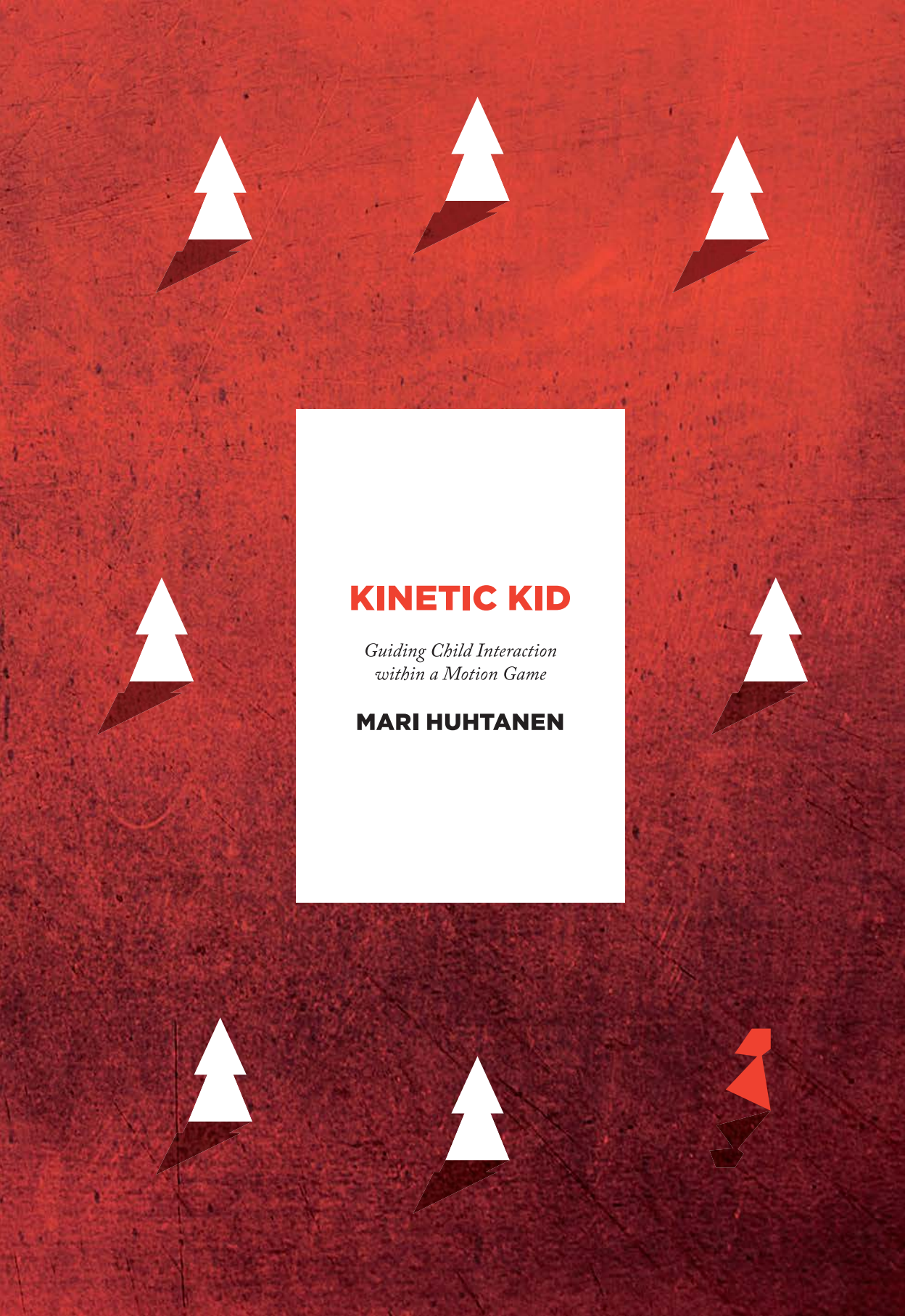

KINETIC KID

Guiding Child Interaction within a Motion Game

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KINETIC KID

NEW MEDIA IN MEDIA LAB, DEPARTMENT OF MEDIA,

SCHOOL OF ART, DESIGN AND ARCHITECTURE

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KINETIC KID

GUIDING CHILD INTERACTION WITHIN A MOTION GAME

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ABSTRACT

MASTER OF ARTS THESIS ABSTRACT

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ABSTRACT:

At present there are no widely established conventions in children's interactive stories and games for using movements to control the characters and interact with a story. Therefore, the designer needs to pay particular attention when planning, writing and implementing instructions for a child. In this master's thesis the focus is on researching and designing a user interface instructions, including help and tutorial elements, for facilitating the child's playing experience.

Kinetic Kid means a child moving a lot. I showcase how children can control a storybook application called **The Sharp-Eyed Little Red Riding Hood** with their own body movements. The child can become the character of the story and help solving tasks using a gesture 'to look forward'. The animated and interactive story is 15-minute-long played using the **Kinect motion sensor**.

The literature analysis consists of two parts: children's abilities and motion games. The first part discusses Child-Computer Interaction, developmental stages and intrinsic properties of a child. The second part focusing on motion games includes a short analysis of user interface conventions in **Microsoft Kinect** games. In addition it explores the influence of motion games on the future development of motion-based applications.

I also conducted interviews with kindergarten teachers to gather their professional opinions on how to instruct children to move and follow guidelines. I used their answers and observations to improve the user interface and develop the game further.

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1 INTRODUCTION

A Kinetic Kid master's thesis describes important details to be taken into consideration when designing a motion-based interactive story application for children. The thesis consists of three separate parts. First part introduces and explains how **Kinetic Stories**, an interactive and motion-based storybook concept, was made. Second part analyses literature and articles written about Child-Computer Interaction, children's development, gestures, user experience and motion sensors in games. The third part is an interview conducted with three kindergarten teachers to gain knowledge and to utilise their expertise about children behaviour.

Kinetic Stories is aimed for pre-school children, more precisely from three- to six-year-olds. The core of interactive storybook is based on ideas of a read along story &cassette, where you listen to the story while looking at the pictures in the book. A narrator tells listener when it is time to turn a page. The interaction is tiny, just turning a page in the book, but it becomes more exciting when the listener needs to wait for the narrator to request it. In Kinetic Stories the whole body physical interaction is a novel element in comparison to the story & cassette. A child needs to complete a gesture in able to go forward in the story. A motion sensor, such as Microsoft Kinect, attached to a bigger screen allows an interactive storybook experience to become a reality. In this master's thesis I will explain the procedure and thinking when creating The Kinetic Stories based on user-led design principles.

A considerable amount of literature has been published on Child-Computer Interaction. These studies indicate what makes children as users different compared to adults and how these factors are considered when designing an interactive product for younger audience. The other half of the literature analysis focuses on games and technology. Studies and articles describe conventions as well as user interaction heuristics in interactive applications aimed for children. In addition an analysis of few Microsoft Kinect games is

done to gain understanding of the current state of motion games. The referred game-related articles bear important factors and perspective for discussion about interactive application design for children.

The third part explains the interview procedure with kindergarten teachers and the outcome. The kindergarten teacher's gave many useful advices on how to make children listen to instructions. Their answers are reflected to the knowledge gained through out this master's thesis and then converted into a coherent solution for improving further the concept of Kinetic Stories.

Finally, the conclusion gives a brief summary and critique of the findings on designing an interactive story for children, especially the tutorial elements of the story, and the future development of Kinetic Stories concept.

1.1 BACKGROUND

Kinetic Stories was made in a company called Delicode. CEO **Julius Tuomisto** suggested collaboration for creating an interactive storybook concept in the spring 2012. My role was to be UI and UX designer, writer and Art Director of the concept. Other team members were: **Janne Karhu,** Lead Programmer and Animator; **Tommi Koskinen**, Sound Designer and later **Amin Alizadeh**, Programmer. **Inkeri Wallenius** would give her voice for the Little Red Riding Hood. **Anu Ahlgren** from Laurea UAS MBA wrote her thesis "Participatory methods in children and technology interaction design" where one part of her work was the first user test for Kinetic Stories with five four- to six-year-olds (Ahlgren, 2013).

The first chapter of Kinetic Stories, The Sharp-Eyed Little Red Riding Hood, is a 15-minute-long interactive animation including a book, was finished in August 2012.

The project has been since showcased in numerous festivals and competitions, where Kinetic Stories has received a lot of positive attention. The biggest achievement was the win in e-Entertainment and Games series in the **Word Summit Award** in Sri Lanka 2013.

1.2 MY PERSONAL HISTORY

My background is graphic design orientated. I graduated as a visual designer from the Tampere University of Applied Sciences in 2008. The practical knowledge of the field I achieved while working in Trainer's House (former Satama Interactive) and Digia as a Graphic Designer, and as a freelancer.

On my first year in Media Lab (2011-2012) I developed a small interactive story of **Dirk, the gentle wrestler** to iPhone in **Nuno Correia**'s Multitouch Interaction course. Tuomisto was present when we showcased our projects. He was interested in my ability to design, write and make graphics and he suggested a collaboration to create an interactive storybook concept for children. I find it very rewarding to participate in the whole lifespan of a project and therefore I became interested in Kinetic Stories.

1.3 OBJECTIVE

The main goal of this written part of the thesis is to find common practices, researched concepts and new information on how to communicate instructions for small children so they know how to play and enjoy playing an interactive story. After finishing the project part of the thesis, a lot of questions arose on possibilities on improving The Sharp-Eyed Little Red Riding Hood and especially on how to make children understand the events in the story. Further research was required to fully comprehend the difference between adults and children as users and on implementing newly discovered knowledge into a working prototype.

Writing a master's thesis is a process of discovery, dead ends, happy accidents and profound understanding. Starting from the practical project first, research second is not the most traditional approach. A lot of complications in Kinetic Stories would have been avoided if I had done it the other way around. Then again I would have not been able to concentrate on some specific details if I had not had the experience of creating the Kinetic Stories first.

In literature review I go through theories and articles about children and interaction. My ambition is to understand boundary conditions for what children are capable of. The more technical side of the literature review examines the possibilities of motion applications. I play through Microsoft Xbox Kinect games to recognize and analyse if there are design patterns or conventions to be seen.

Based on the questions and issues in The Sharp-Eyed Little Red Riding Hood interviews were conducted with child educators from kindergartens. Expectation was to comprehend typical behaviour of children under school age. Moreover the question was about the ways of channelling children's energy into right direction while keeping them motivated when instructing them to play. I have no first hand experience with such young children so I believe it is advisable to hear professional opinions how to guide a child.

In the final conclusions I add up what I have learned from making Kinetic Stories and what I have gained from literature and from the interviews. My objective is to list best practices for a designer to help to design an interactive motion application for children.

2 KINETIC STORIES

From the first vague ideas to a finalized demo it took over half a year to finish The Sharp-Eyed Little Red Riding Hood. The process was quite straightforward, with a professional team, detailed planning, and a fast pace. The first steps included writing the story and creating the concept, then continuing to a detailed storyboard, the character design, creating backgrounds and other assets, animating, programming, testing, adding sounds, and compiling the finished product. The process is explained in detail in the following chapters.

2.1 THE IDEA AND PURPOSE

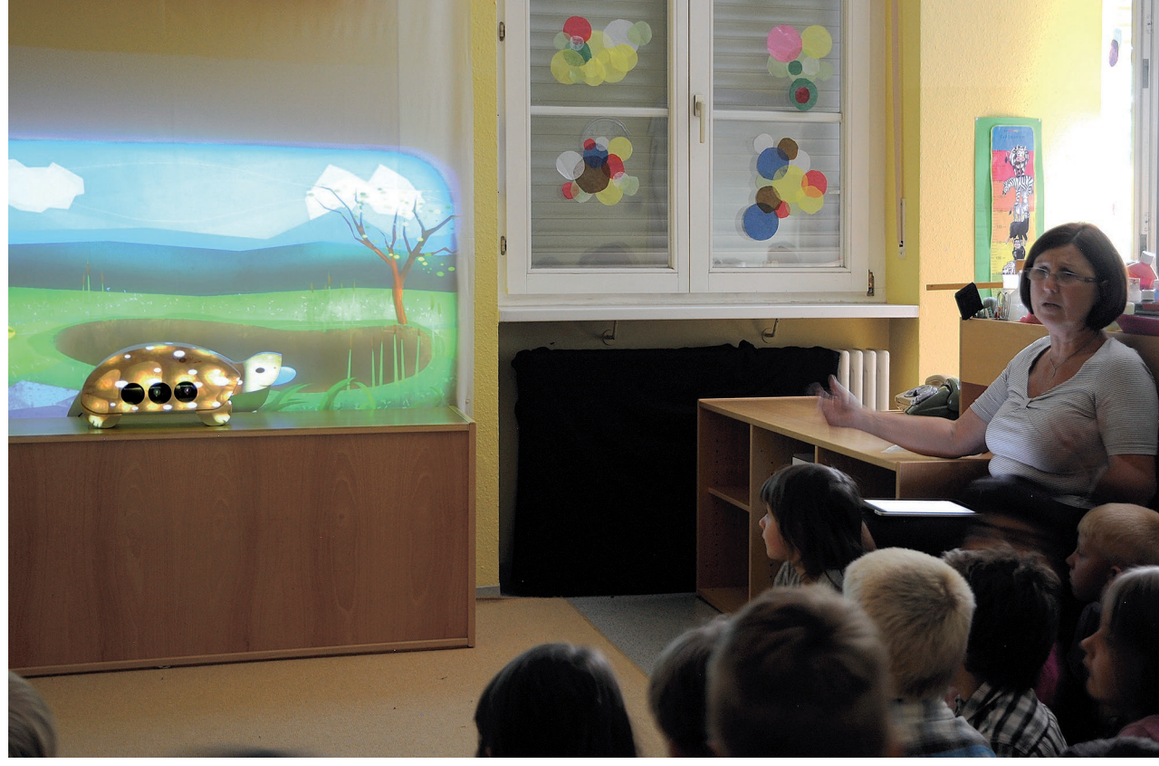
The idea of Kinetic Stories is very simple. As a team, we wanted to develop a new experience for children that uses well-known stories and motion tracking technology. Kinetic Stories would be a collection of interactive adaptations of famous classical stories, which would be played at home in front of a TV or a computer.

