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University of Applied Sciences

Bachelor of Culture and Arts/Design

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WELLBEING GAME INNOVATION

Bachelor's Thesis 2014

## ABSTRACT

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Board Game Design, Game Development, Brain  
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The subject of this thesis is a board game development process for the rehabilitation of people with brain dysfunction. The board game's emphasis is on improving memory and focusing abilities. The research focuses on the best way to assist people in retaining mental wellbeing and safety, through the use of a board game and on how games help in brain development.

The game's development section of the thesis goes over the definition of board games, construction of a game's mechanics and the rule of development. Through the process it is documented how the game characteristics are changing and adjusted as a result of prototyping.

In the process section the prototyping methods that have been used, are documented and the modifications on every prototype version including utilities of testing are described.

Therefore the objective of this project was to create a functional board game, based on a research background and intended to help people with memory and mental issues.

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## 1 INTRODUCTION

Kymenlaakson University of Applied Sciences is a participant in the “Safety and Wellbeing Game Innovations” project, an initiative funded by the EU. The game developed and described in this thesis work was supported and guided by the Patteri Network and Wood Academy as an innovative solution for this project.

Starting by reviewing the objectives of the project from the perspective of healthcare professionals and their clients, and having clarified and defined what benefits the final outcome should deliver. My task was to research how best to assist elderly people in retaining mental wellbeing and safety through the use of a board game. The project was not aimed exclusively at assisting the elderly but later expanded to include any individuals with memory issues or brain dysfunction.

The board game’s emphasis was set on improving the memory and focusing abilities of elderly people. During the research period, the game was also tested, evaluated and supported by the Kakspy Psychiatric Clinic in Kotka. This collaboration widened the view of the target group to include people suffering from mental diseases or dysfunction.

It also opened the possibility of creating a series of board games that utilized skills such as memorization, recollection, concentration, observation, reflexes, speed and all other cognitive abilities that are needed in everyday life, especially for people with mental problems.

This document is divided into two parts covering the research and design process involved. The research section focuses on the field of memory improvement and how games can aid in brain development. The process section is concerned with the development and adjustment of ideas within the game and finally with its prototyping and testing.

Therefore the objectives of the project from my behalf is to create a functional board game, based on a research background and intended to help people with mental issues.

## 2 BACKGROUND INFORMATION

The “Safety and Wellbeing Game Innovations” project has involved students and teachers from the Kymenlaakson University of Applied Sciences in Kouvola and Kotka. Many individuals have been working on different approaches to the subject.

Other individual organizations have also been supporting my project in the background, providing contacts, information and participating during the testing process. From the start the Patteri Network provided me with connections to other organizations that could help in research, process and testing. The Psychiatric Clinic Kakspy in Kotka, helped in the research and in fulfilling the study of rehabilitation. They also allow the first game testing in their facilities. Later two more testing destinations followed, the elderly houses Iltatahti and Etappi. The game is been still under tested in these places since they asked to keep the prototype for a longer period. This is the reason for the poor photo documentation of the latest prototype.

## 3 RESEARCH

### 3.1 The History of the Understanding of Brain Function

The cultures of ancient India, Egypt and China all made a connection between the presence of human mental faculties and the brain. However, the first documented statement associating the brain with mental functioning came from ancient Greece.

The Greek philosopher Plato (427-347 BC) thought that the brain recorded experiences as impressions and therefore was the base of reasoning faculties. Aristotle (384-322 BC) believed that the actions of the mind were related to the functioning of the heart and the heat of the blood. Herophilus (335-280 BC), who presented a theory that lasted for over two thousand years, thought that the folds of the brain's surface were connected to human abilities.

During the time of the Roman Empire, the Greek physician, surgeon and philosopher, Galen (129-200 AD), known as the grandfather of anatomy, expressed the opinion that the soul lay in the brain and paid a lot of attention to the construction of the brain. (Yates 1966)

All of these theories continued to be held as truth for the next one thousand five hundred years without much progress in knowledge or understanding until the eighteenth century. At that time, based on a discovery by the physicist and philosopher Luigi Galvani (1737-1798), whose experiment on moving muscles in a frog by connecting the nerves to an electric wire, proved that bio-electricity and electrical patterns, passed signals through the nervous system. Based on this discovery it was possible to trace the general electrical activity of the brain by monitoring major nerves (Fabiani, Gratton & Coles 2000).

### 3.2 What is Memory

Memory is the process of storing and retrieving information in the brain, which is central to learning and thinking. We continue learning throughout our lifetime, but only a fraction of this information is stored and available for later use. The combination of learning (acquisition) and memory (retention) is the basis of all knowledge and abilities.

Memory is divided into two categories. Declarative memory constitutes all the things that we have experienced like facts or events. It is easier to build up this kind of memory, although it is equally easily forgotten. Procedural memory is different; it stores procedures and the actions that define our core abilities. It is mostly concerned with processes that can be improved with practice.

Little is known about the actual physiology nature of memory. It is known that memory is not situated in a single part of the brain, but involves several brain systems working together. There is also evidence that there are different regions responsible for spatial or emotional memories.

There are three process levels of memory. Sensory Memory records all present occurrences and is stimulated visually, acoustically, aurally or haptically. It filters everything that is of interest to be stored into Working Memory, which evaluates the incoming information and decides what should be retained or rejected depending on perceived value. It helps in recalling information currently being processed, for example what is being said in a conversation. It decays rapidly and has limited capacity but it can be improved using various techniques. Working Memory is vulnerable to

interference, which is why we should complete tasks without interruption. Long-term memory is divided into episodic memory, responsible for events and experiences, and semantic memory, which is a structured record of facts and skills. Long-term memory functions through the actions of storage, deletion and retrieval. Accessing certain items can prove difficult over time; this means that some memories can only be recalled after prompting.

Our knowledge of memory mechanics is still in its infancy, but it is possible to improve memory performance by constantly stimulating it and using it to its greatest extent. (Carter, Russell 2002)

### 3.3 The Habit of Memory

Plato (428-348 BC) said, "*All knowledge is but remembrance*" (Lorayne 2008, p. 20). Cicero (106-43 BC) stated that memory is "*the treasury and guardian of all things*" (Lorayne 2008, p. 20). An acquisitive mind and precise memory is the foundation on which all successful businesses are built, for all our knowledge is based on our memories.

Here is a simple, but conclusive example from everyday life that will justify the above statements: It wouldn't be possible to read this text if the reader did not remember the sounds of the twenty-six letters of the alphabet.

In point of fact, in the case of complete memory loss, the brain would need to start learning everything from the beginning, just as a newborn baby. Someone with complete memory loss would not be able to remember how to use cutlery, or tie shoes, dress, shower, shave, how to drive a car, or write. All the things that are considered as habitual should actually be credited to memory. Memory is in itself a habit.

In early Greek civilization there was a memory system taught called mnemonics.

The word "mnemonic" is derived from the name of the Greek Goddess Mnemosyne, who was the personification of Memory. Mnemonic methods played a large part in ancient Greek education. Trained memory systems were not widely known of by common people. They were, however, used by an ever-rising number of scholars. The use of these secret mnemonic techniques in developing memory had surprising results



for those who used them. Individuals with knowledge of these systems caused amazement due to their incredible ability to remember things and received praise and notoriety from their friends and families. Many felt that this secret was too good to share with others and so kept it to themselves.

By thinking of the memory as a muscle, in order for a muscle to achieve its potential and function optimally in the body, it must be systematically exercised and developed. The same is true also for memory. The only difference is that a muscle, when over-trained, will become enlarged, while memory cannot. Nevertheless, it has been found that the more the mind is trying to remember, the more will be able to remember. It is astonishing how much information a trained memory can collect. According to numerous studies about memory and the quantities of information the brain can store, there is evidence of there being no limit in the capacity of the human memory.

As a result, it is unlikely that an individual could become confused due to remembering too much, indeed, it is documented that the Roman, Lucius Cornelius Scipio, was noted for his ability to remember the names of every resident of Rome, and that Cyrus was able to remember every one of his soldiers' names. Seneca was able to memorize and repeat two thousand words, after hearing them only once. Attaining a trained memory is not hard, anyone can be taught, in fact it is said to be a lot easier than being taught how to play a musical instrument.

However if the person has acquired a trained memory, along with the trained memory he or she will probably acquire a greater power of concentration, a purer sense of observation, and perhaps, a stronger imagination.

Thomas De Quincey (1785-1859 AD) said that *"I feel assured that there is no such thing as forgetting; traces once impressed upon the memory are indestructible"* (Lorayne 2008, p. 20). That is to say that there is no such thing as a bad memory, only trained or untrained ones. Nearly all untrained memories are compartmentalized, which means that subjects may be related but are stored as separate information. To illustrate, people who can remember names and faces may not remember their telephone numbers, and those who remember the phone numbers, cannot remember the names of the people they want to call. Another example is people who have a very good retentive memory,

but may at the same time be very slow to recall. The same applies for someone who can recall things fast, but cannot retain information for a long time.

An easy way to remember things is by associating them in mind with something else that is already known. At this point, it may be assumed that a number of things in memory cannot be associated with something else. Well, this is the key; the subconscious. If a person were linking things knowingly, then they would already have the advantage of a trained memory.

Most things that memory is recalling have been linked subconsciously with another piece of information that previously was known or remembered. It is not easy to realize at the time what is happening in your subconscious. In order to remember; what subconsciously associating with strong links will be remembered, and what is not will be forgotten. (Lorayne 2008)

### 3.4 Age, Mental Abilities and Learning

Memory processes are immediately affected by ageing. Time's influence on the mind however, occurs gradually. In an experiment older people, in comparison to their younger counterparts, were less skilled in linking dissimilar items when presented with them. This inability was found to be even greater when they had to associate various stimuli in order to create a new composite memory. This occurs as a result of nerve cells losing the power to associate between different regions in the brain, areas responsible for linking dissimilar stimuli and events in the parahippocampus (the area responsible for memory encoding and retrieval) and the frontal lobes (the area responsible for remembering longer-term memories associated with emotions).

Conversely, in these same tests, older people were found to be far better than the younger ones at tasks requiring organization, planning and judgment skills. Therefore, comes the conclusion that, although young adults are much better at assimilating new information than middle-aged and older people, they prove to be at a disadvantage when they have to deal with tasks that need careful planning and handling of information. Organizational capabilities are a significant strength acquired through intellectual experience, which older people obtain through the years.

