs to a certain section of knowledge. E.g. Zadeh grades a *pet dog* as 0.9 a pet, while a *guppy fish* is only 0.7 a pet. Therefore the idea of a guppy fish is 0.7 constructed from the knowledge section of pets. This makes it possible to grades all ideas, terms etc. according to their origin.

An interesting perspective is found when fuzzy set theory and this papers understanding of horizontal thinking are combined. The grading in fuzzy set theory goes from .0 to 1, where 1 is when an idea is only constructed of knowledge from that particular section, thus meaning that it is a vertical idea. Grading an idea .0 is when it is not constructed from a particular section of knowledge. Everything between .0 and 1 is also possible.

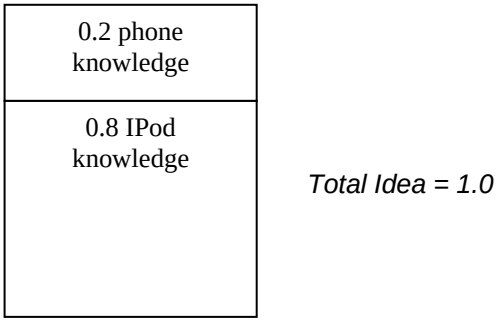

FIGURE 5. The Construction of Knowledge in the IPhone Idea

Demonstrating the combination of fuzzy set theory and horizontal thinking, this part of the paper will use the more commonly known example of the IPhone, instead of the Teflon example. Horizontal thinking would term the idea of the IPhone as a problem about the phone that is solved by knowledge from the IPod section. The fuzzy set theory can define the idea of the IPhone as 0.8 of knowledge section from the section of the IPod and 0.2 from the knowledge section of the phone. Figure 5 illustrates how the IPhone idea is constructed of knowledge from the section on phone and the section on IPod. The point is that IPod stands for the major part of the idea of the IPhone, and phone stands for minor part of this idea.

There are two interesting results of combining fuzzy set theory and horizontal thinking. The first one is the possibility of knowledge management in the generation of ideas and the second one is knowledge management in in the further development of an idea. Part 5.1 and part 5.2 will go a little more into these results.

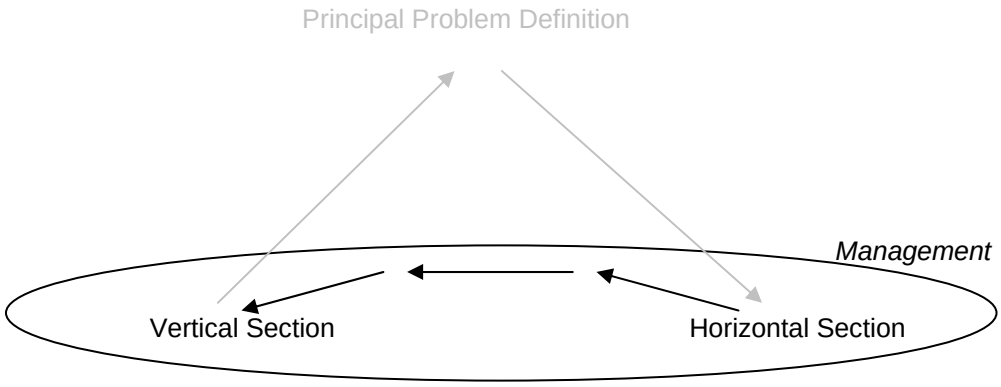

FIGURE 6. Knowledge Management in Creativity

5.1 Generation of Ideas

Horizontal thinking explains how ideas are constructed when knowledge from one section is transferred to solve a problem in another section. Combined with the fuzzy set theory, we can now percieve an idea as a graded construct of parts of knowledge from the problem section (0.2 phone) as well as a graded parts of knowledge from one or more other horizontal sections (0.8 IPod). Together the knowledge parts sum up as one idea (1.0 IPhone). The idea is of the IPhone can therefore be explained in the following sentece:

1.0 IPhone = 0.2 phone + 0.8 IPod

This means that an idea would be constructed from the knowlede section of the problem (vertical section) plus knowledge from the horizontal section as shown in figure 6. The figure also shows a management ring around the vertical section and the horizontal section. If it is possible to manage both of these sections it is possible to determine the output of ideas. At Apple they had a section about IPod. Together with a horizontal section about a phone they eventually came up with the idea about making a phone like an IPod (IPhone). Image that we create another mental library including a section about phone and a section about glass. This

mental library can combine their knowledge into new ideas throgh horizontal thinking, eventually coming up with a number of ideas for *stylish phones* involving glass as various components. The bigger the section about glass, the higher the potential ideas of *stylish phones* involving glass. If you put into the mental library a television section, then there is a potential for ideas for *media phones.* Again, the bigger the section about television, the higher the potential ideas of media phones. A rubber section in the mental library will create potential for ideas for *resistant phones,* involving rubber protection and so on. Figure 7 shows the connection between the knowledge sections available and the ideas developed. Managing the mental library in an idea generation affects what kind of knowledge constructions that would be possible in the ideas, thus making it possible to predetermine a direction in the output of idea (e.g. ideas for phones that involves rubber). Knowledge management in idea generation is therefore to compose the content of the mental library that will fullfill the objective of this task.

5.2 Further Development of an Idea

The knowledge management of the mental library still have an effect in the further developed of an idea.

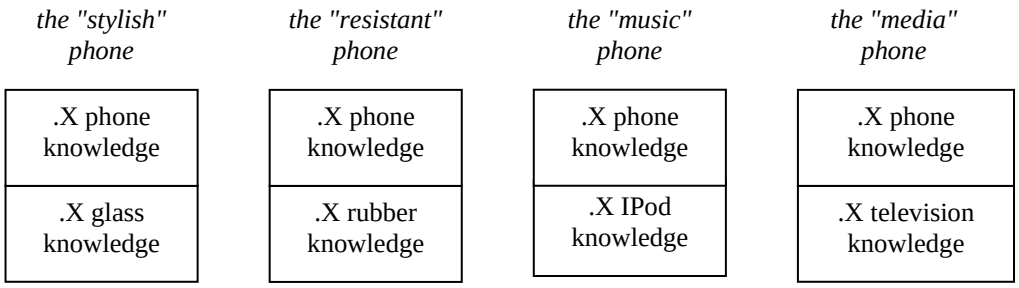

FIGURE 7. Ideas Constructed from Different Knowledge Sections

From the idea generation, one of the ideas was about combining a phone and an IPod. A further development of this idea can take many directions depending on the knowledge available. Figure 8 show some possible directions such an idea can take, when it is further developed. The management here is similar to the management in the idea generation. However, here the grading from fuzzy set theory is translated into a degree of knowledge. If the degree of phone knowledge in the idea is 0.6, and the degree of IPod knowledge is 0.4,

the result might end up as a phone with IPod features. If the degree of phone knowledge in the idea is 0.8, and the degree of IPod knowledge is 0.2, the result might end up as a phone designed like an IPod. If the degree of phone knowledge in the idea is 0.2, and the degree of IPod knowledge is 0.8, the result might end up as an IPhone and so on.

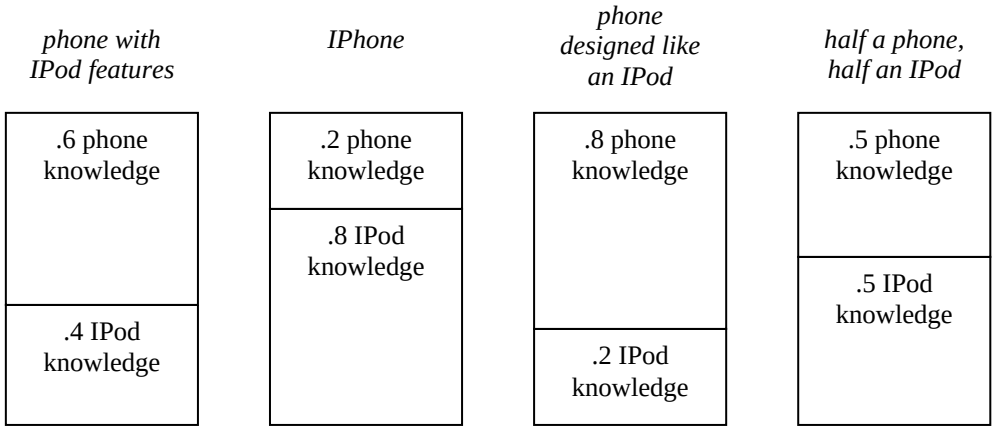

FIGURE 8. Effects of Knowledge on the Further Development of an Idea

The degree of knowledge from a particular section that is "injected" into an idea determines the output of that idea in the further development. The knowledge management in the further development is to compose the size of certain mental sections to be available for "injection" into the idea. In other words: it is to compose the size of the vertical section versus the size of one or more horizontal sections.