Children spend a lot of time in front of the TV. Therefore an animated and interactive story moment could be a nice addition to the entertainment experience. Embodied interaction is the business core of Delicode. Hartson and Pardha (2012, p.329) define the term: *"Embodied interaction refers to the ability to involve one's physical body in interaction with technology in a natural way, such as by gestures."* A gesture controlled interactive story would be an interesting addition to the market albeit nothing groundbreaking. Additionally motion games prompt positive effects for player by supporting positive emotions, social interactions and increased motivation (Bianchi-Berthouse, 2013). With motion tracking the child can actively be involved in the story and thus feel immersed in the fantasy world. When the whole body works as a controller, the child does not need to learn to use any external devices.

Kinetic Stories is more than an animation, but less than a game. It does not have game related logics for example accomplishing mission, collecting items or solving puzzles as well as the whole story being very linear. At the same time Kinetic Stories is more than just an animation, because a child can get involved in it. All the interactions are supposed to be simple enough for even younger children to play it.

The first story, The Sharp-Eyed Little Red Riding Hood, is the first part of the Kinetic Stories collection. The classic story by Brothers Grimm, the Little Red Riding Hood is under a public domain (Authorama, n.d.), meaning the intellectual property rights of Grimm have expired and stories are free to use. I decided to use these classic stories because they are well-known around the world. I adapted the story to make it more suitable for an interactive fantasy world while keeping in mind the target audience. Brothers Grimm sometimes wrote rather brutal details in their stories and therefore rewriting was necessary.

At the beginning of the project I searched for different motion-based interactive installations made especially for children. British artist Chris O'Shea's made Little Magic Stories (O'Shea, 2011) to combine two boys' narrative and illustrations to make an interactive performed installation. Another beautiful example is Puppet Parade from Design I/O (2011). There players' hand movements animated birds and their beaks while other players created flower dust in fron of the screen. One of the most inspiring project was **Fabian Gampp's** Gundula Stories (Gampp, 2012). A projector was mapped into a wooden turtle that had a Kinec inside. A kindergarten teacher told a story from iPad while the story was visualized on the screen. Kinect tracked children and the story reacted to children's movements. It



is very well executed interactive installation where the teacher plays an important role as a storyteller and an instructor. O'Shea's Little Magic Stories and Design I/O Puppet Parade were very visual, but more interesting was their lack of user interface. It was all based on imitating what other people are doing or trying and finding it out by yourself. In Gampp's Gundula Stories the kindergarten teacher was controlling the situation all the time. The teacher worked almost as a user interface when explaining to the children what to do.

After benchmarking interactive installations I decided to keep Kinetic Stories first part very simple, but visually outstanding. After all it was the first time I was designing anything similar. The Delicode team was experienced, but not in this particular genre of interactive stories and children. When I weighed up strengths and weaknesses of the team I decided it would be wiser to aim for executing an idea that was realistic enough to complete, rather than trying to build something too complicated which we would be altering endlessly.

2.2 THE PROCESS

During the spring 2012 I had meetings with Delicode CEO Julius Tuomisto to discuss the scale and outcome of Kinetic Stories and its first part The Sharp-Eyed Little Red Riding Hood. The concrete goals and timeline were set when we received the Think Ink funding for making the first demo.

2.2.1 THE STORY

I had plans of writing a new story on my own. At first I intended to create a generative storyline to produce variance for every gameplay. As I soon realised, generative writing takes a lot of time and effort. Because of the tight schecule I decided it would be wise to look for another option.

In public domain the original author or artist does not hold the intellectual property rights to his or her piece of work anymore and that piece becomes publicly available. The fairy tales by Brothers Grimm are public domain (Authorama, n.d. and Gutenberg, 2013). Stories can be used or rewritten freely by anyone. Some of

the Grimm's classics, such as Snow White, Sleeping Beauty and Rapunzel are very well known because of Disney adaptations. Kinetic Stories is supposed to be a series of interactive stories so the fairy tale archive by Brothers Grimm would suite the purpose perfectly.

I chose the Little Red Riding Hood to be the first story. It is well known, so a little modification does not remove the recognisability. The original version felt too strong and violent for me so I rewrote the whole story while still keeping the main plot in focus. My godmother **Terttu Huhtanen**, who has worked as a kindergarten director, told me that when children hear a story, they imagine the scenes with the capability they have. For example children might think of a scary thing, such as getting killed, is similar to falling asleep and thus not scary anymore. However a visual image and especially animation becomes real straight away. Hearing a story of a wolf getting killed is not nearly as scary as to actually see the wolf getting killed in an animation. I wanted the story to be less grim and more adorable. The wolf would not be killed in the Little Red Riding Hood as Brothers Grimm originally intended.

Rewriting a less violent version of the story was not enough. I needed to embed the interactions within the events in the Little Red Riding Hood and write verbal guidance. Performing the interactive gesture should feel natural and self-evident in the context. Majority of little children cannot read so the user interface has a lot of spoken instructions, requests and praise. I needed to visualise all the interactive situations to write a script for the narrator, Inkeri Wallenius.

2.2.2 THE VISUAL STYLE AND CHARACTERS

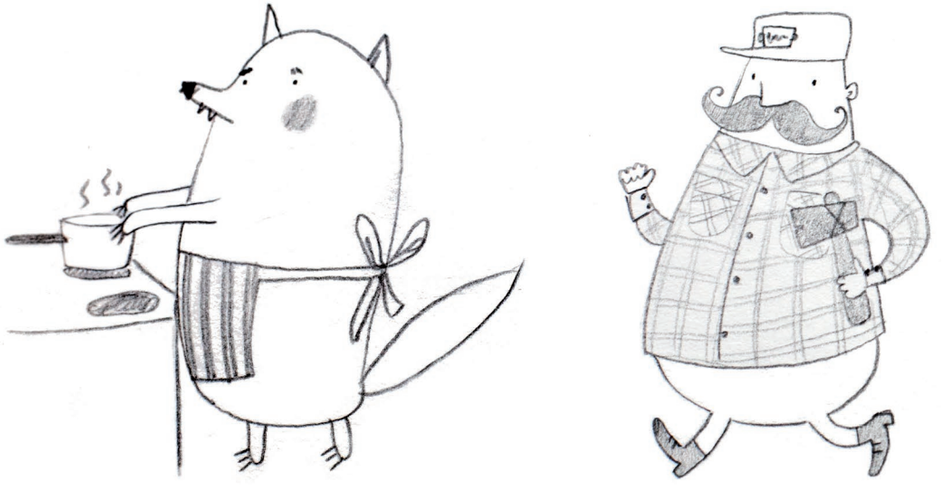
The creation of characters was effortless after the story was decided. I draw multiple sketches of Little Red Riding Hood and her companion. I was set on simple, yet colourful visual style. It should appeal to both girls and boys as well as their parents. After the sketches were done I drew the characters in Illustrator, after which I added textures in Photoshop. I had to stay very organised when moving bits and pieces from one software to another.

One essential part of the design was to make the characters easy to animate. Body parts, arms and legs, needed to move freely. Basically, all the limbs would rotate around the pivot point, similar to a marionette puppet. Animations and interactions would be simple loops so characters were allowed to be a little awkward. I used **Mikko Kunnas'** Kolme ässää as a reference of style in animation.

2.2.3 THE CONCEPT

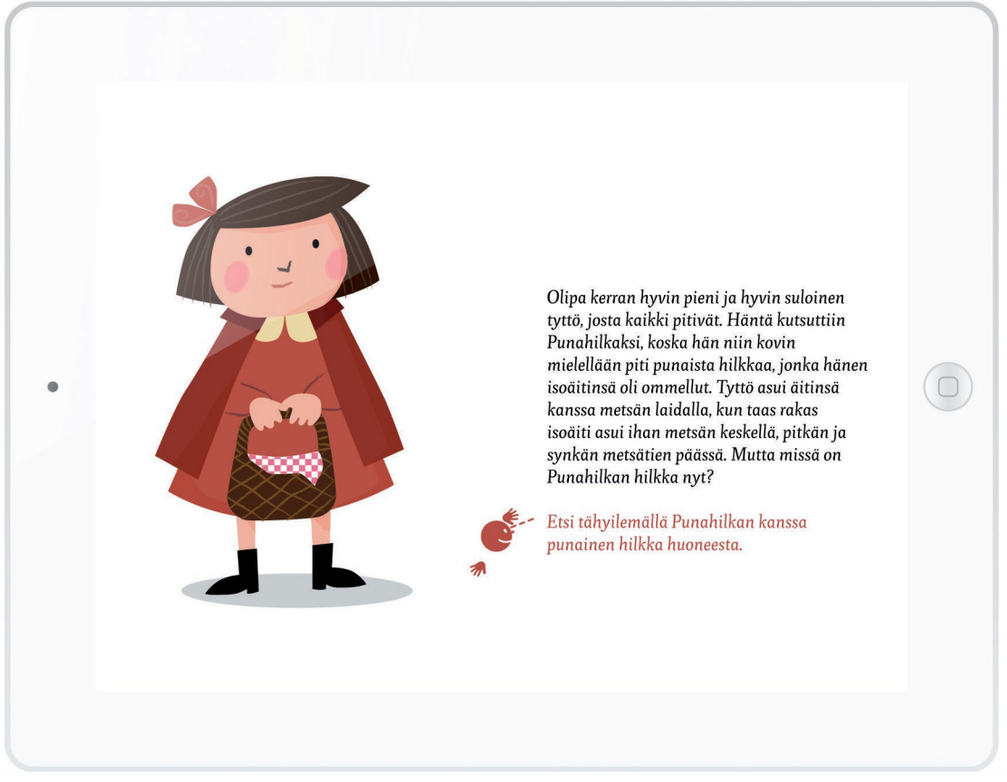
Designing interaction to the story was a new challenge for me. On the other hand, I had grown a strong interest in **Natural User Interfaces**. In **Ferhat Sen's** 2011 Bodily Interaction course in Media Lab I had familiarised myself with motion applications by producing a simple memory game based on postures. The course offered valuable information about the possibilities of motion and skeleton tracking.

At first we were ambitiously planning more interactions to The Sharp-Eyed Little Red Riding Hood, but realised soon after that both the time frame and the size of our team were more suited for



prototyping a simple demo. Staying in the timeframe provided was important even though it would mean only one interactive gesture: the user raises a hand to the forehead in order to look further ahead or trying to see better. We were going to use this gesture in multiple parts of the story.

The concept included a detailed scene-by-scene plan, of the visible characters, their dialogue and interactions, as well as the animations and sound effects.



2.2.4 THE FIRST USER TEST

We made a first rough user test at the very beginning of the project with a four-year-old girl. The story was read to her from an iPad with some pictures of the characters. I included a playful interaction of "looking further" into the story. The purpose of the test was to get instant feedback whether the story was interesting, characters fitting and guidance understandable. She was enthusiastic about the characters, but did not enjoy the scariest part of the story. In addition she required help to understand the gesture so thorough guidance was an obvious improvement for the next implementation. I also took her feedback into consideration when drawing the rest of the graphics and putting some extra attention to the scenes involving the wolf.

2.2.5 THE STORYBOARD

We decided to build Kinetic Stories on 3D graphics and animation software Blender, due to our lead programmer Janne Karhu's expertise with the programme. The team was working in different cities which made flawless communication between the parties important. I delivered a detailed concept and drew storyboards so that Karhu would be able to start programming. The storyboard proved to be an excellent way to communicate visual ideas. It summed up all the details from interaction to animation, camera angles and placement of the characters. I had everything very clear in my head, but another person cannot possibly think in the same way. Even though making the storyboard required time, the effort was rewarded when things needed to be done and explained only once.