Mental abilities are also gradually affected by ageing. Research has shown that an individual's reflexes and reaction times decrease with age. Likewise, due to the pace of thinking slowing down, learning new information and the ability to handle a number of stimuli and tasks successfully, becomes more difficult. This weakening is greatest when it comes to short-term memory. It is for this reason that older people forget names more easily than younger individuals.

In comparison intelligence and long-term memory, for example related to music and other artistic memories, do not deteriorate. In conclusion, ageing develops wisdom and due to this exact reason older people prevail over younger adults in planning, common sense, organizational skills and judgment. These skills improve over the years. (Devanand 2001)

### 3.5 Brain Function, Aging and Memory

There is a prevailing idea within our culture and traditions that the mental faculties of a person increase throughout childhood and youth, and then gradually start to fail during adulthood. This hypothesis is false.

Someone can actually continue to develop their brain function steadily throughout their life and only begin to experience a decline after about the age of sixty. People are often misled into assuming that mental abilities decrease with age because they fail to take into account development through education over the years. Researchers have found that as far IQ is concerned there is no deterioration with age.

Often older people claim that their memory for recent events is getting poorer, however they may remember events from their childhood clearly. A reason why this memory of recent events may deteriorate is that in elderly people the brain remembers key events better.

In childhood there are comparatively many more new, remarkable and outstanding experiences than there are later in life. Therefore those more emotionally significant events are more easily remembered. (Russell P. 2010)

### 3.6 Memory Improvement

Like any other skill, memory improvement can be achieved with practice. During the process of memorizing data there are three stages to storing the information. The first stage is the capturing of data from the sensory organs (hearing, smelling, vision, etc.) where the information stays for only a few seconds. Since the information from the sensory registers is held for less than five seconds, it needs to proceed rapidly on to the second stage where it is registered in the short-term memory. Short-term memory can hold the information for only about fifteen seconds unless something triggers access to the third stage, that of the long-term memory.

In order to make the above-mentioned process more effective there are some principles that are essential to memory improvement. The memory can be improved through the following eleven principles:

- 1. Interest:** Things you are genuinely interested in are easier to remember in great detail. Interest helps you to store and process information so you will remember it for a long time.
- 2. Selection:** Is not necessary to remember everything in detail. By choosing the most important information, for example by making quick notes, you will ease the memory load. Focus your learning on the significant information.
- 3. Attention:** Pay attention to the things you want to remember. When stressed or feeling tense, learning and remembering can prove to be difficult. Stress often disturbs focus. To ease stress it is advisable to take a break or rest.
- 4. Understanding:** The more associations linking pieces of information, the more meaning the pieces will have in terms of memory connections. Learning something means you can pass on the information to others. Create memory connections, associate one fact with another fact.
- 5. Intention to remember:** You need to be in the mindset that you want to remember. In order to increase the level of awareness, it is necessary to concentrate, observe, pay attention and try to remember information for a long period of time.

**6. Confidence:** Have confidence, because if the mind thinks that it can't remember, most likely will not. By placing ourselves in a positive mental mindset. Using positive affirmations, visualizing ourselves remembering the information, we will succeed.

**7. Ego involvement:** Experiences can be divided into two categories. Things that please us or we agree with, and things that displease us or we disagree with. Positive feelings toward a subject reinforce our strengths, opinions and beliefs. Quite often we filter out the negative or displeasing things and only partially hear or remember what was said.

**8. Association:** By thinking over experiences and systematically relating and associating them with something that is already know, then makes easier to remember new information through building connections in the brain. Mind maps are helpful in the process of associating and remembering information.

**9. Background of experience:** It is important to have background knowledge or experience of the information to help the associations between memories.

**10. Organization/classification:** Humans tend to organize things, at least in their minds. The mind creates associations based on the similarities or differences between items and organizes the facts into logical groups. These groups are related to bigger groups, which are again part of a larger group and so on.

**11. Practice:** Developing the memory is like any other skill, such as playing a sport or learning a foreign language. The more you train the more that skill will improve.

(Madelyn Burley-Allen. 1988)

### 3.7 How games affect our brain

The brain scientist Daphne Bavelier (2012) has been concentrating her research on how to develop the brain to be smarter, faster, and stronger through the use of games. Most people when video games are mentioned assume we are speaking about children or teenagers, and this is totally acceptable as approximately 90% of school-aged individuals do indeed play games.

However, with statistics showing that 70% of the 'heads of the household' are gamers, the average age of a gamer is now 33 years old. So if we look at the projected demographics of video game players in the future, we find that they will actually be elderly people. Obviously gaming is a pervasive activity in our society and as a result games have an amazing impact in our daily life.

According to the statistics announced by the American Video Game Publisher Activision after its release of "Call of Duty – Black Op", during only the first month of the game's launch it had been played globally for more than 600 million hours, or the equivalent of 68,000 years (Activision Publishing, Inc. 2010). Certainly this is an amazing area worthy of research and testing to see how to take advantage of that power and put it into use.

Nonetheless video games, as in the case of most things, can be bad for our health if overused. However in reasonable doses even violent games can have strong, powerful and positive effects on many different aspects of our performance and brain. There is laboratory research being conducted where they actually measure precisely in quantitative function the side effects of games on the brain.

As an example, an experiment was carried out to test whether prolonged viewing time of screens would result in making the eyesight worse or not. The results, scientists suggest, conclude that too much screen time is indeed not good for an individual's vision. As a control group people who did not play video games were classified as having normal vision, however in tests adults who did play video games for about ten hours per week, were found to have vision that was much improved and enhanced in two ways.

Players were able to analyze small details better in a context of clutter. For example, they were able to read the fine print on a prescription without using magnifying glasses, just their original eyesight. The second benefit was that the players improved their ability to understand different levels of gray. This translates as the ability to identify small details in a situation like driving in fog and being able to either avoid an accident or be involved in one. It would be positive to take advantage of this knowledge and to develop games for people with needs relating to poor vision that have the motivation to retrain their brain and sight vision.

One other theory that has been tested by brain scientists in the lab is if video games lead to attention problems and higher levels of destructiveness. It was found that gamers have many advantages in terms of focusing their attention and, that they can react faster and had the ability to trace and track more objects than the non-players. Test subjects were found during driving tests to be able to better keep track of other cars, people, animals, lights etc. in their surrounding space. Most young adults can hold about three to four objects in their attention at one time, in comparison to a gamer who can keep six to seven.

As a result of observing the relationship of playing games with the functioning of the brain, scientists have obtained a great deal of insight in to how the brain's networks control attention. The first part of the brain responsible for orienting attention is the Parietal Lobe, the second part active in the process is the Frontal Lobe, which controls the individual's ability to maintain attention. The third area, the Anterior Cingulate is responsible for controlling or regulating attention in resolving conflict. It is evident from brain imaging scans that all three of these networks run much more efficiently in people that play games.

A research project has investigated the individual's ability to multitask and alternate their attention from one task to another, for example cooking while speaking on the phone. In this study conducted by Stanford University in the United States in 2009, gamers were tested along with a control group who were familiar with multimedia tasking. By multimedia tasking we mean using different multimedia concurrently, i.e. listening to music, using the Internet and sending e-mail, all at the same time. One hundred students took place in the testing, but unfortunately the results showed that multimedia tasking has a huge mental price diminishing performance. Eventually, "by doing less, you might accomplish more" (Gorlick A, 2009).

From the game playing subjects however, the tests showed how accurately, to the millisecond, they could switch from one thing to the next. The cost to their performance was much smaller than that compared to the media multitaskers. From these results were achieved two conclusions.

Firstly that gaming and media multi-tasking are completely different skill sets, which should not be compared in the first place. This is also the case when comparing different games as they activate different parts of the brain and at various different levels. So “not all media are created equal”.

The second conclusion was that “*general wisdom carries no weight*”. The facts commonly believed that over use of screen time is bad for our vision and the associations we have made in our minds about video games and their effects on the individual have brought the public to the wrong conclusion; that video games are bad for our vision. In general overuse of games, media and multimedia tasking are never good, but in reasonable doses they can even be really effective in developing better memory and attention skills. (Bavelier 2012)

## 4 GAME DEVELOPMENT

### 4.1 Defining Games

*"The word [game] is used for so many different activities that it is not worth insisting on any proposed definition. All in all, it is a slippery lexicological customer, with many friends and relations in a wide variety of fields." (Parlett 1999)*

A game in which the players move pieces along a premarked surface following particular rules is defined as a board game. There are different types of games such as strategy, chance or rolling dice, or simulations of them and creating other types. Board games usually have an exactly goal that the players seek to achieve.

The rules governing games can also be of great variety too. It takes a differing amount of time to learn to play a particular board game. The learning period may not necessarily depend on how complicated the rules are, but quite often on the number of strategies that are possible, which can make games especially complicated. The board games “chess” and “go” are an excellent example of easy game rules with endless strategies. (Selinker 2011)

A Game is a thoroughly structured equation with a diversity of objectives and an array of possible enjoyment or educational purposes. The basic elements used in game



development are the setting of goals and rules, of challenge and interaction, and of combining mental or physical stimulation or both. Consequently, innumerable games have helped to develop physical skills, perform psychological, educational or simulation roles, or work as an exercise.

Games are not exactly related to salary work, nor are they an expression of aesthetic or ideological features like art however this distinction is not always clearly defined. For instance, many games have evolved to a professional level with skilled players who make a career of playing a specific game. Games such as “Jigsaw puzzles” or games with an artistic layout like “Mahjong”, “Solitaire” or video games are also sometimes categorized as professions. (Radoff 2010)

## 4.2 Game Rules Development

*"Rules are what differentiate games from other kinds of play. Probably the most basic definition of a game is that it is organized play, that is to say rule-based. If you don't have rules you have free play, not a game. Why are rules so important to games? Rules impose limits—they force us to take specific paths to reach goals and ensure that all players take the same paths. They put us inside the game world by letting us know what is in and out of bounds." (Prensky 2007)*

The main precondition that defines each game is its rules. The aim of the rules is to set boundaries in the activities and actions of players. The players for their part should continually follow the rules. This will result in the correct flow of the game, and as a conclusion the player by accepting the rules and playing by them the player experiences the true nature of the game. The rules should be clear containing all the information necessary for the completion and proper operation of the game. Here are some principles for creating solid game rules:

- All players should share a common knowledge of the rules. It is crucial that in a multiplayer game all players have access and an awareness of the same set of rules. When there is disagreement, any unambiguity must be resolved or the game must be terminated.
- Players must always follow the game's rules

- The rules of the game are fixed and cannot be changed during the process of playing. Many games have over time changed their rules but even then, the ways the rules were modified was restricted so that they by themselves determine other, more essential rules.
- The rules of the game are always constant and common to all players, this happens because each person is connected to every other player, otherwise they will feel free to leave or even cheat in the game.