6.0 KNOWLEDGE MANAGEMENT TRANSLATED INTO PRACTICE

The knowledge management perspectives presented in part 5 of this paper are framed in the metaphor of the mind as a mental library. In this frame knowledge is divided into dynamic mental sections. Part 5 only gives a perspective of how to compose a mental library, which is possible to consider in a theoretical world, but not in a practical one. An obvious next step will be to make a translation of the mental sections into something related to a human being. Hereby the knowledge management of creativity might be practically possible.

Potential translations could be a profession, an educational degree and/or a hobby. In the following example of the IPhone a mental section is translated into a profession. The mental

section of phone can be translated into phone developers. The mental section of IPod can be translated into IPod developers. The phone developer is termed as PD and an IPod developer is termed as ID.

In the case of idea generation the knowledge management is to compose the content of the mental library. The content of the mental library can be translated into the professions in the idea generation team. Given that the mental library is termed as ML and the IPhone idea is termed IP, the idea generation team can be composed as follows:

ML (IP) = PD (a) + ID(b)

In the case of further development of an idea the knowledge management is to compose the size of the mental section. The size of a mental section can be translated into experience and years of experience. Given that the years of experience is termed as E and size of the mental section is termed as MS, the team members represented as phone developers in the further development of the IPhone can be illustrated as follows:

MS (PD) = (PD (a) x E (a)) + (PD (b) x E (b)) + (PD (c) x E (c))...

The team members represented as IPod developers in the further development of the IPhone can be illustrated as follows:

MS (ID) = (ID (a) x E (a)) + (ID (b) x E (b)) + (ID (c) x E (c))...

In order to develop the idea of the IPhone the development team can be composed as follows:

ML (IP) = MS (20PD) + MS (80ID)

It seems that the alternative translations of the mental library into an educational degree, a hobby or a combination of all of these might also be a possibility. It might be that the

translation depends on the context of the problem or the situation. It is important to note that these translations are only suggestions and further research has to be made to make a more validated translation.

7.0 CONCLUSION

This paper started out claiming that it would bring a perspective on how knowledge is used in creativity. The contribution was claimed to consist of the metaphor of the mind as a mental library, in the model of horizontal thinking and in the combining of horizontal thinking and fuzzy set theory for developing an understanding of knowledge management in creativity.

The mind as a mental library divides our knowledge into dynamic sections of knowledge. For every problem, a mental section A is defined, which will contain all the existing ideas and knowledge about how to solve that particular problem. All other mental sections contain any other knowledge hold by that person or by a particular team of people. The mental library distinguishes between vertical thinking and horizontal thinking. Vertical thinking is to use the knowledge from mental section A in order to solve the problem. Horizontal thinking is to use knowledge from any of the other mental sections available to solve the problem.
Horizontal thinking requires that knowledge is to be abstracted from the system it is constructed in. This means that horizontal thinking moves principles around from one mental section to solve a problem in another mental section.

The model of horizontal thinking is a three-phase model. Phase one is to turn a practical problem into a principal problem definition, which can be understood horizontally. Phase two is to search the sections in the mental library for a principle that can solve the principal problem definition. Phase three is to use the found principle to solve the practical problem. The model of horizontal thinking is illustrated as a triangle. Phase one and phase two can have multiple output.
The paper identifies that vertical knowledge is needed in both phase one and phase three. Horizontal knowledge is needed in both phase two and phase three.

Finally this paper combines the fuzzy set theory with horizontal thinking. The fuzzy set theory brings in the concept of grading an idea according to the knowledge it is constructed of. Combining this with horisontal thinking it now becomes possible to determine the output of idea generation and of further development of an idea by using knowledge management. The knowledge management in idea generation is to compose the content of the mental library, thus deciding what mental sections that are to be used in the horizontal thinking. The knowledge management in the further development of an idea is to compose the size of certain mental sections.

The paper discusses a potential translation of mental sections in an attempt to give an example of the practical use of these contributions. In the example a mental section is translated into profession, however, the paper also suggests an educational degree and/or a hobby as potential translations.

This paper has laid out a perspective on the connection between knowledge and creativity that has a focus on knowledge management. It is hoped that this perspective together with other existing and future research can make a foundation for a potential scientific and/or practical theory for knowledge management in creativity. The basis for this perspective is a literature research combined with ideas from an ongoing research project.

Further research is needed on the model of horizontal thinking and on the knowledge management perspective of creativity that has been presented in this paper.