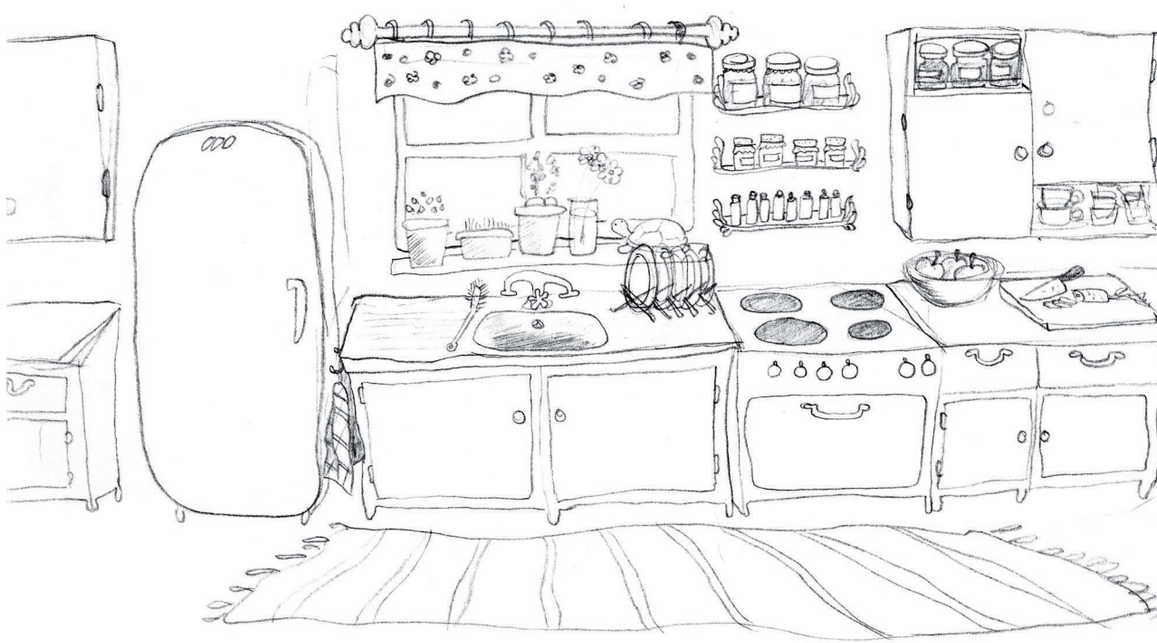

BLAA
BLAA

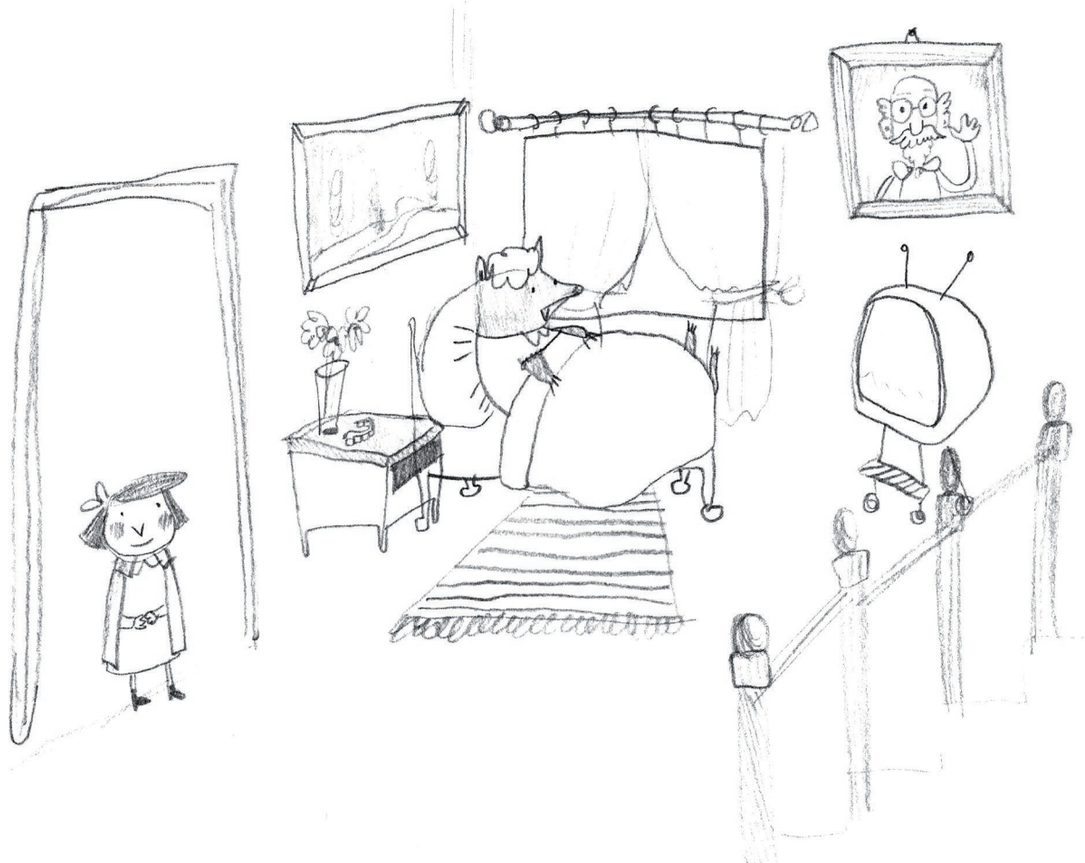
2.2.6 THE GRAPHICS

Drawing graphics was the most intensive part of the project in summer 2012. To create a parallel scrolling effect in the background I drew four different layers that would be moved in slightly different speed when the main character walks past the scenery. I started by sketching the overall look and feel on paper, after which I drew the shapes in Illustrator. I made the composition and arrangements in vector format and moved the composition to Photoshop to add a texture layer. Naming the files correctly seems obvious, but when keeping track of dozens and dozens of files it became even more important. I ended up with five different interiors: Little Red Riding Hood's bedroom and kitchen and grandmother's bedroom, pantry and kitchen. Outdoors scenery consisted of the forest between Little Red Riding Hood's home and grandmother's cottage, and grandmother's garden illustrated in two different angles.

2.2.7 THE SOUND

During August 2012 we implemented sounds with Tommi Koskinen's help. He created the theme song as well as the atmospheric music and different sound effects for story elements and characters. Inkeri Wallenius gave her voice to the narrative similarly as she had done for Tao Tao cartoons of my childhood. We needed to record a lot of voices, commands and praises for the interface. The voice would be the main user interface element in The Sharp-Eyed Little Red Riding Hood, giving children the instructions what to do.





2.2.8 THE BOOK VERSION

During the final weeks of August I created a book version of The Sharp-Eyed Little Red Riding Hood. There is a QR code printed at the end of the book, which takes the user either to the kineticstories.com website or, if the code is shown within the game, it opens a secret level where a child can dance freely in a disco with the main characters.

2.2.9 THE DEMO

The final stretch of the project was hectic. There was a lot of fine-tuning and altering to be done. We did not have time to test the application with children, which is never advisable. A promotional video of the gameplay was shot together with the four-year-old girl we tested the earlier version with. She seemed to enjoy the experience a lot.

After the demo was finished in August 2012 we needed to make the world aware of what we had done. Using social media channels, Facebook, Twitter as well as the website kineticstories.com we informed everyone interested in the next steps of the project. The end result was an independent application for Mac or PC attached to a Kinect motion sensor and preferably a bigger screen.


THE SHARP-EYED
LITTLE RED RIDING HOOD
R
E D

2.3 THE OUTCOME

The Sharp-Eyed Little Red Riding Hood is a simple concept. In the opening menu you have to practice how to "look further", raising a hand to the brow. When the user looks further the second time the story begins.

Camera starts rolling when Little Red Riding Hood wakes up in her room. She is wearing her pyjama so the player needs to help her to find the red cape. After changing clothes she goes to see her mother in the kitchen who asks her to visit her grandmother and take a gift basket along. On the road to the grandmother's cottage she meets a wolf who advises her to collect flowers to make the grandmother happy. While Little Red Riding Hood is collecting the flowers, the wolf runs to the grandmother's cottage and captures her to a pantry. When Little Red Riding Hood arrives to the cottage, the wolf is dressed up as the grandmother and pretends to sleep in her bed. When the two of them are talking the wolf attacks and captures Little Red Riding Hood and locks her in to the pantry as well. A huntsman comes to the cottage to see if Little Red Riding Hood is all right and finds out of the evil plans the wolf had made. With the player's help the huntsman captures the wolf and rescues Little Red Riding Hood and her grandmother. At the end everyone is happy and they all enjoy a lovely dinner in the garden. The wolf is also with them, tied to the chair.

After the end titles the main menu reappears. Player has a choice to open the secret disco level with the QR code from the book or play the story again. The secret disco is a free form dancing place. When the child moves Little Red Riding Hood moves in the same manner. Disco is divided into two regions: a country disco and a city disco. Taking sidesteps in front of the TV changes the disco music from city style to country or vice versa. Playing through the entire story takes approximately 15 minutes.

The story resembles short animation series on the TV children are familiar with. The difference is that the child can be part of the story. When the interaction starts, the player needs to react and help the character. The problem is always the same; the character needs the player's help to look around to find important things. When the player has succeeded with the action the story continues automatically. There is no generative elements or other gestures to do.

Anu Ahlgren from Laurea university of Applied Sciences made the first user test for Kinetic Stories as a part of her thesis *"Participatory methods in children and technology interaction design, Case Little Red Riding Hood* " (Ahlgren, 2013). She tested seven four- to six-year-old children in a kindergarten. During the test Ahlgren made numerous observations of technical or design errors. For example the Kinect camera did not detect small and slender children, did not respond to their movements or stopped suddenly working completely. Children who participated in the test were very excited about the concept, but were disappointed after playing the game. They felt frustrated about

keeping their hand up for a long period of time and felt tired of all the time spent standing up. Children would have wanted to play the game sitting down. Most of them would have preferred to play the game together with their friends or parents. Children need to have a possibility to choose what to do and when. Some would have wanted to play the secret disco-game a lot more and whenever they wanted. Ahlgren asked us to pay attention to words we were using when giving instructions and recommended us to make a user test with children about the actual words used. Ahlgren mentioned that difficulty levels could make the story more immersive. Consequently the story should be more difficult for older players. (Ahlgren, 2013)

Ahlgren's (2013) user test left me puzzled. The group she interviewed was rather small and all kinds of things could have influenced their feelings about the story, especially the fact that the game was not functioning properly. Nonetheless after playing The Sharp-Eyed Little Red Riding Hood they did not seem to be enthusiastic about it anymore. Vilkko-Riihelä (1999) mentions that executing research with young children is problematic because they are so easily influenced by everything non-research related. All Ahlgren's observations were good and they should definitely be examined to improve the project. Several rounds of user testing and iteration are required to fine-tune the game (Höysniemi et al., 2005b). Conducting the user test with children is necessary as their behaviour cannot be predicted or simulated. The testing method can make or break the outcome and for that reason the test results need to be examined critically. The younger the child, the more careful the researcher needs to be when making generalisations (Vilkko-Riihelä, 1999).

Ahlgren (2013) proposed relevant questions. What is the purpose of an interactive story application compared to a game? Is it the precise movements in the interaction, the content of the story or something else? For me an interactive story application is another way to enjoy favourite stories in comparison to books. The interactivity elevates the story to another level where the listener can be a part of the events.

If Kinetic Stories would be a game it had not been so linear. There would be multiple possibilities to solve problems. The actions and puzzles would overcome the original fairy tale. The story of Little Red Riding Hood would just merely be a theme keeping it all together.

2.4 THE FUTURE OF KINETIC STORIES

Since the demo was completed it has participated in numerous competitions and exhibitions. Generally people have been very enthusiastic about the idea and we have received a lot of positive feedback. The project has not claimed the pre-schoolers living rooms yet as Kinetic Stories lacks an attainable platform. Everything works fine as an installation, but as an application it requires multiple steps and technical knowledge: owning a Kinect, a computer and preferrably a TV, downloading and running the program, and making the necessary connections.

The marketplace of Microsoft Xbox would be a natural place to distribute our story. Young families most likely received their Kinect sensor with Xbox. One 15-minute-long story is small compared to the marketplace full of big blockbusters. Luckily nowadays independent developers can sign up and apply for the **Independent Publisher Development Program** (Microsoft, 2014e). Mobile ecosystems such as App Store by Apple and marketplaces by Android and Windows would offer a more suitable platform, but our application is not designed for mobile use.

One alternative platform for Kinetic Stories is on Smart TV. For example Smart TV by Samsung (Samsung, 2013) has a built-in motion sensor and voice recognition. It also includes a virtual store where small applications can be purchased and accessed. In the near future platforms will have more competition. If there is a secure and a viable ecosystem with quality content, users will be likely to follow. Delicode took a risk of developing Kinetic Stories before the market for interactive motion control stories has mainstreamed.

To be considered as a serious product, Kinetic Stories should include more content in addition to The Sharp-Eyed Little Red Riding Hood. Therefore Delicode has decided to extend the application with following stories: Hansel & Gretel, Bremen Town Musicians, and the Four Skillful Brothers.

2.5 CONCLUSION

The first fairy tale of Kinetic Stories, The Sharp-Eyed Little Red Riding Hood, is undoubtedly an interesting concept. During the project I had to use all my skills and knowledge as a concept designer, a writer and a graphic designer. We had a fantastic team where everyone excelled in their own field.

Ahlgren's (2013) user test revealed some big flaws in the design and execution, which was a necessary wake-up call. It reminded me to learn from mistakes and thus become a better designer. It established my curiosity in the matter of designing an interactive application for children. I feel pride of what we have achieved, but how can we improve our work in the future?

The audial and visual quality was mentioned as one of the main aspects of what makes a good game according to the children (Mäyrä & Ermi, 2005). Kinetic Stories' visual style has received a lot of praise and I am extremely proud of the outcome. Tommi Koskinen did an excellent job with audio. The music, the narrative and the sounds together make The Sharp-Eyed Little Red Riding Hood a quality product.

Koštomaj and Boh (2011) conducted research about the users of an interactive storybook. They noted that movement was influenced by many factors, for example the dynamics and the rules of the game, the rhythm of the music and the physical playing space (Koštomaj & Boh, 2011). Higher tempo and dynamics can exhaust players so Koštomaj and Boh (2011) used different techniques, such as altering the rhythm of the music and fine tuning the gestures to more accurate ones which required children to calm down and concentrate. Kinetic Stories has a very calm rhythm and player does not need to move much. A continuous calm rhythm and monotonous interaction can leave a negative impression of the game. On the other hand too high tempo leads to exhaustion. Kinetic Stories would need some variance in the tempo to ensure that the children have enough energy to play through the required 15 minutes.

The problems of The Sharp-Eyed Little Red Riding Hood are not in the story, sounds or visuals, but in the technical difficulties and interaction design. Children who tested the game did not enjoy playing it or did not understand the concept (Ahlgren, 2013). So I need to take a step back and concentrate on the literature of children's expectations and conventions used in motion games.

3 CHILD-COMPUTER INTERACTION

Child-Computer Interaction (CCI) is a research area specialized on targeting how children act as users in a digitalized world. It is closely related to Human-Computer Interaction (HCI) that is focused on the user experience, playfulness and communication (Read & Bekker, 2011). Read and Bekker's (2011, p.7) detailed definition for Child-Computer Interaction is:

> *A study of the Activities, Behaviours, Concerns and Abilities of Children as they interact with computer technologies, often with the intervention of others (mainly adults) in situations that they partially (but generally do not fully) control and regulate.*

Generally CCI and HCI have the same interest, but a different target audience. CCI also takes into consideration the influence of the adults. Interaction Design and Children and Child-Computer Interaction are the two keywords for searching papers from the field. Read and Bekker (2011) mention that during the past decade a growing amount of papers have been written about the subject: from 15 papers in 2003 to 85 papers in 2010. Children using the internet was an important topic ten years ago, but now other subjects, such as playing exergames, have come to replace it. Short lifespan of research topics does not make CCI obsolete. It does, however, show how rapidly the technology advances.