Rules are repeatable from game to game and are movable among sets of dissimilar players. (Salen 2004)

### 4.3 Prototyping Process

*“Experience prototyping facilitates active participation in design through subjective engagement with a prototype system or service, product, or place.” (Buchenua M. & Suri J. F. 2000)*

In overview, prototyping is an easy and fast way to make a sample of an original concept. It is enough to represent the idea for development and testing purposes with the designers, clients and target group.

The prototype is an integrated idea, a predetermined model to be tested initially by the designers, and then in the process of development by the potential users. The methods of prototyping could be analogous to the techniques of role-playing, simulation exercises, body storming or scenarios and representations of a situation. Whatever the methods used for the prototype, it is recommended that it be easy to build, fast and cheap. In this way it is possible to try many different concepts and ideas in a short time, and to gain critical feedback fast, with the result that the tester can precede with the next updated version of prototype more quickly. (Martin, Hanington 2012)

## 5 PROCESS

### 5.1 Brainstorming

The subject of safety and wellbeing game innovations is a broad category with unexpectedly many angles of approach. Therefore at the beginning of the project, by following others participants advice it was decided to focus attention on developing a board game targeted at elderly people.

A crucial part of the brainstorming session was the identification of skills that could possibly train and help the elderly with games. Skills such as memorization, recollection, concentration, observation, muscular reflexes, accuracy, speed and all other cognitive abilities that are needed in everyday life. Each skill could actually suggest a series of possible game concepts. Eventually the focus was set on the mental affects of game play specifically on the memory.

Another restriction and driver to the final design was the construction material. Materials such as plastic, cardboard and composites of these two were considered for the game, but it was decided that the end product would be made out of wood. Wood is a natural material that is considered to be friendly, respectful, warm, and with nice touch to the users hand. Besides, wood is associated with Finland and therefore was an obvious choice for a game made in Finland.

### 5.2 Naming the Game

When choosing the product name, characteristics of the game were considered and put in different languages on a list. The shape of the pieces, of the board, the material the game was made from, and terms for the word memory were combined in a mix of languages; Finnish, English, Latin, Greek and ancient Greek.

In the beginning the list contained the following possible names: Memory Box, Muisti Boxi, Woodme, Mnemonia, Mnemosin, Mnemonic, Moneta, Moneti, Memonia, Memonto, Memento, Boximuisti, Polygon Memory, Monikulmuisti.

The name that distinguished itself amongst the others on the list was Mnemonic, but in the process of making it easier to pronounce for Finns it was changed to Memonic. As

was mentioned earlier a Mnemonic was a learning and memorizing system in ancient Greece, and its name was derived from that of the Goddess Mnemosyne.

In Greek myth, Mnemosyne was the daughter of Ouranos and Gaia. She was the Titan goddess of memory and time as well as the creator of language. After she slept with god Zeus for a whole week she give birth to the nine Muses, the Greek goddesses of poetry and the arts. This story shows that the ancient Greeks connected the concepts of knowledge, learning and the arts with time and memory (Aaron 2011).

### 5.3 About the Game

Memonic is a game that has been developed as a rehabilitation method, in order to exercise and improve memorization, recollection, concentration, observation, tactical thinking and focusing in players. As a priority it was designed for elderly people and people recovering from or suffering from mental diseases or dysfunctions.

The game consists of three different kinds of object. There are two wooden playing boards, a selection of wooden pieces and three types of instruction cards of differing levels of difficulty. (Figure 1.)

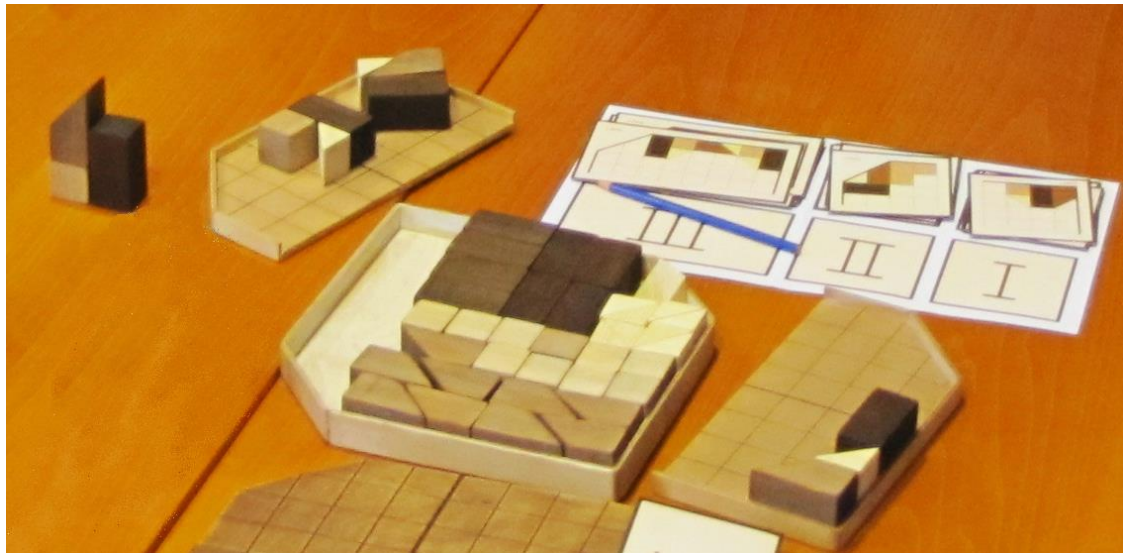


Figure 1. Board Game Memonic.

The boards are an empty imitation of the playing areas shown on the instruction cards. These playing areas are divided into squares to aid the understanding of the space. Also the boards have a frame around the down part from player's side so the pieces can more easily be placed in the right spot without falling off the board.

The wooden pieces come in four different shapes and are colored in a tonal scale, with the biggest pieces being the darkest and the smallest being the lightest. The pieces are used to build representations of the patterns shown on the cards. There are twelve pieces of each shape. (Figure 2.)



Figure 2. Wooden pieces.

The cards are split into three levels of difficulty in the game. During gameplay level one puzzles are built on the left side of the board, in level two they are built on the right and in level three the whole board is used. The level of difficulty involved while playing is shown at the bottom of each card. The text also plays another role, it forces the players to hold the cards in the correct position. The game contains twelve cards for each level. (Figure 3.)

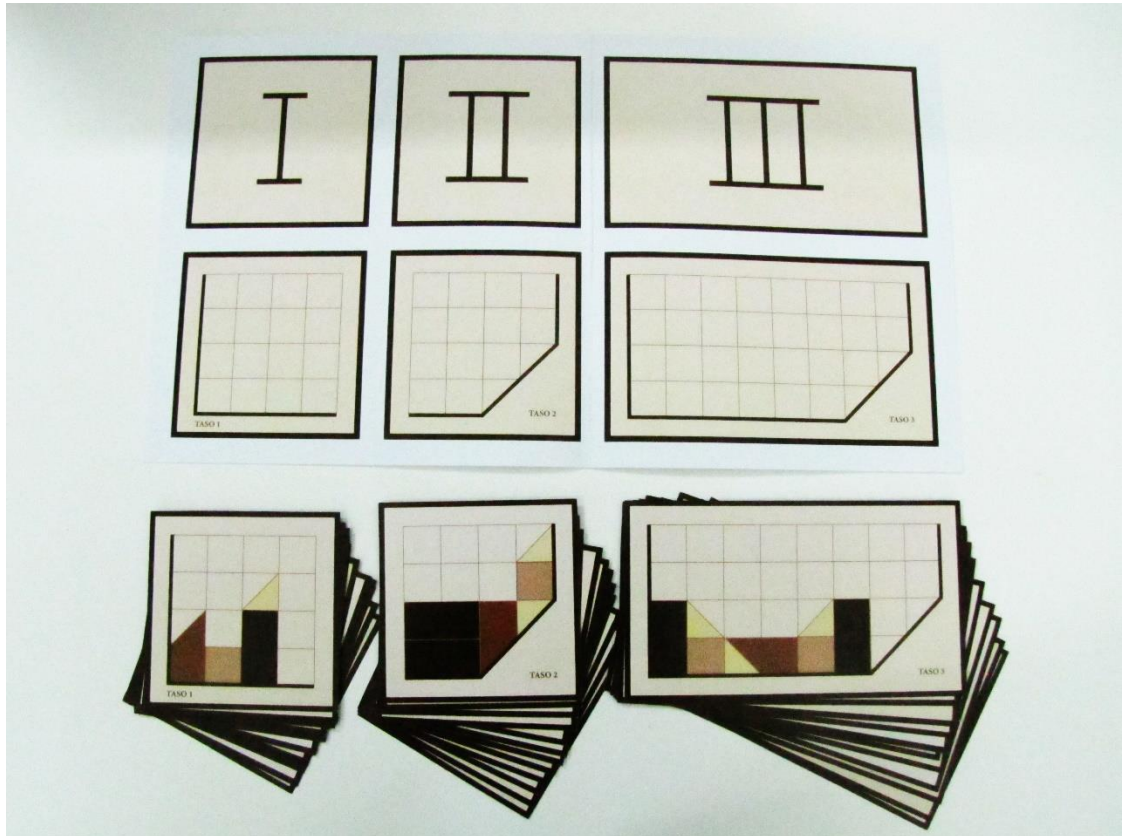


Figure 3. All Level cards.

#### 5.4 Game Rules

In the development of the game rules, as I mention earlier there are a series of prerequisites that need to be considered. Nevertheless, especially in the case of this game and each target group it aims to help, there needs to be even more in the way of reconsiderations in the creation of the game rules.

- Easy to learn. The elderly along with many others, find it highly difficult to adapt to complicated rules or complex combinations and shapes.
- No multitasking. Many puzzle games use multitasking in their game mechanics by having multiple tasks be achieved or demanding attention of many things at the same time, however in this case there was a need to focus more on the skills of observation and attention.
- Variation in difficulty. The people predefined as playing this game just like any other person, have different capabilities and will have need of different starting points. A game divided in levels also gives the users a more obvious feeling of improvement.
- Level of difficulty. The balance in levels of difficulty is one of the most crucial objectives in game design. In the case of easy gameplay, the user has no challenge and as a result it can be boring and unstimulating. Respectively, if the difficulty level is set too high then a game can get demoralizing and sooner or later the player will give up on it.