LIST OF REFERENCES

Altshuller, G., Shulyak, L., Rodman, S. & Fedoseev, U. (1997). 40 principles: TRIZ keys to innovation. Technical Innovation Center, 1997.

Colman, A. M. (1978). A Dictionary of Psychology. Oxford, UK: Oxford University Press.

Bailin, S. (1988). Achieving extraordinary ends: An essay on creativity. Dordrecht Kluwer Acedemic.

Barron, F. X. (1963). The need for order and for disorder as motives in creative activity. In: Taylor, C. W., Barron F. X., eds., Scientific Creativity, New York: Wiley, 153 - 160.

Cohen, B. & Murphy, G. L. (1984). Models of ecoconts. Cognitive Science, 8, 27-58

Csikszentmihalyi, M. (1996). Creativity: Flow and the psychology of discovery and invention. New York: HarperCollins.

Dawkins, R. (1976). The Selfish Gene. Oxford, UK: Oxford University Press.

De Bono, E. (1968). New Think: The use of lateral thinking in the generation of new ideas. New York: Basic.

De Bono, E. (1970). Lateral thinking: creativity step by step. New York: Harper & Row.

Dietrich, A. (2004). Psychon. B Rev, 11, 1011 - 1026.

Gardner, H. (1993). Creating minds: An anatomy of creativity seen through the lives of Freud, Einstein, Picasso, Stravinsky, Eliot, Graham, and Gandhi. New York: Basic.

Guildford, J. P. (1950). Creativity. American Psychologist, 5, 444 – 454.

Guilford, J.P. (1963). Intellectual Resources and their values as seen by scientists. In: T Taylor, C. W., Barron F. X., (Eds.), Scientific Creativity. New York: Wiley, 101 - 118.

Gruber, H. E. (1981). Darwon on man: A psychological study of scientific creativity (2nd ed.). Chicago: Unversity of Chicago Press.

Hampton, J. A. (1987). Inheritance of attributes in natural concept conjunctions. Memory & Cognition, 15, 55-71.

Hausman, C. (1984). Discourse of novelty and creation. Albany: State University of New York Press.

Hayes, J. R. (1989). Cognitive processes in creativity. In J. A. Glover, R. R. Ronning, & C. R. Reynolds (Eds.), Handbook of creativity (pp. 135 - 145). New York: Plenum

Hayes-Roth, B., & Hayes-Roth, F. (1977). The prominence of lexical information in memory: Representations of meaning. Journal of Verbal Learning and Verbal Behaviour, 16, 119-139.

Johansson, F. (2005). The Medici Effect. Boston, Massachusetts: Harvard Business School Press.

Karlsson, J. (1999). Relation of mathematical ability to psychosis in Iceland. Clinical Genetics, 56, 447 – 449.

Kohonen T. (1984). Self-Organization and Associative Memory. Berlin: Springer.

Maier, N. R. (1931). Reasoning in Humans: II. The Solution of a Problem and its Appearance in Consciousness, Journal of Comparative and Physiological Psychology, 12, 181 – 194.

Marsh, R. L., Landau, J. D., & Hicks, J. L. (1996). How examples may (and may not) constrain creativity. Memory and Cognition, 24, 669-680.

Rhodes, M. (1961). Analysis of creativity. Phi Delta Kappan

Roe, A. (1952). A psychologist examines 64 eminent scientists. Scientific American, 187 (5), 21 – 25.

Schön D. & Argyris C. (1974). Theory in practice. San Francisco: Jossey Bass Publishers.

Simonton, D. K. (1984). Genius, creativity and leadership. Cambridge University Press.

Simonton, D. K. (1990). Scientific Genius: A Psychology of Science, Cambridge: Cambridge University Press.

Smith, E. E. & Osherson, D. N. (1984). Conceptual Combination with Prototype Concepts. Cognitive Science, 8, 337-361.

Smith, S. M., Ward, T. B., & Schumacher, J. S. (1993). Constraining effects of examples in a creative generation task. Memory & Cognition, 21, 837-845

Thagard, P. (1997). Coherent and Creative Conceptual Combinations. In T. B. Ward, S. M. Smith and J. Viad (Eds), Creative thought: an investigation of conceptual structures and processes. Washington DC: American Psychological Association.

Weisberg, R. W. (2007). Creativity and Knowledge: A Challenge to Theories. In Sternberg, R. J., Handbook of Creativity (pp. 226 - 250). Cambridge University Press.

Zadeh, L. (1965). Fuzzy sets, Information and Control. 8, 338-353