3.1 ABILITIES OF CHILDREN

In a motion game context, the most apparent difference between an adult and a child is the physical size. Read and Bekker (2011) have listed other distinctions, such as children's developing motor skills, memory and processing abilities in addition to children's reading ability. Adults and children definitely have different capabilities and motivation. To understand children more profoundly, some theories from the field of psychology can help.

Jean Piaget (1896-1980) was and still is one of the leading psychologists specialised on children. His theory of cognitive development covers the whole childhood. The theory consists of four stages: Sensorimotor from newborn to two, Preoperational from three to six, Concrete Operational from six to twelve and Formal Operational from twelve years onwards. The Preoperational stage interests me the most as the target group for Kinetic Stories consist of children of three- to six-years-old. At the time children start to develop motives not instantly related to physical well being, compared to the earlier stage, but thinking has not yet developed into more advanced level that comes in Concrete Operational stage. (Vilkko-Riihelä, 1999)

At the beginning of the Preoperational stage children cannot differentiate themselves from the world. They are egocentric and cannot see the world from another point of view than their own (Mitchell, 1992). *"The young child's grasp of things is intuitive and highly subjective, rather than logical and objective"* (Mitchell, 1992, p.7).

In the Intuitive Thought Substage, from four- to seven-year-old, stories are important tools for developing children's thinking. The child can easily identify with the story characters and process positive and negative emotions, such as success and fear. Stories are a way to teach moral. Children are not able to process all emotions, especially fear, so they need an adult to explain and to reflect. Furthermore, children cannot differentiate the story world from the real world. Stories are handled with the resources they have. Therefore everything is taken quite literally and thinking is concrete. (Vilkko-Riihelä, 1999)

In The Sharp-Eyed Little Red Riding Hood the wolf is the bad guy, a scary villain. Turning dangerous animals into lovable creatures can make children believe that all, for example wolves, are just appealing characters not to be scared of. Stories are just stories and for that reason children need adults to explain the reality.

Different psychological theories need a critical point of view. Children develop individually and in different time. Early relationships and the environment give the base for growing up to become an individual thinker. On the other hand theories give useful generalisation to understand physical growth and the reasons behind children's thinking and behaving. I believe it is important to know few basic theories, because they work as general guidelines when designing for children.

3.2 MOTOR LEARNING

A child's motor learning is rapid. A one-year-old is already learning the most fundamental movements such as walking and balancing. Motor learning is an internal process that reflects a capability of performing a motor task (Schmidt & Wrisberg, 2004). Learning is primarily based on repetition, and the most effective way to learn is observing the motor performance of others (Schmidt & Wrisberg, 2004). Mimicking has been acknowledged as the best way to learn a movement (Bianchi-Berthouse, 2013; Höysniemi & Hämäläinen, 2005a and Schmidt & Wrisberg, 2004).

Motor development progresses from the head to the toes and from the centre of the body to the fingertips. Most of the essential learning happens during the first years. Young children learn by sensing and doing. The basic skills of walking, running and jumping comes before a specific skill such as skiing or skating. The awareness of one's own body and ability to move freely makes the child an individual, a person not dependent on parents or surroundings. (Numminen, 1996)

"Motor skill – A skill for which the primary determinant of success is the quality of the movement that the performer produces" (Schmidt & Wrisberg, 2004, p.5). Schmidt and Wrisberg (2004) divide task-based skills in discrete, serial and continuous types. Discrete skill, such as throwing a ball, has a defined beginning and end, and it does not last long. Serial skill, for example brushing teeth, has many discrete skills connected together in an order. Continuous skill does not have a clear end or beginning, but it is more repetitive or rhythmic such as swimming or bicycling. (Schmidt & Wrisberg, 2004)

Muscle memory is a local storage for repetitive physical actions (Hartson & Pardha, 2012). In addition, sensory memory enables a child to stay within rhythm (Hartson & Pardha, 2012). Children enjoy playing games and moving with distinct rhythm and tempo. Movements according to sound are pleasurable (Numminen, 1996). In Koštomaj and Boh's (2011) research higher tempo in a game increased the movement. The variance of the rhythm was preferred, as the children did not get tired as easily. When tasks requiring finer motor skills were involved, children calmed down (Koštomaj & Boh, 2011).

Games aimed for younger children focus simply on learning a new task while games for older children tend to have a scoring mechanism allowing them to become better and comparing their progress to other players or their previous achievements. Bianchi-Berthouse (2013) calls the enjoyment easy fun and competing for a better score hard fun. Motion games, such as Nintendo Wii, Sony Move and Microsoft Xbox Kinect, can bring joy and encourage children to move. They do not replace practice, but motion games can enhance the motivation.

3.3 PLAY

Playing is a way to learn (Piaget, 1951). Moreover children develop their social relationships, emotional life and mental abilities through playing (Vilkko-Riihelä, 1999). It helps them understand different concept. Through imagination children can process thoughts and ideas.

Between the ages of two to three children play mainly alone. They guide themselves and talk aloud the rules of the game. At the age of three to four motor skills have developed sufficiently for children to be active. They can play with each other but do not always need company. The rules of the play can change in an instant. Children play role games to try safely different roles such as being a doctor or a fire fighter. Six-years-old can follow rules and play organised games with other children. They have more patience in comparison to four-year-olds. Imagination and roles have deeper and more complicated structures than before. Seven-years-olds identify strongly to their fellows and want to do and like the same games and music as others at their age. (Vilkko-Riihelä, 1999)

When players enter the game world, they come out with new experiences and interpretations (Mäyrä & Ermi, 2005). We can give the rules and the items for children to play with, but most certainly they will come up with their own way to play and develop own memories of the events. Playing feeds the imagination (Piaget, 1951). Mäyrä and Ermi (2005) wrote that the fantasy world; characters, the world and the storyline, are the central elements in games children enjoy playing. One reason for this is the actions and decisions they would not be able to do in a real life (Mäyrä & Ermi, 2005).

The key elements for designing a motion game for children are robustness, responsiveness, intuitiveness and physical appropriateness (Höysniemi et al., 2005b). Robustness is crucial for concentration and perseverance. A product which fails to work is not even worth using. Responsiveness and especially an immediate response are self-evident for a game to work. Intuition, on the other hand, is essential when the user is learning to understand the mechanics. We act in a predictable manner based on conventions. For example, some babies have adapted to the touch screen convention and try to apply it even to glossy magazines. Physical appropriateness means that the user is detected and treated accordingly. The tracked body image responses to the avatar movement in the game. Höysniemi et al. (2005b) discovered that in Quiqui's Giant Bounce -game, children had their own way of performing certain movements. For instance, when the dragon was supposed to swim, some children swam dog paddle, some breaststroke and some butterfly stroke (Höysniemi et al., 2005b). Children do not care if a computer will not recognize their swimming technique as for them their technique is the right way to do it. In a natural user interaction the computer adapts to the children and not the other way around.

3.4 USABILITY HEURISTICS

Norman and Wadia (2013) state that people tend to ask these questions when operating a new product:

1. *What can I do?*
2. *Where? How?*
3. *What happened?*
4. *How do I get back (undo)?*
5. *Help in understanding how the product works.*

Norman and Wadia (2013) further elaborate questions one, two and four the need for clear visible cues and question three the requirement for feedback. Furthermore, question five must be included as a coherent model in the product. For me these questions summarise the design of an interactive application. All questions need a simple answer before an implementation becomes a product. User should never feel the need to ask any of Norman's proposed questions. A product or an application design is a flow requiring meticulousness in every step from the beginning until the end.

Although designers tend to imitate the real world with buttons, switches, lights and sliders when designing user interfaces, it is sometimes very hard to recognise the interactive parts of the interface. Signifiers are perceived signals that user can recognise as an interaction point (Norman & Wadia, 2013). Children are not overly accustomed to user interface conventions. For this reason a designer needs to remember that when designing a user interface.

Norman and Wadia (2013) emphasise the importance of immediate, intelligible and informative feedback. *"Give users a sense of control over their experiences"* (Hartson & Pardha, 2012, p.692). The control is guaranteed when the user knows what to do in the application. Technology can sometimes be erratic. A good feedback system allows user to correct the gesture regardless whether the fault was in the detection or in the user's movements (Norman & Wadia, 2013). A good tutorial, a written or spoken help, animated model examples or a video are ways to describe tasks to user. Schmidt and Wrisberg (2004, p.276) say that: *"One of the most important ways practitioners can influence the learning process is by providing people with feedback about their actions"*. Feedback can become intrinsic from awareness of one's own body motions or extrinsic, for example, a judge providing ratings of the performance (Schmidt & Wrisberg, 2004). In videogames extrinsic feedback can be a score table.

3.5 CHILDREN AS USERS

Children are a tabula rasa, a blank slate, ready to be filled with all kinds of information, experience and inspiration. They were not born as computer experts, but they will soon grow up being ones. Everyday life has certainly become more technology orientated; such as it was for me as a six-year-old girl, using the computer for the first time in 1990.

Children as users are fresh and inexperienced. They do not know about conventions or logics. Instead they start trying and if it is interesting enough they will figure it out and start using it. I learned using DOS, because I wanted to play the PC game Commander Keen. My dad told me the basic commands and I copied them with an eagerness of a monkey, many years before I was able to understand English let alone write properly.

Today children grow up with computers, smart phones, game consoles and tablets. "*These days, kids are on computers almost as soon as they can sit up and move a mouse or tap a screen*" (Nielsen, 2010). They start using digital appliances from early age and learn new things on the go. Jacob Nielsen made a thorough user test of children

using the Internet in 2001 with six- to twelve-year-olds and in 2010 with three- to twelve-year-olds (Nielsen, 2010). Although Kinetic Stories is not a website, the actual game does have similarities with the investigated websites, such as navigation. Some of the key facts that Nielsen (2010) discovered included children's willingness to try many different options, eagerness for instant gratification, preference for sound and animation and real-life reference for spatial navigation, especially for pre-schoolers.

Whitebread (2001) remarks how the attention spans of children are short and they have to be engaged with something familiar with a promise of something new.

> *Activities intended to help young children learn must first and foremost interest them, intrigue them and be personally relevant for them. Only then can their motivation be held, because they have not yet learnt to exercise deliberate control very effectively. (Whitebread, 2001, p.123-124)*

Making an application relevant to the user sounds self-evident, but as it is a fundamental attribute, it is worth mentioning. Kinetic Stories tries to make the game personal by putting the child in the shoes of the main character.

Nielsen remarks that children "*…tend to reuse the same method they've used before to initiate an action.*" (Nielsen, 2010). When children learn one way to do a thing they repeat it even if it does not fit the situation. Failure reduces their interest. Guiding children to right gestures starting from the beginning is crucial. This is especially true in a story game that is based on motion.

3.6 HOW A GAME MOTIVATES CHILDREN

Motivation keeps people trying and going forward. There are multiple ways to enhance a child's motivation. "…*It is reasonable to presume that the motivation of most learners is related to their perceptions of success in achieving their goals"* (Schmidt & Wrisberg, 2004, p.191). If a task at hand is too easy or too difficult, it does not motivate. For continuous motivation the task needs to be possible and prosperous.

People are more motivated for personally related and process-oriented goals (Schmidt & Wrisberg, 2004). *"As long as learners feel they are competent or successful, they will continue to be motivated."* (Duda, 1993 and Nicholls, 1989, cited in Schmidt & Wrisberg, 2004, p.191) Social factors, the possibility to share the experience with others is influental (Bianchi-Berthouse, 2013).

The value of positive feedback should not be questioned. Children learn movements by observing how other people do the same task and if they hear praise or find it enjoyable, they will continue the action until they learn it (Schmidt & Wrisberg, 2004). In The Sharp-Eyed Little Red Riding Hood the mouse that provides user support cheers every time the child performs a movement.

Visuality including the characters and the animations is important as well. McCue (2005) investigated that recognizable characters, interesting animations, sufficient interactivity and different difficulty levels make the game succesfull.

The context for playing games is usually at home with friends and family (Read & Bekker, 2011). Social factor is significant. The shared experience, the social factor of the game makes playing with friends and family motivating (Bianchi-Berthouse, 2013).

4 MOTION GAMES & TECHNOLOGY

Myron Krueger was one of the first pioneers in motion-based applications. His work Videoplace in 1980's (Krueger et al., 1985) was as advanced as many Kinect games are today. In the Videoplace a camera was tracking body movements, which were projected to a screen. Player could make objects bigger and smaller, capture them in hands, pushing them around and live paint with hands (Krueger, 1988).

Since Videoplace there have been several commercial products based on body movement, for example Me2Cam from Intel and Mattel in 1999 (D'Hooge & Goldsmith, 2001), EyeToy from Sony in 2003 (IGN, 1234), Wii from Nintendo in 2006 (Nintendo, 2014) and Move from Sony PlayStation in 2009 (Parrish, 2009), not to mention numerous dancing, shooting and driving games in arcades. Microsoft published Kinect motion sensor in 2010 (CNet, 2011).

There are also other motion sensors such as Asus Xtion (Asus, 2014) and PrimeSense Carmine (PrimeSense, 2014). The future of motion sensors is likely to be interesting.

The term Natural User Interface (NUI) is often associated with motion sensors and their interactive applications. Natural User Interface can be defined as something intuitive, easy to use and easy to learn or all of the abovementioned (O'Hara et al., 2013). User's gestures and movements are the way to control the computer. New vision and depth-based sensors, for example Microsoft Kinect, have been developed to make natural use possible. Designing a controller-free interface bears problems and inconsistencies. Accuracy of movements, tiredness when moving around and utilizing adequately space in motion are just some of the challenges. On a positive side, a low learning curve and a total immersion in starting to use a natural application make it interesting. Controller-free usage is hygienic and thus allows the use in public spaces or for example in hospitals (O'Hara et al., 2013).