#### 4.5 How to Play

The set up was made to be fast and easy. Each player places one of the boards in front of them, with the corner side of the board at the left. Then the wooden pieces are placed on one side, with the level cards on the other, then the game is ready to start.

Each level card uses a specific number of pieces. This makes it easier to memorize and also to confirm if the result is correct.

- Level one consists of four pieces. (Appendix 1. Cards Level 1)
- Level two of six pieces. (Appendix 2. Cards Level 2)
- Level three of eight pieces. (Appendix 3. Cards Level 3 part1) (Appendix 4. Cards Level 3 part2)

The board has a thicker line carved across its middle, which separates it into two smaller fields.

- The left side is used for Level one cards.
- The right side is used for Level two cards.
- The whole board is used for Level three cards.

**How to Single Play:** When a player is playing alone, they use only one board. To start playing he or she, picks a level card (if they are a beginner we suggest they start at Level 1), and then observes it as long as is needed to memorize it. They then hide the card from view. Afterwards, by using the wooden pieces available, the player tries to represent the shape combination shown on the card on the playing board.

- If he or she fails, then they can try either a lower level of card or just repeat the same level of difficulty with a new card.
- If they have succeeded then the player can try to repeat the level with another card or raise the difficulty to the next level of cards.

**How to play with two players:** The process is the same as was described for a solo player, but in this case the aim is that the player needs to be faster than their opponent. To start, each player takes a level card at the same time, observes the card and tries to memorize it as fast they can and then hide it. Now by using the wooden pieces they try to repeat the pattern on the board before their opponent. When a player completes their shape they say “Stop” and the other player has to stop immediately.

- If the player who said stop has the correct shape combination they win that round of the game.
- If the player has made a mistake the win goes automatically to the opponent even if he has not finish.

## 5.5 Prototyping

There were five game versions implemented during the prototyping process. Every one of the five prototypes had to support a series of tasks, which considered and tested the game mechanics, materials and quality. After each cycle of testing all errors and other faults were noted and an attempt was made to repair problems before the next test cycle.

**Version 1:** The very first version was made on A3 paper and tested by just drawing the shapes on it. The idea and mechanics were clearly good enough to be consider for further development.

The difficulty nonetheless was way above the level of enjoyment. The shape of the board was rounded off on some of the corners. This type of playing board design would



demanded more types of pieces, in a greater variety of shapes, if the player was to fill the board. This would increase the games difficulty.

In the game each player was meant to have their own colored pieces, one player with warm colors and the other with cold colors. There were no levels shown on the cards to define the difficulty within the card deck, just randomly placed patterns of six to twelve pieces. This could bring about a strong feeling of luck in the game as the competition between the players was raised due to variation in levels of difficulty that could be picked at random.

**Version 2:** By the second prototype the board and pieces already had the dimensions and characteristics that would appear in all later editions.

For a start, in order to better understand and present the idea, a 3D model was made on the computer (Appendix 5. 3D Modeling). I used the 3D modeling program Rhinoceros 5 to do this. During this process, the board achieved its final shape and dimensions, and the number of different shape playing pieces was reduced to four. Before mocking up a model with materials, the idea about coloring the pieces for each player was changed. Now they were colored individually on the base of the four shapes only.

Again for this version the prototyping had to be easy, fast and cheap. The playing pieces were made out of cardboard, and on top of these forms printed colored paper was glued (Appendix 6. Cardboard Pieces 2<sup>nd</sup> Version). The board was made of a piece of plywood cut to the required dimension, which also had a printed grid glued onto it to show the board field. The board was meant to be used by both players at the same time (Appendix 7. Board 2<sup>nd</sup> Version). The cards were printed in color at a size of seven by seven centimeters. Finally three level of difficulty card types were introduced, the player had to remember six pieces on first level cards, eight pieces on second level cards and twelve on the third level. (Figure 4.)



Figure 4. Pieces and Board.

The second version was the first playable model. It was tested by colleagues, students, and other individuals at the University. It was also presented to Markku Kärmeniemi, the director of rehabilitation at Kakspy Psychiatric Clinic in Kotka at this stage. Kärmeniemi was also the person who gave the team the opportunity to test the game in their facilities with their clients.

**Version 3:** The third prototype was the most decisive of all, since the pieces and boards that were made during that time, were also utilized in the next cycle of testing. The materials selected at this stage were used until the sixth version.

From the very beginning it was predetermined that the game would be made out of wood. The playable pieces were handmade from pinewood (Figure 5.). The board was manufactured by CNC machine in the workshop of Kymenlaakson University of Applied Sciences, with the assistance of my colleague Dario Vidal from the Wood Academy office (Appendix 8. Wooden Board and Pieces). I was also under the supervision of Ari Haapanen, the operator of the CNC machine and teacher at Kymenlaakson University. Three variations of the boards were also produced for later use. (Appendix 9. CNC)



Figure 5. Wooden Pieces

Though this version was not colored, because it was made from 100% pure wood, it had a very nice feeling in the hands, a wonderful wooden smell and all the pieces were a pleasing pale natural color. This raw finish was an inspiration and the genesis of a series of ideas and later plans for the board game. (Figure 6.)



Figure 6. Wooden Pieces without color

**Version 4:** Since the third version was tested and approved for its basic use of materials, the next improvement had to be the coloring of it. There were however a few things I wanted to avoid when coloring the product. Firstly I wanted to avoid using solid colors that could isolate the element of wood from the user, and secondly I did not want to use bright colors that could give the feeling that this is a child's game and not for adults. By defining these two criteria that I had in my mind, two other concepts for coloring options surfaced.

The first option was to select colors that were the best for elderly vision. The elderly can show symptoms of color blindness, and have difficulty distinguishing between colors. Colors such as red, green, yellow and blue will appear muted to their eyes. To get the best results in their case it is wise to use bright colors in high contrast combinations (Bonnie R.).

Even though a color palette, tailored specifically for elderly peoples sight could have been the best decision for them, the project’s target group had now changed to also include people suffering from mental illness or dysfunction. For this reason I chose my second option, which was to create a palette of natural wood color shades for the four pieces, ranging from really light to really dark. By doing this, the game still had the characteristics of the smell and feeling of the wood. Wood will always be considering an elegant material and transmits respect for the user. (Figure 7.)

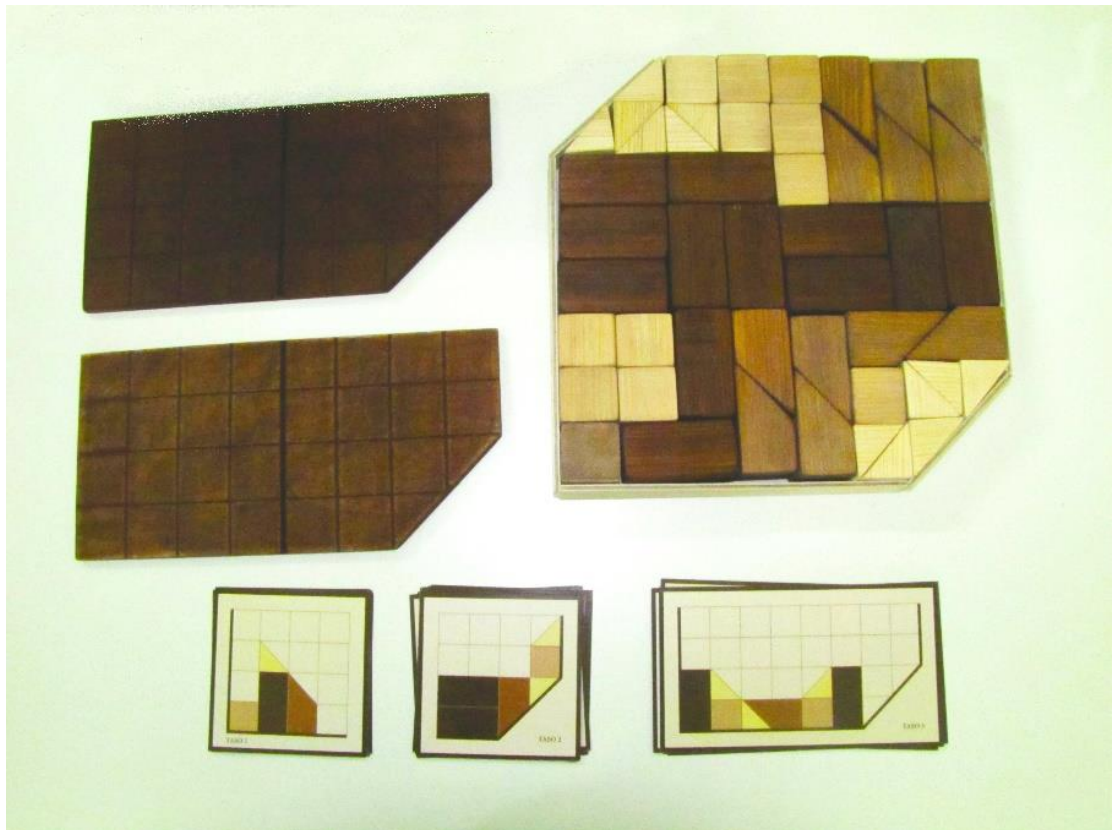


Figure 7. 3<sup>rd</sup> Version

Another modification and improvement was carried out on the level cards. The difficulty of the third level was reduced by now using ten pieces in place of the twelve that were required before.

The 4<sup>th</sup> Version was sent for one week of testing to Cicatrice Clinic, Kaksy in Kotka. The tester group were patients of the clinic with mental dysfunction, schizophrenia, drug addictions and others similar problems. The results from this testing were crucial for the continued development of the project. After playing the game, the testers would fill in a short questionnaire about their experience as did the staff who



acted as observers. After the results were received and analyzed the green light for the next improved version was given. (Appendix 10. Kakspy Testing Meeting)

### 5.5.1 Questionnaires

In order to collect data after the game testing two questionnaires were arranged, for both the patients and the staff members at the psychiatric community in Kakspy. The patients, who are the actual target group we are focusing on, answered questions on the game, whereas the staff answered questions on the experience they had watching the test subjects. They acted as reliable observers. In order for the questionnaires to be understandable for everyone, there were translated from English to Finnish by fellow co-workers Antti Viitanen and Anne Sundström.

In the first group, with the staff members, a qualitative questionnaire was used so they could express, either individual situations, opinions or personal experiences during the testing. With the experience the staff possesses with the patients they can answer the questions objectively through observation. (Figure 8.)