Norman (2010) gives a critical perspective for natural user interfaces. Different gestures, such as a headshake or a handshake, have a culture related meanings (Norman, 2010). How to design a set of globally acknowledged gestures? In comparison to gestures, a mouse click is universal; it does not awake any emotions or offer another interpretation. It is precisely what it is, an accurate point and click with an external device on a Graphical User Interface (GUI). Moreover gestures are not a proper input method for more precise actions, for example designing a house or writing a novel.

How does body recognition adapt to a person with a disability or an injury? Communicating, for example two hand gestures, is not possible to commit if the other hand is disabled. Norman (2010) mentions that gestures are ephemeral: they do not leave a trace, they can sometimes be hard to track or some unintentional gestures are tracked as inputs. Furthermore Norman (2010) states that gestures require a learning curve. A more complex system requires different gestures for different purposes. People can generally remember six gestures and after that the cognitive load is too much (Microsoft Corporation, 2013). Norman (2010, p.5) concludes, "*…standards are more important than optimization*". If some system becomes widely used and accepted it is hard, if not impossible, to change it. Standards and conventions make sense in the ever-changing world.

Playing a motion game requires a lot of space compared to playing on a computer, a console or a mobile phone. According to Höysniemi et al. (2005b) the playing area should be big enough and there should not be too quick changes in transitions between movements. Moreover the environment should be included in the interaction design (Hartson & Pardha, 2012). One very important detail in motion games is to communicate where the invisible borders of the playing area are. Physical space influences player's experience (Koštomaj & Boh, 2011). Too small space or obstacles can restrict the experience and obstruct free movement. Designers cannot influence the actual physical space, but they can contribute by telling instructions to clear the space and guide the user to stay within the game zone.

4.1 KINECT GAMES

Designer does not need to re-invent the wheel in a modern information society. The Human Interface Guidelines for Kinect, published by Microsoft Corporation (2013), recommends that a designer should take cues for gestures from the existing Kinect applications. To understand better how Kinect-controlled games work, it is best to play them. I tested six different Microsoft Kinect games and made observations how user interface and interaction were built and instructed. The test included the following games, released for Xbox 360: Kinect Adventures!, Kung-Fu High Impact, Big League Sport, Hulk Hogan's Main Event, Kinect Motion Sport and Sesame Street: Once Upon the Monster.

4.1.1 KINECT ADVENTURES!

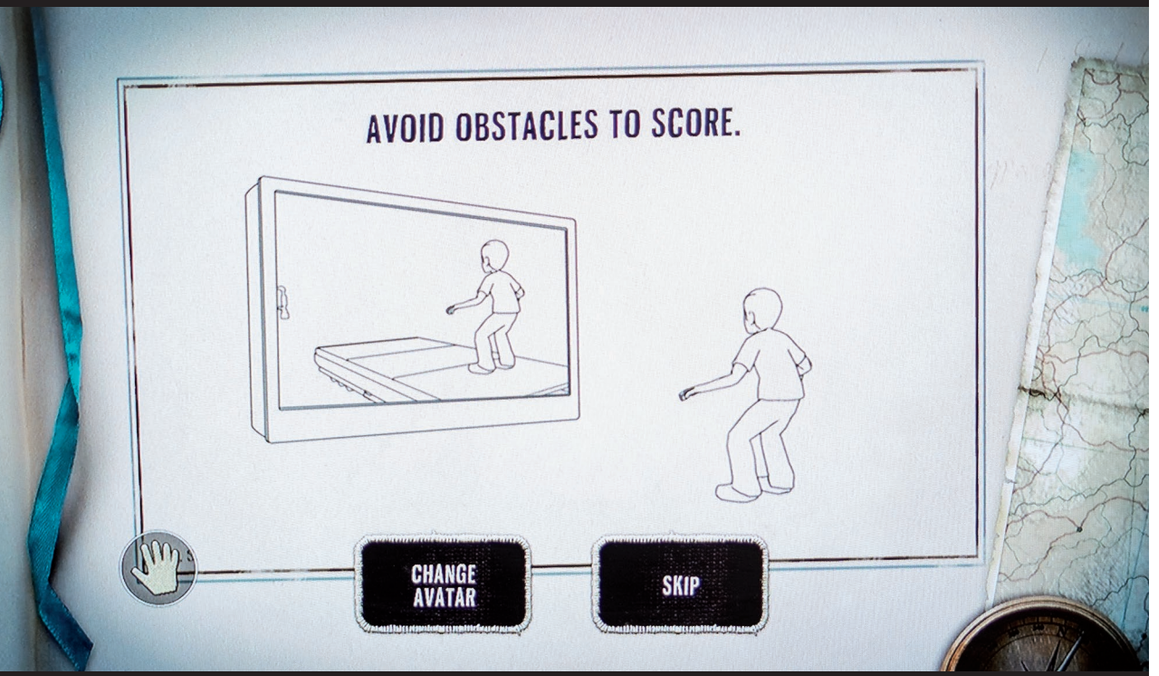
Kinect Adventures! was released 2010 and sold along with the Kinect motion sensor (Microsoft Xbox, 2014b). It is safe to assume that most people who have bought Kinect motion sensor have also played this game. Kinect Adventures! has many gestures that have since become standard in Microsoft Kinect games. For example to

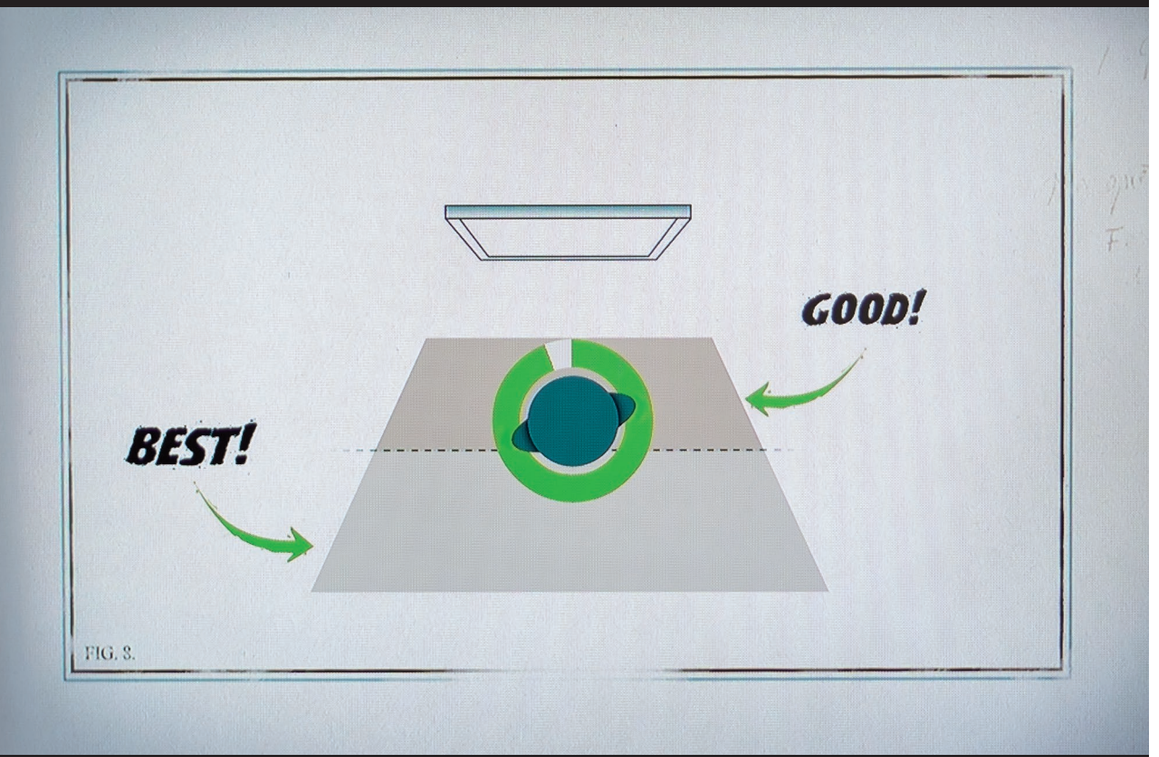
pause the game the player needs to hold the left hand in a 45 degree angle for couple of seconds while the right hand is resting on the side.

Starting from the main menu Kinect Adventures! has approached the design from user and technology perspectives. When there are no traditional controllers and the only pointer is the player's hand, it means a less accurate aiming. Five different game mode icons are in the middle of the screen, side by side. They are big, colourful and easy to aim. The "pointer" is the hand icon. When you want to "click" something you just hold your hand still for two to three seconds and an animated ring goes around the hand icon. During the two seconds you can cancel the "click" by moving your hand away. Big enough hotspots are vital for hitting the right target, such as settings or choosing the right game. Not all the hand movements are meant to trigger actions. After all, hands are used to do other things than just controlling the game.

In a Reflect Ridge game, a translucent 3D avatar is standing in the middle of the screen, his back towards the player. Realising that the avatar moves according to player's body movements is intuitive. Player's mission is to dock obstacles and collect points while moving in the handcar. There is slight clumsiness and delay from time to time, but all in all the tracking is good.

When the game is loading, player needs to look through a looping animation showing how to play the game. Instruction animations are very clear and simple. They are pictured from the angle where user is in front of the TV showing how the real-life movements affect the movements of avatar.





During the gameplay there are multiple hints that help user to find the invisible boundaries of the playing area. If you step outside from the camera view, the game pauses immediately and persuades you to come back. There is a small animation on the top left corner showing the preferable spot to stand during the game. A little character is animated to demonstrate the traffic lights style status of the camera detection. Grey light is for joining in, orange light signals the camera detection and green light shows that everything is ok.

4.1.2 KUNG-FU HIGH IMPACT

Kung-Fu High Impact was released in 2011 (Kung-Fu High Impact, 2011). In the game the player is Kung-Fu hero fighting enemies in a comic world. The game is very physical, because player uses real whole body movements such as jumping, kicking and punching. There is no avatar, but a live video picture of the player to guarantee the immersion. A step-by-step guide shows the desirable movements, but a player can improvise new combos as well. Effectively all the movements cause some sort of damage either to the player or the enemy. On the top right corner a small animation video suggests certain movements for receiving extra points or causing more damage.

At the beginning of each episode the player needs to pose in ways indicated. Simultaneously a camera takes a picture of the player, which is later used to illustrate some frames in a comic book.

The use of the Kinect control is natural, subtle and imaginative. The mechanism would suite little kids perfectly. The player is rewarded for every movement, whether they are performed correctly or not,

or invented on the go. There is no delay in camera tracking or steep curve to learn how to play. A real-time video image of you is enough to give feedback of your motion. It works as a mirror. The opening menu is the only difficult thing to control since Kung-Fu High Impact expects the player to be very precise with it. Swiping the hand sideways needs to be accurate in order to activate an item.

4.1.3 BIG LEAGUE SPORTS

Big Leagues Sports is a game collection including baseball, soccer, hockey, basketball, football and golf. It was released in 2012 (Microsoft Xbox, 2014a). The opening menu is big and activating items remind of Kinect Adventures!. While the game is loading, a tutorial for particular sport is explained with pictures.

All the games are rather linear and hence boring. For example in basketball player needs to execute certain movements in predestined order to finish. There is no room for player's imagination or for special skills. A transparent 3D ghost functions as a live tutorial, hovering next to the avatar and showcasing the next movement. Instructions are clear and informative and they are solely based on pictures so even a very young child could play the game.

4.1.4 HULK HOGAN'S MAIN EVENT

Hulk Hogan's Main Event is a simple show wrestling game released in 2011 (Microsoft Xbox, 2011a). It is just as linear and simple as most games in Big League Sports. Tutorial consists of small, animated cue cards on the bottom of the screen. Player has to carry

out the movements one by one in the order stated in the cue cards. The gameplay feels similar to a slow motion aerobic class. After a movement player needs to wait for the animation before executing the next movement. However the game was built fool-proof because the program anticipates only one particular movement at a time and then detects whether player succeeds. Movements, such as raising hands up and throwing the opponent down and raising one knee up and bending sideways, are easy to repeat, even for children. The instructions are straightforward.

4.1.5 KINECT MOTION SPORTS

Kinect Motion Sports was released in 2011 (Microsoft Xbox, 2011b). The sports games include football, skiing, soccer, hang gliding, horseback riding and boxing. A live ghost image of the player hovers on the background of the three-times-three menu grid. Albeit the graphical user interface looks out-of-date, it works well.

When the horseback riding game is loading, the tutorial screen shows instructions for the game. An animation with human figure in front of the TV and written instructions convey the player the way to play the game. The really long text is easy to neglect. No additional help is provided during the gameplay. Figuring out the gestures is challenging, but after learning they feel natural. The player is holding an invisible bridle. Shaking hands up and down makes the horse gallop faster. Turning other hand left or right turns the horse. Lifting both hands up in the air makes the horse jump.

4.1.6 SESAME STREET: ONCE UPON THE MONSTER

Sesame Street: Once Upon The Monster was published in 2011 (Microsoft Xbox, 2014d) and it is probably the best benchmark for the Kinetic Stories. The interactive storybook aimed for young children includes six chapters containing many different mini games. Player can for example fly, play drums, play musical flowers, water the plants and dance.

Characters are familiar to children from the Sesame Street TV show. A storybook operates as a user interface and every page opens a different mini game. A real world physical example is a well thought idea to accustom children to use an interactive application. A Sesame Street character is giving short verbal guides while an animation backs up the instructional message. Help is repetitive but responsive. Many details indicate how the game was clearly designed for young children, for instance the entire game is text free. The little booklet which comes along the game gives very thorough explanations of the different chapters so parents can guide their children through more troublesome parts.

Player spontaneously makes right movements, because in every mini game the movements are designed to fit the context. The same hand gesture might have a different outcome in different mini game which player does not necessarily even notice. For example in watering the flowers Elmo tells player to just water the flowers. Instantly when the player raises a hand a water shower appears on the screen and moves according to the hand movements.