Figure 8. Kakspy Testing Meeting

- Question 1: Can this game help people with special needs? And how?
- Question 2: Do you believe this game can help the improvement of memory?
- Question 3: How did the testers adapt to the game? (Game rules)
- Question 4: Did people play multiple times?
- Question 5: Was any comments were made about the game by the testers?  
Do you have proposals to improve this game further?

Since the questions from above are about the observation of the patients, the answers have been included and combined with the answers conclusions from the second questioner bellow.

The second document was a quantitative questionnaire earmarked for the testers. This quantitative test was designed so the players were able to reply easily and fast through a series of multiple-choice answers, and there were only a few questions in consideration of their situation and condition so they would not feel pressured. The focusing of the questionnaire in this group was firstly on the material side of the game, level of difficulty, size of the pieces, and the cards, while the second part focused on the experience of the game-play and the improvement of it. Below are displayed the Questions and the statistical graph based on the answers.

- Question 1: How was the variation of difficulty in the game?  
Easy                      OK                                      Difficult
- Question 2: How was the size of the pieces?  
Small                      OK                                      Big
- Question 3: Were the cards understandable?  
Yes                                      In between                                      No
- Question 4: Would you like to play this game again or something similar?  
Yes                                      Maybe                                      No
- Question 5: Would you like to comment on anything else about the game or to suggest further improvements?

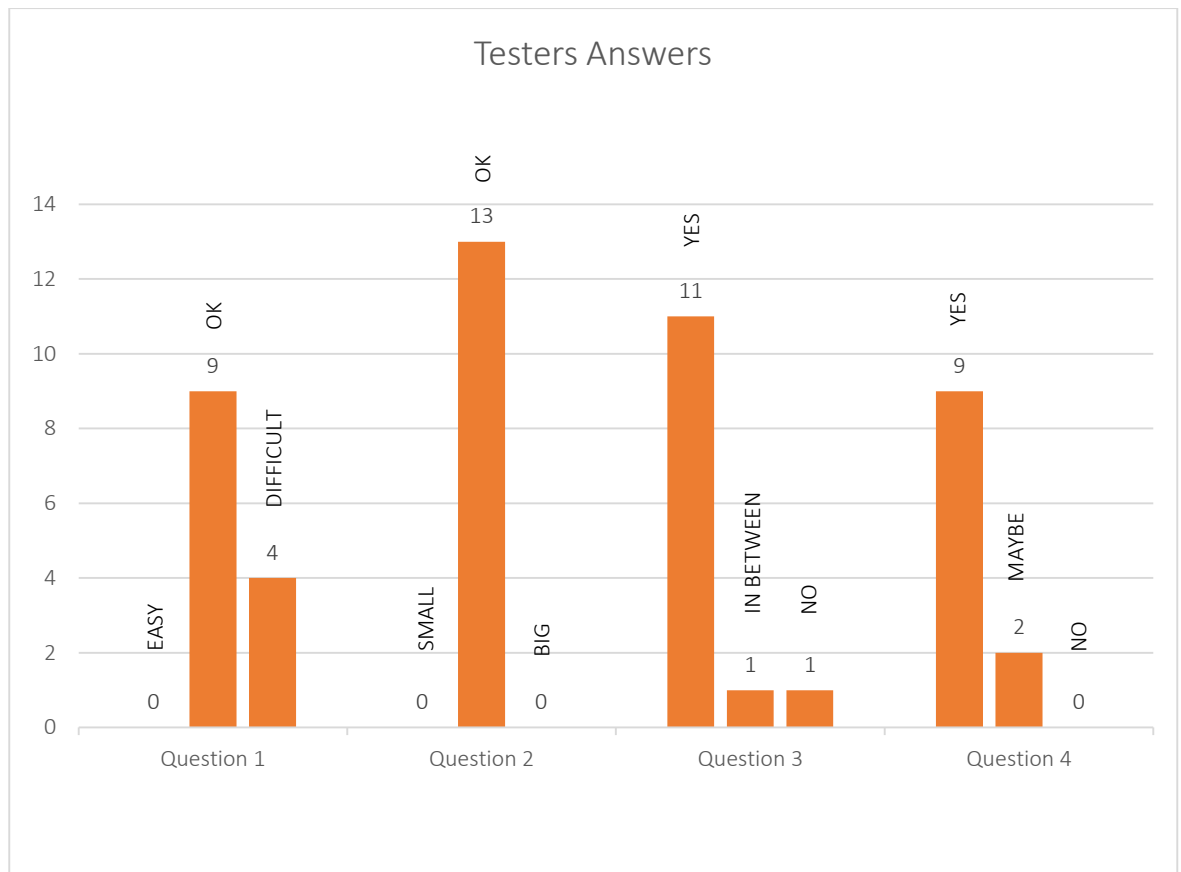


Figure 9. Questionnaire 1: Testers Answers

Along the bottom axis are displayed the numbers of the questions that correspond to the first questionnaire above. At the top of the columns appears the number of responses received to each question and also the selected answer to the question. There were thirteen respondents from both sites that the Kakspy community is administrating. (Figure 9.)

As we can see from the statistical graph above the responses were in the majority positive, and in some cases 100% positive, without any critical flaws. The next step was to analyze these results.

**Question 1:** How was the variation of difficulty in the game?

Even though most of the people rated the difficulty of the game as normal, four of the thirteen found it difficult. There was also a comment from the staff members, that almost none of the players tried the third level. As result of this data there was a need for modification at all levels.



**Question 2:** How was the size of the pieces?

As I mentioned before at 2<sup>nd</sup> Version, I believed that the sizes of the pieces and the board were the most suitable for this game. Block of a good size and proper feeling in the hand plus a board size big enough for easy transportation or even to fit inside a back pack were optimal.

However even though the answers were 100% positive, the game had not been tested yet with the elderly. In one of our evaluation meetings, I resaved an advice from one of the colleagues Mika Haaja, with experience over elders take care. His statement was that people with Parkinson or weak hands couldn't hold or use the specific pieces. The hands are weak and trembling, and even the vision is not helping enough to spot them.

**Question 3:** Was the cards understandable?

The cards from the 4<sup>th</sup> version even if they got positive responds were suffering on many points. Frist observation was from the testing meeting with the staff members of Kakspy when surprisingly all of the testers had to use their farsightedness glasses to look at the cards. The resize of the cards was then obvious to me even though was none comment about it.

From the answers and commends from the staff was achieved that most people had problems with the card colors that wasn't following the tonal scale from the pieces. Rightly and sadly however this was because of the poor printing quality. One last comment that was mentioned was the difficulty of orientation on holding the cards since there were on square shape and the highlight underline wasn't enough to show which side was the dawn one.

**Question 4:** Would you like to play again this game or similar?

Happily all testers show positive and highly interest about the game and even the attention to bay one after the publishing.

**Question 5:** Would you like to comment on anything else about the game or to suggest further improvements?

On this section was pretty much all the comments that was mentioned above and mostly about the understanding of the cards. Also some positive comments about idea of the game itself.

One last comment that was mentioned from the staff was that at least in their observation, none of the testers wanted to play with another player. Based on that, one of the suggestions for further development was to separate the board in half so each user can have the playable board in front of them.

## 5.6 Final Prototype

Thanks to the results from the questionnaires radical changes were about to be made on the final prototype that was made until this point. The version 5 of this game was also and the most challenging to be achieved. Challenging from two perspectives. Firstly by solving the problems that were mentioned before and secondly by raising the construction quality of the prototype. This version was also the one that was sent for testing in two elder houses, Iltatähti and Etappi both located in Kouvola.

Firstly the pieces had to be repainted in order to achieve higher contrast in between them. As was mentioned before the remake and resize was also under consideration. However since 100% of the answers from the questionnaires about the size were positive I chose to give it a chance at the next testing.

The board on this version was cut in two separate boards, one for each player. In this way the area the players needed to be focused was smaller in the eye and easier to have it just in front of them. Also it may help as well with the problem of multiplying. Maybe one of the reasons people didn't want to multiply was that the board was keeping the players too close and maybe the moves with the hands were interfering into the other's playing field. And by separating the boards the players are not needed to be so close any more and they have also more space.

One more thing that changed on the board was when I was trying to figure out, a packaging way and transportation. So by placing a small frame around the boards I made the boards to be part of the packaging. The frame is part of the game around the down part from the player's side so the pieces can more easily be placed in the right spot without falling off the board. (Figure 10.)

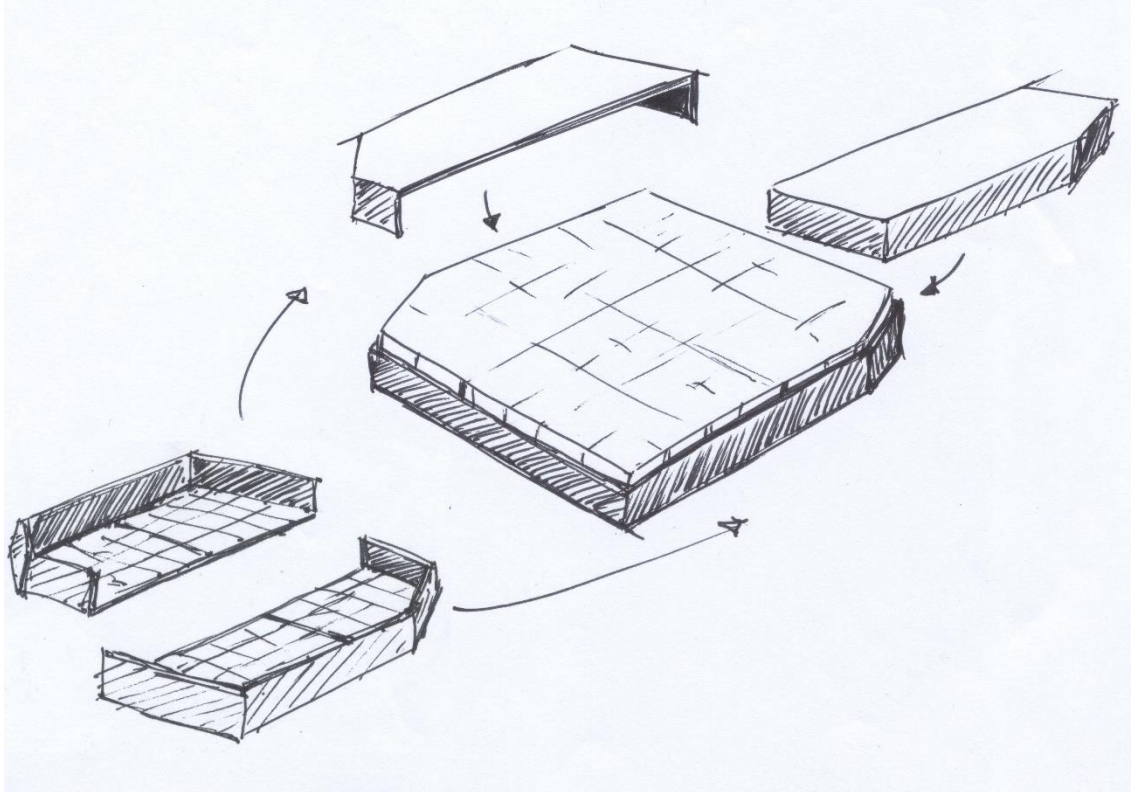


Figure 10. Board and Packaging.