Once Upon The Monster has a very smooth and effortless multiplayer mode. The second player can join in and out the game at any point. The detection and reaction for second player is immediate. Waving hand to the avatar confirms the multiplayer mode. Stopping is just as easy, leaving the play area changes the play mode.

4.1.7 CONCLUSION OF KINECT GAMES

The Kinect games had a lot of similarities in user interaction, but also enough differences to make each game unique. One key similarity was pausing the game. Conventions repeating in every game are crucial for building a common language to motion games. Opening menus seemed to have two disciplines: point and hold for two or three seconds (Kinect Adventures!, Big League Sport and Kinect Motion Sport) or point and flick your hand vertically to the side (Kung-Fu High Impact and Hulk Hogan's Main Event). Sesame Street: Once Upon the Monster had a book as an opening menu and a specific gesture to activate the page, pulling hands apart. From the menu options I prefer to point and hold as it reminds closely point and click used as an input method in other interactive applications. Accurate aiming was challenging in point and flick menus. The book interface in the Sesame Street suited the context well. Children can relate easily to a real world analogy.

Many games use the time when the game is loading up to show tutorial animations for preparing the player to the tasks. During the game situation player usually receives additional help either from visual cues or animated avatars. Communicating and instructing the gestures carefully is strongly recommended in Human Interface Guidelines of Kinect (Microsoft Corporation, 2013). Some of the

FIG. 3.

games succeed implementing the cues better than others. Gliding and horseback riding in Kinect motion sport did not contain any help during the gameplay and in addition the tutorials before the game were too long to read or to comprehend. Nevertheless good tutorials are not enough, if the action itself does not work. For example in Hulk Hogan's Main Event the next gesture was always very clear, but the linearity and the time spend on waiting new animations to appear takes all the pleasure from playing.

Generally the tracking and feedback worked well in most of the games. Experiencing delay or lag was rare. Visual feedback for player's movements came by moving an avatar, using a ghost image, a video or just a plain hand icon. The context determines the best way. In Kung-Fu High Impact the gameplay was very physical therefore a live video feedback not only improved players movements, but also helped to prevent injury.

Ergonomics is essential to keep the player motivated. Designer should make the gameplay feel effortless and fun (Microsoft Corporation, 2013). For example in gliding game of Kinect Motion Sports I felt tired after holding my arms up for only less than a minute. Negative mental image is enduring and thus difficult to change.

Human Interface Guidelines ephasises on keeping the players' cognitive load low, because in general it is hard to remember more than six gestures at one time (Microsoft Corporation, 2013). This rule of thumb is especially handy with young children. Sesame Street: Once Upon The Monster had a rich variety of different movements, but there were never more than three movements per one mini game. In addition in all these games, visual and verbal guides were appropriate to guide the player onward. Surprisingly many Kinect games were heavy on text. Most of the young children cannot read and lengthy instructions feel redundant if there is a good and coherent tutorial animation to be watched.

Rich audiovisual experience and the whole body movements made me feel engaged with the game. Especially in games where the control was continuous and not merely mimicking a movement while waiting for the animation to happen. The role-related movements increase immersion by helping the player to feel like being a part of the fantasy world (Bianchi-Berthouse, 2013). Reflex Ridge and River Rush mini games in Kinect Adventures! succeeded in that. The game responded beautifully to my movements. Controlling a handcar or a inflatable boat felt real.

Feedback is the most important aspect of a fluent interaction experience. Players need to feel that they are in control when using the application (Microsoft Corporation, 2013).

To secure the smooth playing experience, the player has to stay in the field of the motion sensor's vision. Kinect Adventures! uses a little helper window to guide player back to the preferred playing area. Staying in the Kinect's field of view is not enough if the tracking is not reliable and instant. For example in Sesame Street: Once Upon the Monster player plays drums according to the rhythm. If there was a prominent delay between hitting of the drums and hearing the sound, playing the game would be impossible.

The user interface should give appropriate feedback of which parts of the screen are interactive and what kind of interaction they offer (Microsoft Corporation, 2013). An audio feedback is just as important as visual. Designer should consider what information the player requires (Microsoft Corporation, 2013). All feedback information is not necessary. Sometimes the information load can end up reducing the feeling of immersion. Confident and more skillful players should be able to play without waiting for visual cues or messages to tell the next step.

4.2 ENGAGEMENT

Engagement means committing time and effort in return for positive experience. Players engage to feel immersion, to become something else or to test their skills. In Kinetic Stories the user will encounter a beautiful illustrated animation in return for a few interactive gestures and time spent on following the story.

A research conducted by Bianchi-Berthouse (2013) showed the increasing relation between player's body movement and engagement. The Guitar Hero game was played in a test situation and the players stepped into the role of a musician very quickly (Bianchi-Berthouse, 2013). *"Gaming was no longer only a question of challenge; the experience itself was also seen as a reward by the players"* (Bianchi-Berthouse, 2013, p.60). In addition Mäyrä and Ermi (2005) mention a rewarding feeling player achieves after playing a game.

Bianchi-Berthouse (2013) presents two concepts for playing experience: hard fun and easy fun. In the easy fun player is experiencing wonder, awe and mystery in addition to feeling like being a part of the game. The player wants to relate to the characters. Hard fun games engage with skill and challenges. The challenge is

to become better and better. Body movements related to the game enables easy fun and stepping into the fantasy world. (Bianchi-Berthouse, 2013)

Kinetic Stories falls into the category of easy fun. The child becomes Little Red Riding Hood when his own actions move the character on the screen in a similar manner. Engagement starts when the child steps into the role of the character and fulfills tasks to progress in the story. Playing the role also leads the player to experience the emotions of the role (Bianchi-Berthouse, 2013). For that reason the scenes need to be designed with care not to cause any negative emotions, such as fear. In Ahlgren's (2013) research some children were scared by the wolf and said that the game was stupid. Children can enjoy the game a lot if they feel they are a part of it, but too strong immersion can feel intimidating. Designer's job is to take all kinds of emotions into account and design a game that does not leave a negative impression, but encourages positive affection.

Setting goals is a way to engage the player. The perception of success in achieving goals is a key to learner's motivation and in addition realistically defined goals encourage improvement (Schmidt & Wrisberg, 2004). Measuring performance in a game helps the player to observe whether the goal is achievable. Accomplishing and exceeding one's limits is a good motivator. Schmidt and Wrisberg (2004) encourage people to set different kinds of goals for different purposes.

4.3 GESTURES

Many terms have been used for describing motion-based interaction. Hartson and Pardha (2013) define one of the terms, embodied interaction, which means a possibility to use a physical body for interaction with technology. O'Hara et al. (2013) speak about touchless interaction referring to a controller-free way to interact with applications. Norman (2010) sums everything under the plain term: gestural interaction.

Gestures are a good example of basic intrinsic needs to manipulate objects, either digital or physical, with hands (Hartson & Pardha, 2012). For example some babies have assimilated the basic touch gestures and are trying to use different objects, such as magazines or cameras in a similar manner.

What gestures are natural and thus logical? Do all people have same intuition for those gestures or is it something a user has to learn? Body movements impact the player cognitively, affectively and physiologically (Bianchi-Berthouse, 2013). Designer has to address the player beyond mechanical presentation of the movement. Gestures need to feel natural in the context they are presented.

O'Hara et al. (2013) lists gestures for different purposes: a gesture for pointing, a manipulative gesture for controlling an object or an entity, and different gestures that refer to communication or language, such as semaphoric gestures, sign language and coverbal gestures. Current applications and games use mostly the first two categories, possibly because they are easier to predict and implement due to their resemblance of traditional point and click user interfaces.

As technology develops, the Natural User Interfaces become more natural. Microsoft Xbox One's Kinect has a sophisticated palm detection. The user can start using hand gesture commands by simply showing the palm to the Kinect camera. By grabbing and pulling a fist closer or further from the camera, user can zoom in and out. Grabbing also moves objects. Opening and closing "invisible curtains" allows user to go back to home screen or come back to the game (Microsoft, 2014f). The ambition for creating universal gestures is important and in addition they are simple enough to remember. The most important thing is the context of gestures. Making a move or grabbing something needs to feel logical in that environment and response immediately.

Fitts's law explains how a target that is bigger and closer is easier to move (Fitts, 1954). This revelation was done before the time of point and click interfaces or interactive gestures, but it describes scientifically a basic principle. Gesture control lacks in accuracy, therefore making the use of bigger targets, for example on menu items, necessary. Furthermore, the users have to be able to use interfaces quickly and effortlessly and then big hit targets are advantage. The price to pay for too demanding user interface is losing the user's interest, especially if they are children.

4.4 AFFORDANCE

Affordances are characteristics of user interface objects and interaction design features that help user to operate the application (Hartson & Pardha, 2012). Hartson and Pardha (2013) categorize affordances into cognitive, physical, sensory and functional types. In The Sharp-Eyed Little Red Riding Hood the cognitive affordance is the narrative that explains the user what to do next. Physical affordance helps user to perform the physical task, in our case making the gesture to look further. Sensory affordance enables user to sense: to see and to hear. Functional affordance ensures that the game reacts to the gestures performed.

If a designer makes a gestural system, a user needs to know that the system exists and a user needs to have instructions how to use it (Saffer, 2008). Designer's responsibility is not to leave user ignorant and alone with the application.

Saffer (2008) talks about attraction affordance: a zone or a screen so inviting, appealing and ready to use that a user wants to start trying it out instantly. He gives an example of Apple's phones "slide to unlock" request inviting user to get started. Moreover presenting

content with which to interact is one way to create affordance. Such as an opening menu in The Sharp-Eyed Little Red Riding Hood showcasing and inviting the player to try out the basic gesture immediately.

Erika Hall outlines a good interface text: *"Be authentic. Be engaging. Be specific. Be appropriate. Be polite."* (Hall, 2008, p.74). Whether the text is written or spoken, it is adviced to include all abovementioned. For insufficient text Hall lists properties such as vagueness, rudeness, obliviousness, unnaturalness, presumptuousness, inconsistency and being too clever (Hall, 2008, p.105). Saffer encourages the use of metaphors for explanations (Saffer, 2008). Familiar examples are preferred when trying to describe a gesture to the user. *"The best metaphors are those that match the understood meaning of the gesture with the action being performed"* says Saffer (2008, p.153).

Illustrations are an equal way to address people from different cultures and children not able to read yet. A simple well-drawn illustration can suffice to explain how something works (Saffer, 2008). Many Microsoft Kinect games tested in the previous chapters had either a picture or a simple animation for describing the movement. Additionally the perspective in the illustrations depicted the living room situation clearly for the player.

"Watching while doing is a powerful way to learn a gesture" (Saffer, 2008, p.151). Looping animations of a gesture, video of the player or real-time helper can be effective when communicating to the user what to do next. Almost all Kinect games I tested used those methods to guide the player.

5 THE INTERVIEWS WITH KINDERGARTEN TEACHERS

As Kinetic Stories is targeted for pre-schoolers, I wanted to have a discussion with people who have special knowledge of children's behaviour. Kindergarten teachers have education and skills to recognise children's individual features in normal development and the general knowledge of how children behave in a certain age. My aim was to gather an in-depth understanding of children's behaviour to help me design more suitable content and interactions for Kinetic Stories.

For a scientifically accurate research I should have interviewed more people and analyse the answers using acknowledged methods, for example a peer debriefing (Lincoln & Guba, 1985) or statistical analyses. However, the interviews I conducted served only to support the main output described in the master's thesis, the creation of The Sharp-Eyed Little Red Riding Hood. The reason for undertaking the interviews was to talk with experts and to hear their ideas for guiding children in a playful environment, thus improving the design of the project.

I spent an hour with each interviewee and presented the same questions of the following topics: children's digital experiences, motor, social and emotional development, and ways of playing, listening and learning. In addition to the semi-structured questions, we had small conversations around the subject to fully comprehend the topics we had already discussed. For some of the questions, such as motor development, I could have collected the information and theories from the literature, but I wanted to hear if kindergarten teachers, as child educator experts, had something further to add or an insight to reveal about the matter.

5.1 QUALITATIVE RESEARCH

Metsämuuronen (2006) says that a qualitative study applies when one is interested in details and structures rather than generalized information. To produce a qualitative study a method, a specified research technique, needs to be chosen to excavate information of the subject of interest and one of those methods is an interview (Metsämuuronen, 2006). Structured interview has clear questions and clear answers, but it requires careful planning and does not suite if the researched group is too heterogenic (Metsämuuronen, 2006). In semi-structured interview I would have control over questions asked, but it could still offer the possibility for more conversation. An open interview was another option, as it gives deep information and resembles conversation (Metsämuuronen, 2006). Compared to the open interview, the semi-structured interview gave me the possibility to match the answers more easily according to themes.

An interview requires planning. Researcher has to know the interviewees in able to get their core knowledge. The discusssed topics have to be familiar for both parties. Researcher initiates and controls the interview situation in addition to motivating the

interviewee. All information should be handled with confidence. Furthermore interviewees have to be able to trust the interviewer. (Hirsjärvi & Hurme, 1982, p.27)

The focus on the interview is on the researched subject. Interviewer should stay neutral, not allowing his own opinions to steer the conversation. The interview is a unique event that has to be planned and documented for results to be analysed and used later on.

For analysing the results the data needs to be abstracted. The data is organised so that conclusions are independent from individual answers and can be seen as generalised level. The answers need to be transformed into accessible data. (Metsämuuronen, 2006)

I analysed the dataset with my best knowledge. Metsämuuronen (2006) warns that when only the researcher analyses the results, personal assumptions can jeopardize the dignity of the research. Fortunately in this case I am not trying to form a theory of any kind, but only to collect useful information that can help me design better content and interaction for children. Analysing the interviews is in fact just stating the facts rather than making assumptions. A good qualitative report lists relevant observations in a right context and with many viewpoints (Metsämuuronen, 2006).

5.2 ETHICS

During interviews I worked discreetly. I explained the purpose of my interview and asked written permissions to record and use the answers in my master's thesis. When going through the records I used my interviewee's gender and age as a mark to differentiate them. I did not use their names. All observations interviewees made from the real life situations did not identify any particular child. I will hold the recorded interviews in a safe place unidentifiable to the interviewees.

5.3 RESEARCH PROCESS

I started by outlining my lack of knowledge about children and my objectives. I needed to interview people who are specialised in planning and organising activities for children. I found one interviewee through my contacts and two others through the Association of Kindergarten Teachers in Finland. All of them had many years of experience as kindergarten teachers and two of them had started advanced studies on the matter.

I framed the questions from the different viewpoints in children's life. I asked about the children's digital nativity and how common digital devices such as smart phones, tablets and consoles were for them and in the kindergarten. The motor, the social and the emotional development, how children play and how they learn to listen instructions were the rest of the topics I covered. Each topic had sub questions to establish the terminology and to highlight the key points.

All the interviews were made individually in different locations in Helsinki in September and October 2013. At the beginning of the interview I introduced myself, explained the purpose of my research

and asked the interviewee to sign the permission form. After that I started to record the conversation and began to ask questions in an order from the list. I also had a less formal conversation about the Kinetic Stories project and the challenges it was having at the end of the interview.

Afterwards I listened to the recordings and made notes of all the interviews. The questions and the notes can be found from the Appendix. I wrote down the key facts from all the topics and from all the interviewees. Then I compared their answers to find similarities in their answers. With such a small group it was also possible to raise individual highlights bringing new information to my research.

5.4 RESULTS

In the following paragraphs I have made a summary of what the interviewees agreed, disagreed and highlighted about each of the topic. I am calling my interviewees with names **W25**, **W28** and **W30**, where W stands for woman and number stands for her age.

For some of the questions, such as motor development and play, I could have found the information from the child development books in which the interviewees also referred to. I still wanted to hear if kindergarten teachers could share some new information or emphasise certain aspects of the theories.

5.4.1 DIGITAL NATIVITY

A digital nativity was the topic for the first set of questions. All the interviewees agreed on children playing and talking more about games nowadays. Everybody seems to know the household names such as Angry Birds. Especially the games played on the iPad are popular. Children usually play at home and with older siblings. They do not have their own smart phones or tablets. The kindergartens do

not have interactive games or consoles. The more senior personnel do not seem to have a keen attitude towards games and consoles. They also lack experience with such devices.

5.4.2 MOTOR DEVELOPMENT

A motor development progresses immensely from birth until eight years. The interviewees told that movements are holistic, which means that children tend to move the whole body even if they are only supposed to wave one hand or leg. It is easier to make movements that come from the whole body and happen in front of you at the same time, rather than doing separate movements, especially if a child is not able to see the movements while performing them. W28 mentioned that a movement that goes across the body, for example touching left shoulder with right hand, is difficult for young children.

All the interviewees told that children seem to have quite a lot of physical hobbies, for example dancing and playing football. When children move and do things, it is full of joy. Hobbies can help children to accommodate to group situations and follow rules, but the interviewees said that the difference is not tremendous comparing to others who do not have such hobbies. The support and the encouragement from the adult are vital for children's self-esteem, particularly when they are trying something new and unfamiliar. Then again children of the discussed age are not too self-aware. A critical thinking comes later.

5.4.3 EMOTIONS

A pre-schooler goes through a huge variety of emotions every day. All the interviewees said that the emotions begin from the body. Children feel and react with their body. It is difficult for them to try to explain how they feel whereas reactions to joy or disappointment are instantly seen in their behaviour. Children are very spontaneous, but the personality affects how much emotion they show. W30 listed yelling, crying and sulking as outbursts of negative emotions. W28 adds kicking, breaking and calling things stupid. Positive emotions can be seen from the facial expression, jumping and being enthusiastic. As W30 said: *"the confidence is unlimited!"*

5.4.4 SOCIALITY

Being social becomes more important when children grow older. W25 told that girls like to play in pairs, and a third person makes the dynamics difficult. Boys prefer bigger groups. W30 stated that the personality plays a key role in how big groups a child wants to play with.

When there is a group, there is a leader. Among groups of younger children, a leader is usually someone whose personality fits the task. With older kids the leadership is earned by skill or knowledge. W30 says that girls are surprisingly strong team leaders. The kindergarten teachers try to break the leadership roles and mix the group dynamics regularly.

Children are very keen on imitating others. They mimic someone they idolise, adults or others. In creative tasks such as drawing and crafts all participants seem to have the same outcome. Imitating is an easy way to learn. W25 said that imitating is easier than a verbal instruction. W28 added that when words are not enough, a model is always sufficient. W30 stated that for small children imitating is a fun play, but six-year-olds also imitate to learn.

5.4.5 COGNITIVE SKILLS

Cognitive skills develop with trial and error. It is very natural to try on one's own and figuring out how things should be done. However, if a task is too difficult, children give up easily. W28 says that exploring is so interesting and rewarding that in itself it is enough to motivate children's actions. Older children will ask help if they do not know how to overcome a problem. Playing is exploring and learning to understand.

5.4.6 FOLLOWING INSTRUCTIONS

Rules and regulations are important for children. W25 says that adults tend to speak too much when instructing children. All interviewees agreed on short, simple, one word or maximum one-sentence instructions. Rules can slowly and gradually become more difficult. W30 mentioned that children could not remember long or complicated rules at one time. Children need clear and concrete instructions, for example "raise one hand up" or "put a hat on". All the interviewees also use simple pictures to help out when explaining a task that needs to be done. Especially when the task is something

abstract or new. W28 believes that children have to understand the context of the rules. W25 advises using songs and silliness when trying to make children do something. Positive atmosphere and calm situation helps them concentrate. W28 says that choosing encouraging words, for example "let's try…" takes out the pressure of failing. Forcing never works out. The task at hand also needs to be suitable for the child's abilities.

5.4.7 KINETIC STORIES AS A CONCEPT

Finally I discussed shortly about the Kinetic Stories concept with my interviewees. W25 believed that linear structure could be a good thing for young children. It teaches concentration and conclusion. Making the game adequately difficult is important. However the tasks should not feel overwhelming. W25 also thought that five- to six-year-olds can fully enjoy a game in comparison to three- or four-year-olds, who require flawless and instant feedback to be even willing to try it out. W28 suspected how a computer can react seamlessly to a child's behaviour and how the interactions work. Moreover W28 was curious about the level of difficulty and whether a child can change it himself. She suggested that an adult could always work as an intermediate between the child and the game. W30 was suspicious whether children can mimic movements when they are not in a right context, for example swimming in front of the TV. The possibility to play together with an adult was also wished for.

5.5 CONCLUSION

I had a very broad conversation with the kindergarten teachers about the different aspects of development in the life of a child. Some of the facts were familiar to me from a child's developmental psychology theories such as the development of play (Piaget, 1951) and motor growth (Vilkko-Riihelä, 1999) (Numminen, 1996), but nevertheless everything was very interesting in addition for hearing comments and observations for which they have a solid experience. Some of the comments reflected strongly their own beliefs. For example children could not imagine themselves swimming in front of the TV, because it is not an actual swimming environment. I believe children have the capability to imagine almost anything. I learned a lot of new details that are vital when designing an application for children. Different things motivate younger players and that interest is not always so easy to harness.

The key information was about mimicking and how to give the instructions. Mimicking is already included in the Kinetic Stories when a little helper mouse shows what kind of movement the player needs to do next. The child can act as a model for Little Red

Riding Hood when all the player's movements are mirrored to the character's movements. However, I believe that mimicking needs some fine-tuning for next chapters of the Kinetic Stories.

I knew that instructions should be clear, but I was surprised how interviewees emphasised the concrete and the maximum one-sentence instructions. Even the experienced teachers that children are familiar with use pictures and models as a way to explain abstract and confusing tasks and situations. Interviewees also said repeatedly that the verbal instruction might not be enough. The Kinetic Stories has relied heavily on verbal guidance and after the interviews I realised that I need to build more cues to the interface to support the instructions in multiple ways. After all, an interactive story cannot offer what an adult can: a physical proximity and instant understanding. Kinetic Stories cannot hold a child from a hand, look him in to the eyes and tell and explain him things. That is why we need to rely on building the interactive story fun, positive and flawless in interaction.

Children express their feelings very physically. They cannot hide emotions. Although the variety of emotions is endless, they seem to repeat some behavioural patterns when they are happy and when they are angry. The Kinetic Stories could have "an emotional sensor", a camera and a microphone that detects these emotional outbursts and reacts to them accordingly. Bianchi-Berthouse (2013) has made observations how body postures reflect emotions. The postures could be one possibility to detect the mood of the child.

Sustaining children's motivation might be perplexing, but I was interested to hear that trying and discovering fascinates them so much that they yearn for more. The optimal level of challenge

maintains the motivation of the players (Bianchi-Berthouse, 2013). An interesting feature in Kinetic Stories would be the adjustment of difficulty according to the child's skill level, as children are so different compared to each other. Then again, our interactive story is not supposed to be difficult at all.

In social context less immersive experience might be preferred so that player can divide his attention to other events and conversations that are happening around (Mäyrä & Ermi, 2005). The Kinetic Stories is light entertainment and does not require total immersion.

The kindergarten teachers preferred the linear structure to the story. The linear can be associated more easily to the TV animations and thus children have some sort of expectations of the content and the length of the story.

6 CONCLUSIONS

The purpose of this master's thesis was to find a set of design guidelines to follow when designing a storybook application for a kinetic kid. Designing an interactive application for children requires skills and knowledge. However it is not rocket science and many of my discoveries are principles of interaction design.

Context is the key for all interaction. Furthermore the kindergarten teachers emphasised the importance of giving instructions that fit the situation. Also Sesame Street: Once Upon the Monster had many mini games of which most utilised the context so well that the user did not need any detailed instructions. The context helps children to figure out expected interactions.

The game needs to be technically robust. The motion detection and interaction has to be flawless. Any kind of malfunction jeopardizes the user's trust for the game and thus reduces the interest of playing.

For users, the main problem of The Sharp-Eyed Little Red Riding Hood was executing the right gesture. Children were unable to follow the help given by a little mouse character. A visual indication, such as an animated tutorial enables the user to know when to use gestures for interaction.

Children find simple and concrete instructions easy to follow. This conclusion was seen in the answers provided by kindergarten teachers and in the Microsoft Xbox Kinect games. Especially in the Sesame Street: Once Upon the Monster verbal instructions were exemplary: simple, concrete and repetitive. The game reacted instantly to the user's action by giving verbal guidance as well as repeating them.

Solid feedback is required in addition to robust instructions. Throughout the research, the importance of instant feedback was emphasised. The kindergarten teachers stressed how praise, positive and encouraging tone can make children try again and continue with the game.

Playing games together with friends and siblings is fun. Children are social and they want to share their experience with others. A friend can help out in a tricky task and thus make the experience unique.

Mimicking is a powerful method to learn. Children experience through trial and error, but also by watching how others do the same thing.

A reliable study of a motion game can only be done together with the target group, children. The next chapters of Kinetic Stories have to go through more rounds of user testing and iteration.

Adults play a big role in children's life. Furthermore the adults are the ones designing the applications for the children. They are the ultimate help where children seek comfort. Children need adults to help out when playing games and to reflect emotions evoked by playing experience.

Outstanding audiovisual experiences help children to engage in the fantasy world. Additionally the suitable level of challenge, the sense of control, and an opportunity to influence the game experience make the game more meaningful for the child.

To briefly summarize all abovementioned, children's interactive application design should include the following aspects:

- *Interaction is relevant in the context.*
- *The application is technically robust and reliable.*
- *Visual tutorials and cues are used to guide the player.*
- *Verbal instructions are short and concrete.*
- *Feedback is instant and encouraging.*
- *The experience is enriched by a multiplayer possibility.*
- *The interactions can be learnt through mimicking.*
- *Several user tests and iterations are conducted.*
- *A child can benefit from an adult's support and presence.*
- *The game is engaging and motivating.*

Based on the conclusions I decided to revert back to the basics and iterate the learning outcomes for the next chapters of the Kinetic Stories. Delicode has decided to carry out the rest of the chapters with the following stories: Hansel & Gretel, Bremen Town Musicians, and the Four Skillful Brothers. For implementing the findings of this master's thesis I made a concept for a mini game: The Little Red Riding Hood's Day Off. It is a simple and linear story of Little Red Riding Hood learning to swim, fly and make soap bubbles. Moreover it will be tested with kindergarten children. There are more gestures and tasks included, as well as clearer and simpler instructions and tutorial animations attached to the context.

Kinetic Stories has been an impressive learning curve which has continued throughout my master studies in Media Lab. I have had to utilise all my experience and knowledge from concept design, storytelling, graphic design, user experience and user interface design. I was eager to research what has been discovered in the field of Child-Computer Interaction and Natural User Interfaces with the focus on interactive applications using gestures and body motion. I feel that I have now opened a door to a fascinating world that is about to change the way we think and interact. Remember the name Kinetic Stories, as you will be sure to hear it in the future!