Finally the cards, are made bigger than before, on the size of 90 to 90 millimeters and also the colors are properly imitating the colors from the real pieces. According to the feedback there was also a problem with the way of holding the card. A way to solve the problem in this case was to place a readable text at the bottom so automatically when the player picks up a card, subconsciously can hold it in the right way. Therefore at the bottom of every card is indicated the level that the player is currently playing.

One more thing that was developed during the 5<sup>th</sup> version was the logo of Memonic game. However the logo is still under deployment also with the color pallet witch will be finalized when the wood colors will be stabilized. (Figure 11.)



Figure 11. Memonic Logo.

The final version is currently under testing from in two elderly houses. First destination is Iltatahti and as second destination Etappi, both located in Kouvola city.

## 6 CONCLUSIONS

By combining skills I've achieved during the last years of my studying and my personal interests over gaming, fantasy and crafting it led me to the game design.

In the proses of the game developing first of all I had to learn. It's really important to know the situation of the target group, in this case the elderly people, and also to know what you're speaking about, when it comes to their situation and also about games and how can help in rehabilitation. For that helped a lot the research that was made for both thesis and the project.

I had to work fast. Prototyping is something that needs to be done fast and then tested. Afterwards with all the knowledge that was achieved from the testing through feedbacks and observation is able to proceed with a new prototype. All games have to go through the testing and it's the most important part of design process.

Solve the problems. From the beginning of the game development until the end the designer has to make lots of decisions and every single, even the smallest thing can change the entire game. As a person I was always attached in my works and I was holding on what was feeling right. I was supporting and believing in my ideas. However in this case I learn to not be attached in ideas. Many times, as you have read in the prototyping chapter, I had to take chances that were about to change the whole idea of the game. In other words I learned an important skill as designer, and that is how to allow the problem to become the generator of process and new ideas.

To be aware what I can do. When you're working in a project alone you have to stand alone in many decisions. However, one thing that is need to know in this case, is to be smart enough to know when you need help. During my studies I manage to achieve skills in many different subjects. But knowing a bit of everything doesn't making me good on anything. When the game had start taking the final form it was also the end my task as game developer. My knowledge over the many parts was coming to an end, and in order to proceed I had ask for assistants from wood experts and graphic designers.

This game give breath to a whole series of game concepts and ideas, based on health and wellbeing innovations. Through this game I made important contacts and meet people that I could count in the future as partners, colleagues or even employers.

## REFERENCES

Yates A. F. 1966. *The Art of Memory*. 1st ed. London UK: Routledge and Kegan Paul Ltd.

Fabiani, M., Gratton, G., & Coles, M. G. H. 2000. *Event related brain potentials: Methods, theory and applications*. 2nd ed. New York, NY: Cambridge University Press.

Carter P. Russell K. 2002. *Maximize your Brainpower*. 1st ed. West Sussex UK: John Wiley & Sons Ltd.

Lorayne H. 2008. *How to Develop Superpower Memory*. 8th ed. Hollywood USA: Frederick Fell Pub.

D. P. Devanand, M.D. 2001. *The Memory Program*. 1st ed. Canada: John Wiley & Sons, Inc.

Russell P. 2010. *The Brain Book: Know Your Own Mind and How to Use it*. 8th ed. New York USA: Routledge, an imprint of Taylor & Francis Books Ltd.

Madelyn Burley-Allen. 1988. *Memory Skills in Business* 1st ed. Menlo Park, CA, USA: Crisp Publications Inc.

Activision Publishing, Inc. Press Release, 2010, *Call of Duty®: Black Ops™ Delivers Engaging Online Experience that Connects Millions of Players Everyday*, [online] December. Available at: (<http://investor.activision.com/releasedetail.cfm?ReleaseID=538848>) [Accessed on 3th March 2014]

Gorlick A, 2009, *Stanford News, Media multitaskers pay mental price, Stanford study shows*, [online] August. Available at: (<http://news.stanford.edu/news/2009/august24/multitask-research-study-082409.html>) [Accessed on 13th March 2014]

Bavelier D, 2012 Daphne Bavelier: Your brain on video games, [video online] Available at:  
([http://www.ted.com/talks/daphne\\_bavelier\\_your\\_brain\\_on\\_video\\_games?quote=1963](http://www.ted.com/talks/daphne_bavelier_your_brain_on_video_games?quote=1963)) [Accessed on 1<sup>st</sup> March 2014]

Parlett D. 1999. The Oxford History of Board Games. 1st ed. New York USA: Oxford University Press.

Selinker M. 2011. The Kobold Guide to Board Game Design. 1st ed. Kirkland WA: Wolfgang Baur.

Radoff J. 2010. History of Social Games. [Online] Available at:  
(<http://radoff.com/blog/2010/05/24/history-social-games/comment-page-2/>) [Accessed 14 March 2013]

Prensky M. 2007 Digital Game-Based Learning. 1st ed. St. Paul Minnesota: Pedagon House.

Salen K. 2004. Rules of Play: Game Design Fundamentals. 1st ed. Massachusetts London UK: The MIT Press Cambridge.

Buchenua M. & Suri J. F. 2000. Experience prototyping in proceedings of designing interactive systems (DIS). New York USA: ACM Press.

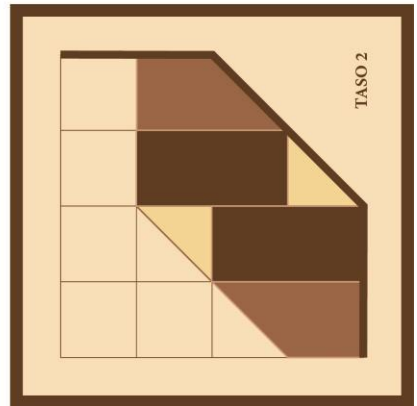
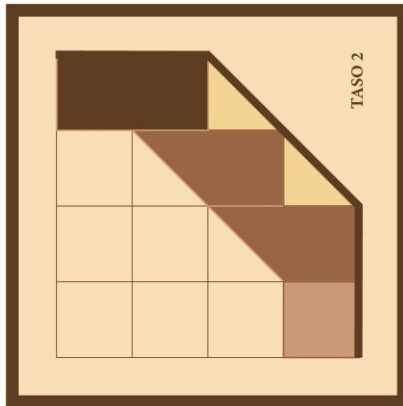
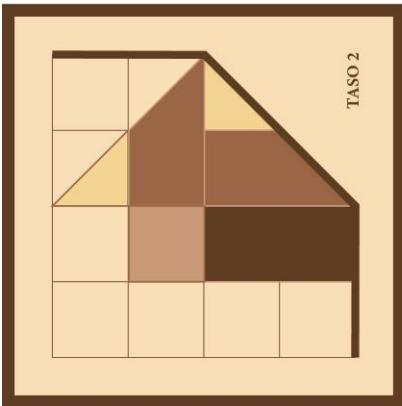
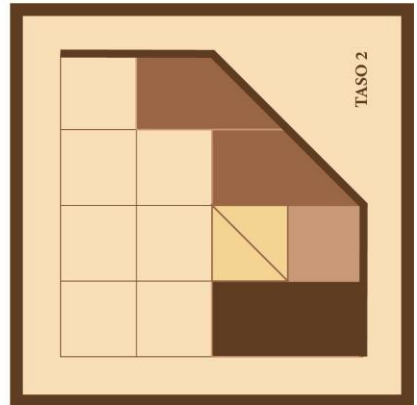
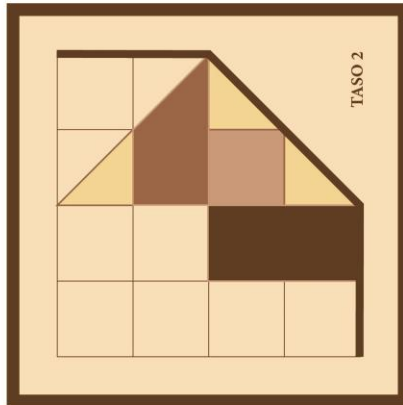
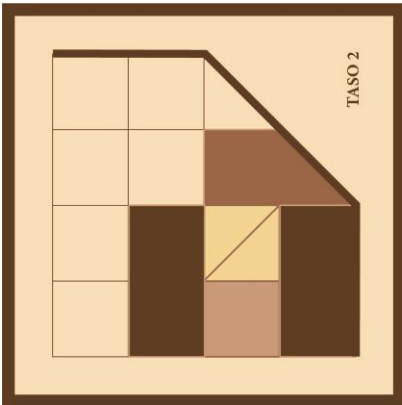
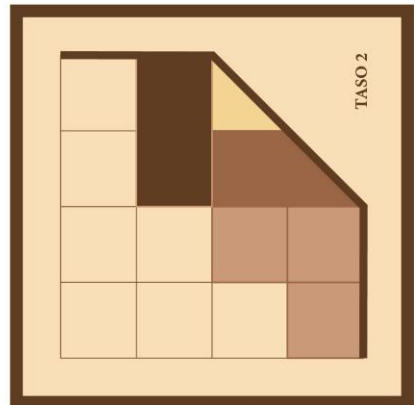
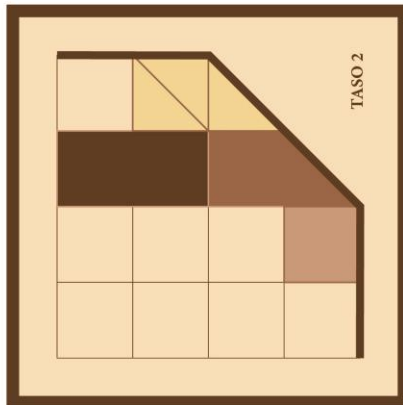
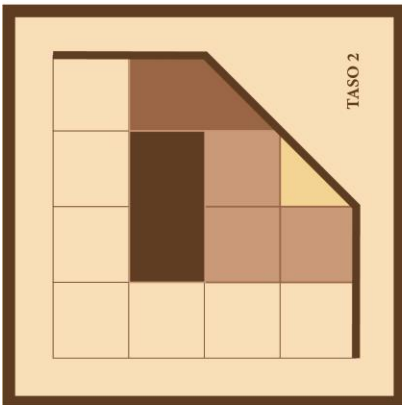
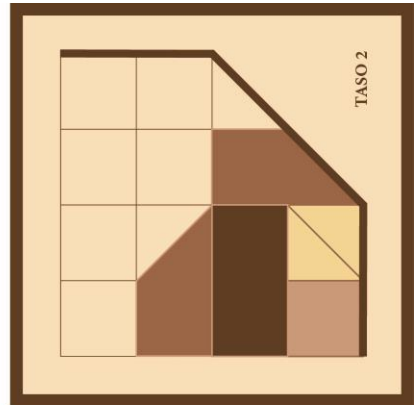
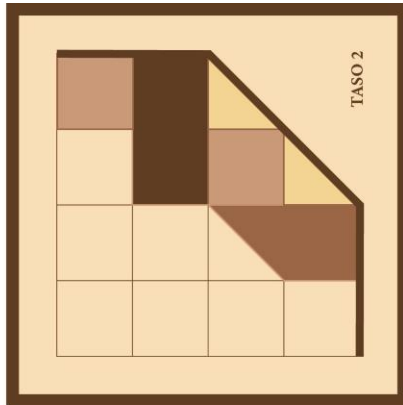
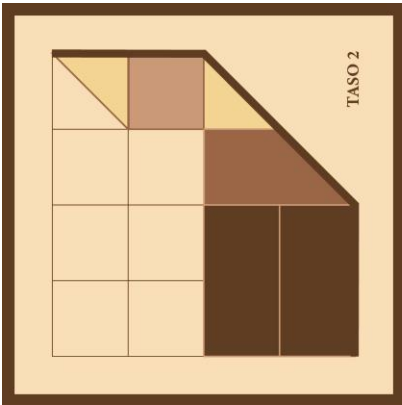
Martin B. & Hanington B. 2012. Universal Methods of Design. 1st ed. Beverly, MA: Rockport Publishers.

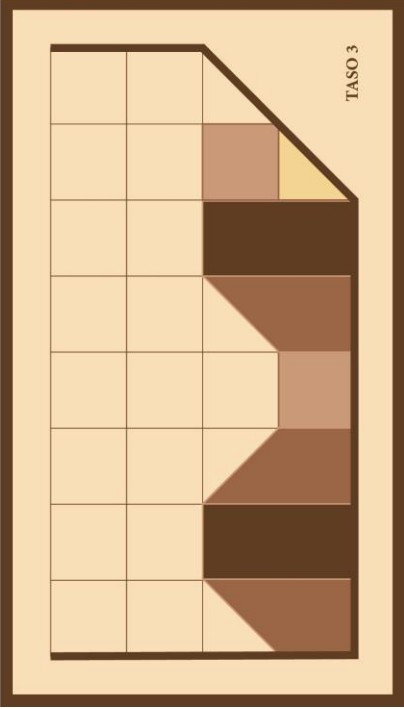
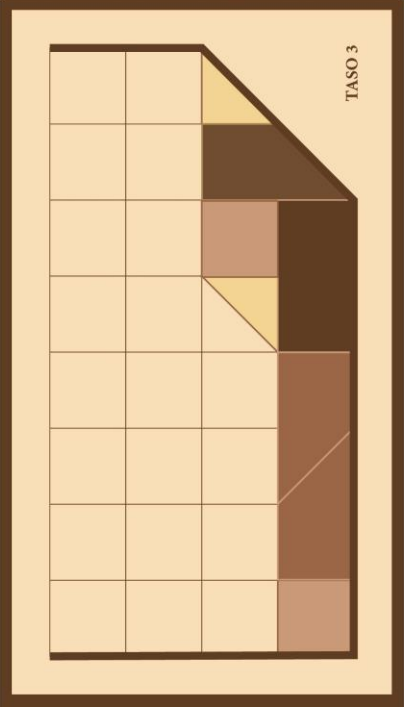
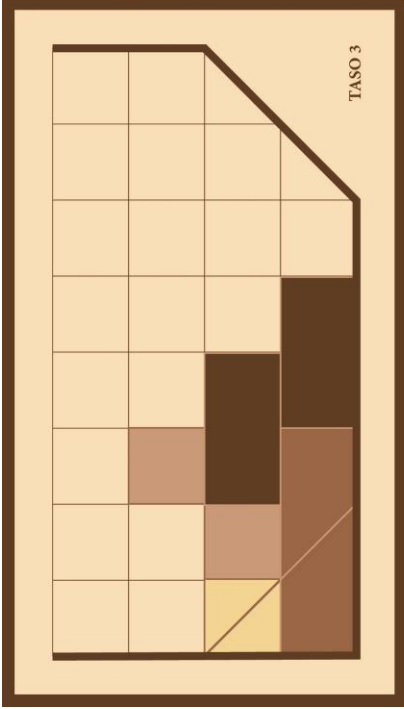
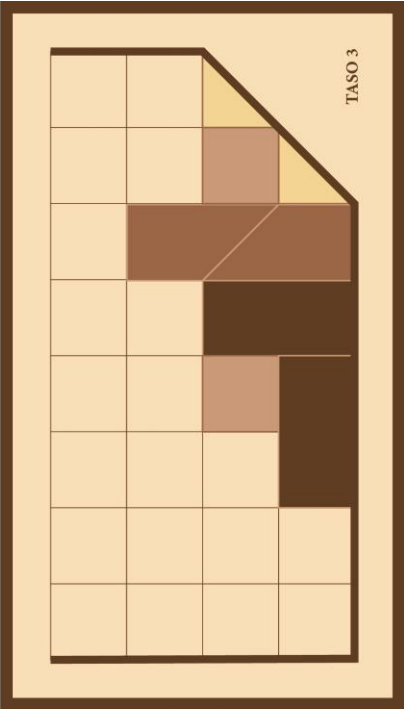
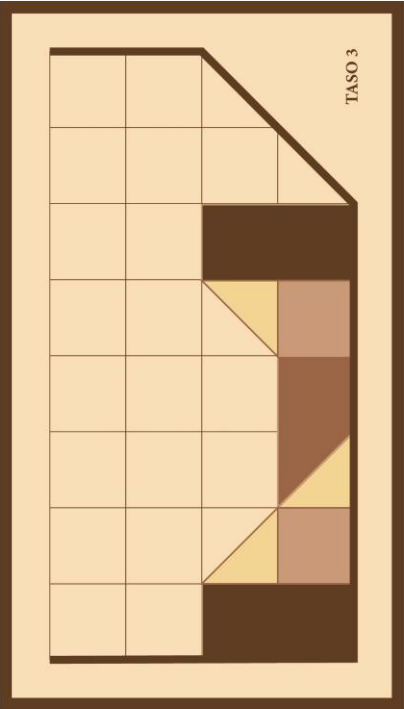
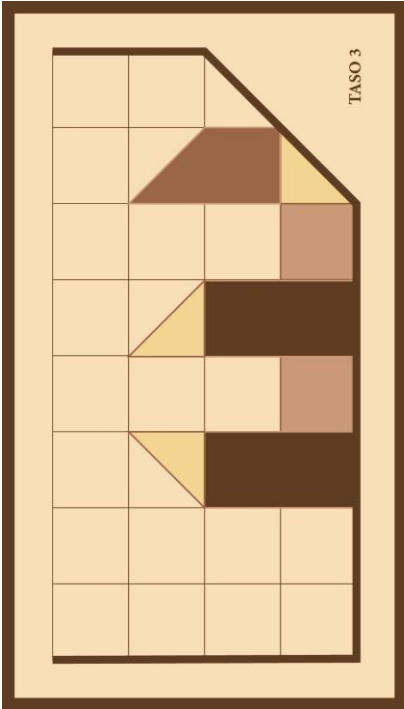
Aaron J. 2011. Theoi Project [online] Available at:  
(<http://www.theoi.com/Titan/TitanisMnemosyne.html>) [Accessed on 16th April 2014]

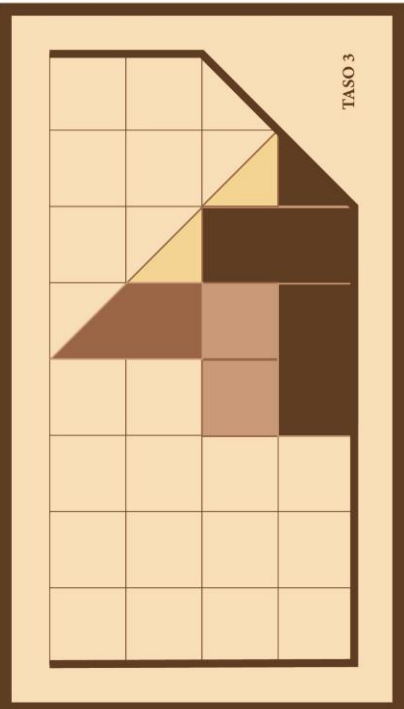
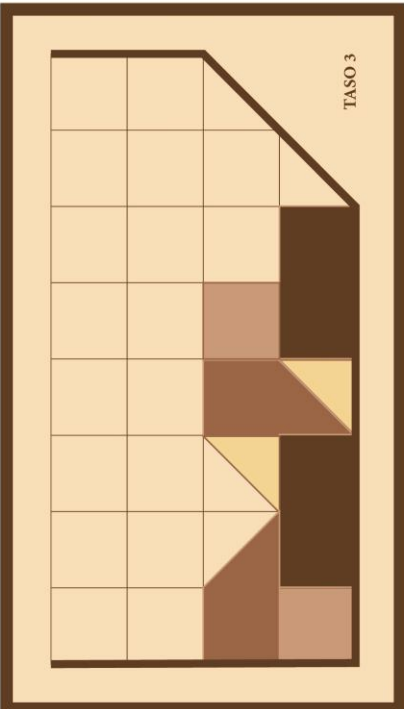
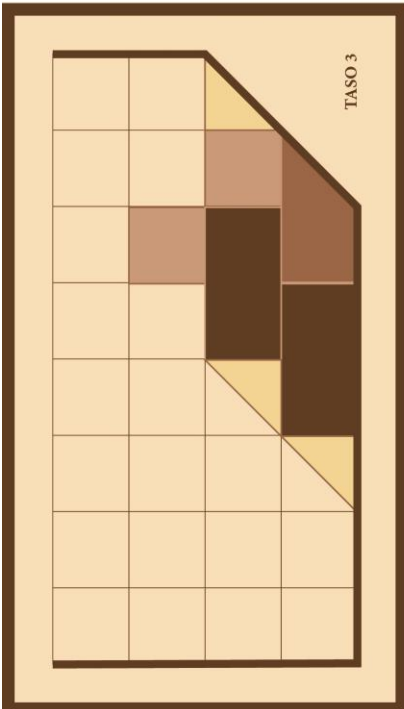
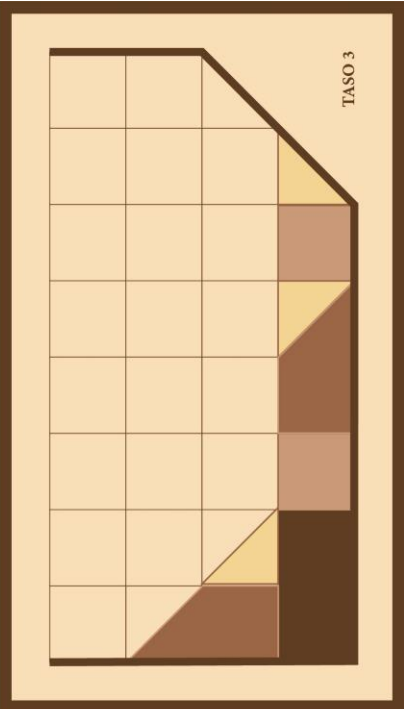
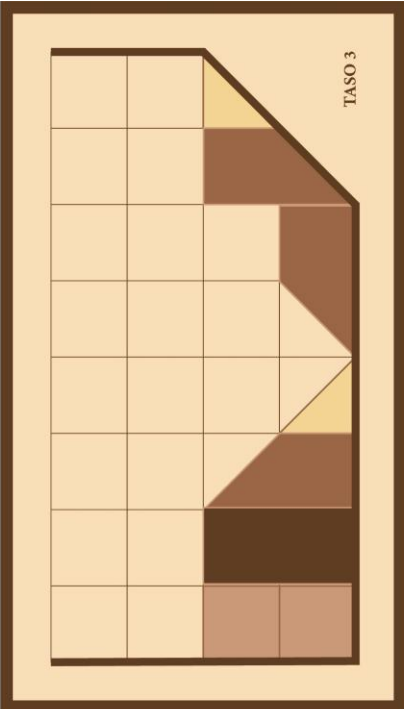
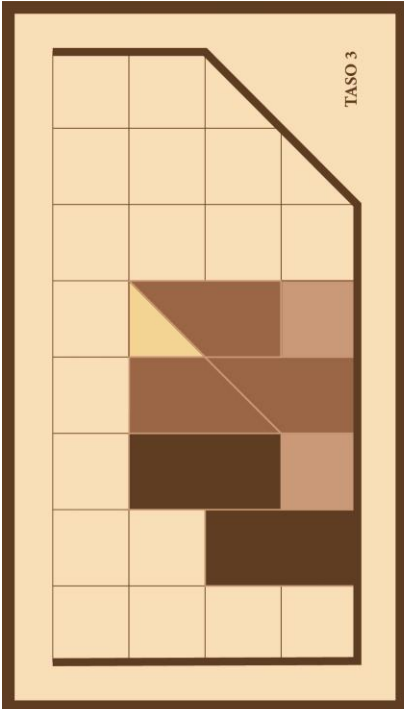
Bonnie R.. The Best Colors for the Elderly. [Online] Available at:  
([http://www.ehow.com/info\\_8551183\\_colors-elderly.html](http://www.ehow.com/info_8551183_colors-elderly.html)) [Accessed 24 March 2014]

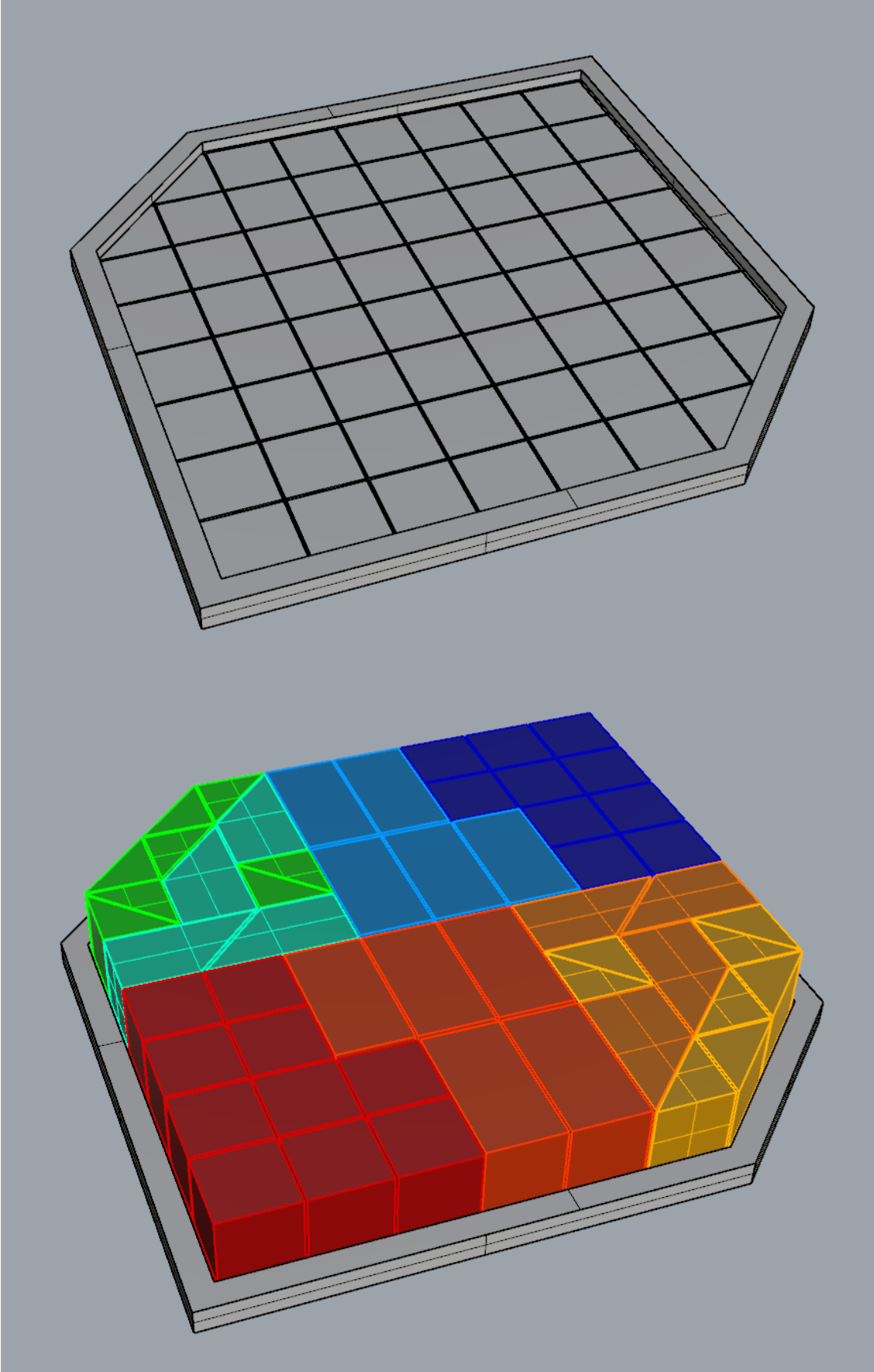






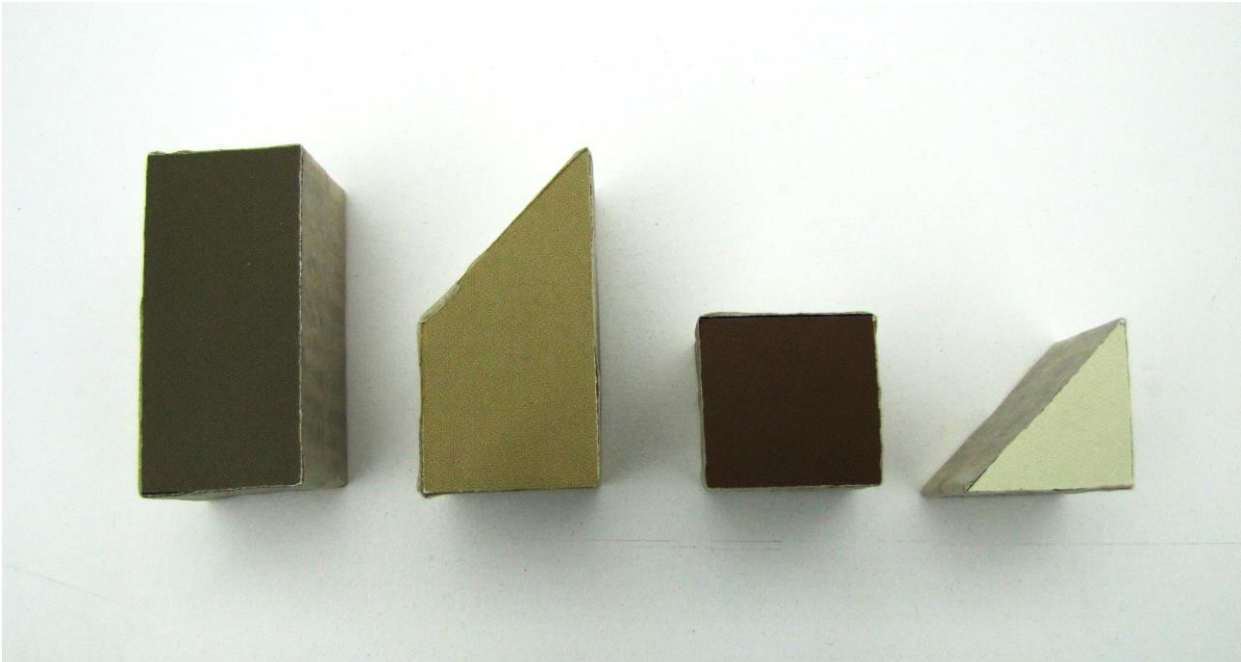






Cardboard Pieces

Appendix 6.



Board 2nd Version

Appendix 7.