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PICTURES

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APPENDIX

AWARDS AND NOMINATIONS FOR KINETIC STORIES

- *Kinetic Stories (as Kinected Stories), 2012 AVEK D2 Winner*
- *Kinetic Stories (as Kinected Stories), 2012 Think Ink finalist, honorary mention (placed top three)*
- *Kinetic Stories (as Kinected Stories), 2012 Mindtrek Launchpad finalist in Tampere, second place*
- *Kinetic Stories (as Kinected Stories), 2012 Game Connection Europe, selected projects*
- *Kinetic Stories, 2013 Game Connection America, selected projects*
- *Kinetic Stories, 2013, The Financing Forum in Malmö, selected projects*
- *Kinetic Stories, 2013, European Design Award, finalist in miscellaneous digital*
- *Kinetic Stories, 2013, Word Summit Award, e-Entertainment and Games winner*

INTERVIEW QUESTIONS

1 LASTEN TEKNOLOGIANATIIVIUS

- *Puhuvatko lapset tarhassa tai muskarissa älypuhelimista, tietokoneista, padeista tai pelikonsoleista?*
- *Näkyykö laitteiden käyttö lasten toiminnassa ja leikeissä?*
- *Onko lapsilla omia älypuhelimia?*
- *Leikitäänkö päiväkodissa/ muskarissa/ tarhassa interaktiivisilla digitaalisilla peleillä tai laitteilla?*
- *Jos leikitään, leikkivätkö lapset mieluummin yksin vai ryhmässä?*
- *Millaisia pelejä tarhassa pelataan?*

2 FYYSISYYS

- *Millaisia eroja eri ikävuosien leikeissä näkyy? Onko sukupuolella eroa?*
- *Miten lasten leikki ja liikkuminen kehittyy? Onko nähtävissä näkyviä muutoksia?*
- *Kuinka paljon lapsen persoona vaikuttaa ikäkauden yli?*
- *Onko jotain tiettyjä leikkejä ja liikkeitä, jotka ovat erityisen helppoja? Entä onko vaikeita tai mahdottomia leikkejä tai liikkeitä? Onko sukupuolessa tai iässä nähtävissä eroja?*
- *Ymmärtävätkö lapset oman kehon rajat. Ovatko lapset itsevarmoja liikkeissään vai onko niissä vielä kömpelyyttä. Onko eri liikkeillä eroa, juoksu, kiipeily, kuperkeikat, tanssiminen?*
- *Ilmaisevatko lapset itseään isoilla kehon liikkeillä ja käsillä vai puhumalla? Onko iällä tai persoonalla eroa?*

3 TUNTEET

- *Miten lapset osoittavat positiivisia tunteita ja onnistumista?*
- *Miten lapset osoittavat negatiivisia tunteita, turhautumista ja epäonnistumista?*
- *Miten lapset käsittelevät tilanteita, joissa he eivät osaa jotain?*
- *Hakeeko lapsi apua aikuiselta, kaverilta vai yrittääkö hän itse?*

4 SOSIAALISUUS

- *Leikkivätkö lapset mieluiten yksin, kaksin vai ryhmässä? Onko eroa sukupuolten välillä? Entä iän?*
- *Matkivatko lapset toisiaan?*
- *Onko olemassa ”ryhmänjohtajia”, jotka valitsevat leikit ja saavat lapset leikkimään omien ohjeiden mukaan?*

5 KOGNITIIVISET TAIDOT

- *Jos lapsi kohtaa uuden esineen tai asian, miten hän oppii käyttämään sitä? Kokeilemalla? Kysymällä apua? Matkimalla muita?*

6 LEIKKIEN OHJEISTAMINEN

- *Kuuntelevatko lapset ohjeita?*
- *Jos eivät kuuntele, miten heidät saa keskittymään ohjeisiin?*
- *Ovatko ohjeet konkreettisia?*
- *Ovatko lapset tottuneet kuulemaan samankaltaisia ohjeista?*

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HAASTATTELUJEN YHTEENVETO:

W25: 4 vuotta kokemusta 0–6-vuotiaista
W28: 10 vuotta kokemusta 0–6-vuotiaista
W30: 6 vuotta kokemusta, erityisesti 0–3-vuotiaista

1 LASTEN TEKNOLOGINEN NATIIVIUS

W25

- *Lapset puhuu tarhassa tosi paljon (elektronisista) peleistä. Erityisesti iPadilla pelattavista peleistä.*
- *4-5 vuotiaat puhuu paljon, 3 vuotiaat vähemmän*
- *Lapset yrittää käyttää esimerkiksi digikameraa kuin iPadia, mutta muuten älylaitteiden käyttö ei näy leikeissä.*
- *Lapsilla ei ole omia älypuhelimia, mutta kertovat isosiskoista ja –veljistä joilla on omat. Joillakin harvoilla lapsilla voi olla ”leikki”iPadeja.*
- *Tietokoneet, joita päiväkodeista löytyy on ikivanhoja.*

- *Päiväkodista löytyy Muumitietokone, ensitietokone. Yksinkertainen muovinen leikkikalu.*
- *Päiväkodissa ei ole ollut pelipäiviä ja vanhemmilla työntekijöillä on vähän kielteinen asenne pelejä kohtaan.*

W28

- *Eskari-ikäset (5-6 vuotiaat) puhuu enemmän mitä pelejä on pelannu.*
- *Lapsilla ei oo näkyny älypuhelimia.*
- *Tarhassa ei oo konsolipelejä, mutta jotain lelutietokoneita löytyy. Henkilökunnalla ei varsinaisesti oo osaamista elektronisiin peleihin.*

W30

- *Alle kolmevuotiaatkin käyttävät iPadeja ja leikkii kännykkää. Isommat lapset puhuvat myös paljon. Tämä on lisääntynyt paljon viime vuosina.*
- *Laitteiden käyttö näkyy leikeissä. Kosketus eleet toistuvat muissakin yhteyksissä.*
- *Lapsilla ei ole älypuhelimia mukana päiväkodissa.*
- *Päiväkodissa ei ole konsolipelejä tai muita elektronisia leikkikaluja lasten käytössä.*
- *Lapset pelaa kotioloissa usein sisarusten kanssa.*

FYYSISYYS

W25

- *3v alkaa vasta harjoitella mielikuvitusleikkejä, mutta leikit eivät ole kovin pitkäkestoisia tai monimutkaisia.*
- *4-5v osaa kehitellä jo monitasoisia ja pitkiä mielikuvitusleikkejä.*
- *Tyttöjen ja poikien ero riippuu paljon kasvatuksesta, mutta kyllä pojat ovat pääsääntöisesti fyysisempiä ja valtaavat paljon tilaa leikeilleen kun tytöille riittää pienempi tila/ paikallaan olo.*
- *Tyttöjen ja poikien ero leikeissä näkyy enemmän brändätyissä leluissa (Pet Shop, Barbiet) kuin tavallisissa satuhahmoissa.*
- *3-5 vuotiaat tarvitsee paljon enemmän liikuntaa kuin aikuiset.*
- *4 vuotiaana kehon liikkeet alkavat eriytyä. Eli kun liikuttaa yhtä kättä vain käsi liikkuu eikä koko kroppa.*
- *Lapsilla on tietyt ikäkausinormit, mutta persoona vaikuttaa paljon kehityksen ajankohtaan.*
- *Leikeissä pitää olla yksinkertaiset säännöt. Sääntöleikkien leikkiminen alkaa kunnolla vasta 6–vuotiaana.*
- *Sellaiset liikkeet, jossa on koko kroppa mukana ovat helpompia kuin yksittäiset tarkat liikkeet.*
- *Pienet käy baletissa, tanssissa, jumpassa, luistelussa ja jalkapallossa aina vain enemmän ja enemmän.*
- *Liikunnallisia harrastuksia harrastavat lapset ovat tottuneempia tekemään yhdessä ja seuraamaan ohjeita.*
- *Lasten liikuntaharrastukset ovat liikunnasta nauttimista, ei suorittamista.*
- *Aikuisen tuki on tärkeä, jos yrittää jotain uutta asiaa.*

- *Uimaliikkeet sopii paremmin yli 4 vuotiaille. Kun liike tapahtuu silmien edessä niin liike on helpompi tehdä. Eriaikaiset tehtävät, jossa pitää liikuttaa kahta kättä eri suuntaan/aikoihin saattaa muuttua yhdenaikaisiksi. Sammakkouinti voi olla vaikea hahmottaa, mutta jos näkee mallin niin ehkä se sitten onnistuu.*

W28

- *Iän myötä taidot kehittyy, mutta yksilölliset erot on suuria.*
- *Pojilla on parempi karkeamotoriikka ja tytöillä taas hienomotoriikka, mutta tyttöjen ja poikien erot on sekoittumassa nykyisten kasvatusmetodejen takia.*
- *3-4 vuotiaat on jo varsin liikkuvaisia, osaavat juosta, kiipeillä, hieman tasapainoillakin. Kehon hallinta paranee.*
- *5-6 vuotiaat osaa jo jonkin verran noudattaa yksinkertaista koreografiaa ja yksinkertaisia sääntöjä.*
- *Persoona ja ympäristö vaikuttaa paljon lasten kehittymiseen.*
- *Kinect voi motivoida lapsia kokeilemaan liikkumista, koska kyseessä on erilainen ”teknisempi” ympäristö.*
- *Lapset ei piittaa, jos ne ei osaa. Kriittisyys tulee vasta iän myötä. Mutta isommille lapsille pitää olla jo oikeassa suhteessa haastetta, että se motivoi, mutta ei tee mieli luovuttaa.*
- *Pienten lasten liikkuminen on oppimisen riemua täynnä.*
- *Oman kehon hallitseminen alkaa olla 5-6 vuotiailla paljon parempaa.*
- *Kehon poikittaislinja, kehon ylittävät liikkeet on lapsille haastavia.*
- *Kun tilanne on rauhallinen, positiivinen ja aikuinen kannustaa niin lapset uskaltavat herkemmin kokeilla asioita.*

- *Lapsilla tunteet näkyy kropassa paljon. Olemus kertoo paljon tunnetilasta. Ne ei tiedosta vielä omaa kehonkieltään.*

W30

- *Tytöt ja pojat leikkii paljon yhdessä. Poikien leikit saattaa olla riehakkaampia. Eskari-iässä (6v) on eriytymistä enemmän.*
- *Päiväkoti-ikäiset lapset kehittyy ihan hurjasti fyysisiltä taidoilta.*
- *Rohkeammat lapset uskaltaa yrittää enemmän.*
- *Alle kolmivuotiaat ei osaa sääntöleikkejä, mutta yli 4-vuotiaat pystyy leikkimään sääntöleikkejä.*
- *Kolmivuotiailla alkaa olla jotain käsitystä oman kehon rajoista. Mitä pystyy tekemään ja mitä ei.*
- *Lapset harrastaa.*
- *Jos lasta kiinnostaa joku asia, niin se uskaltaa yrittää enemmän ja sillä tavalla oppii nopeammin.*
- *Lapset ilmaisee itseään isoilla kehon liikkeillä, sekä positiiviset, että negatiiviset tunteet. Lapsi ei osaa peitellä tunteitaan.*

TUNTEET

W25

- *Tunteet lähtee koko kehosta. Tunteiden sanallistaminen on vaikeampaa.*
- *Lapset sietää vähemmän ja vähemmän epäonnistumista ja purkaa tunteen itkemällä, haukkumalla asiaa tyhmäksi tai murjottamaan lähtemisellä.*

- *Riippuu paljon lapsesta miten asioihin reagoi.*
- *Aikuisen tuki ja oikea suhtautuminen on merkittävää.*

W28

- *Lapset ilmaisee tunteita kasvonilmeillä, puheella, spontaanisti*
- *Negatiiviset tunteet voi näkyä aika fyysisesti. Potkitaan tavaroita, haukutaan tyhmäksi, lähdetään murjottamaan*
- *Suhde aikuiseen vaikuttaa siihen hakeeko lapsi turhautumiseen apua aikuiselta. Etenkin pienet lapset. Isommat lapset haluaa olla itsenäisempiä ja selvitä yksin.*

W30

- *Ilo näkyy koko kropassa. Itseluottamus on rajaton.*
- *Negatiiviset tunteet on huutoa, mökötystä, itkua.*
- *Jos lapsi ei osaa, niin siitä voi seurata turhautumista. Osaavat myös pyytää apua aikuiselta.*

SOSIAALISUUS

W25

- *Alle 2v leikkii yksin tai rinnakkain yksin. 3-4v alkaa leikkiä enemmän porukoissa 2-4 lapsen ryhmissä. 5v eteenpäin pystyy leikkimään isommissakin porukoissa.*

- *Tyttöjen on vaikea leikkiä kolmistaan. Tytöt leikkii mieluiten kaksittain ja pojat porukassa. Ulkoleikeissä tytöt ja pojat sekottuu helpommin.*
- *Lapset matkii. Ihannoitua johtajatyyppiä helposti matkitaan, mutta lapset myös valittaa että "toi matkii".*
- *Askarteluissa ja luovemmissa jutuissa matkiminen on vahvaa.*
- *Uusien liikkeiden ohjeistamisessa aina näytetään esimerkki, malli, jota lapsi matkii ja jäljittelee. Malli on helpompi kuin sanallinen ohje.*

W28

- *Lasten leikkiminen noudattaa psykologisen kehityksen linjoja. Yksinleikki - rinnakkaisleikki - yhdessä leikki*
- *Lapset matkii tosi paljo toisiaan ja aikuista. Mallista oppiminen on luonteva ja merkittävä tapa oppia. Kun sanat ei riitä, niin malli riittää.*
- *Ryhmissä on usein vahvoja lapsia, jotka ohjaa leikkiä. Päiväkodissa näitä rooleja yritetään rikkoa. Lapset vaihtaa itsekin rooleja.*

W30

- *Leikin kehitys noudattaa psykologista kehityskaarta. Rinnakkaisleikki – roolileikki – ryhmäleikki – sääntöleikki*
- *Ikä ja persoona vaikuttaa siihen leikkiikö yksin vai ryhmässä.*
- *Lapset matkii toisiaan. Eskarit matkii myös oppiakseen jotain. Nuoremmat matkii hauskuutta.*

- *Lapsista nousee usein ryhmänjohtajia, jotka ohjaa leikkiä. Pienillä johtajuus on enemmän persoonaa ja isommilla eskareilla taidolla ansaittua johtajuutta.*
- *Tytöillä näkyy yllättävän vahvana johtajuus-ilmiö.*

KOGNITIIVISET TAIDOT

W25

- *Jos lapsille ei anna ohjeita niin lapsi keksii käyttötarkoituksen itse (ei välttämättä oikein).*
- *Kokeileminen on luontevaa.*
- *Apua kysytään herkästi.*
- *Kokeilu ja uteliaisuus ei riitä pitkään yrittämiseen, jos peli on liian vaikea.*

W28

- *Jos asia ei oo ennalta tuttu, niin lapset mielellään tutkii ja kokeilee selvittääkseen asian. Leikkihän on kokeilemista.*
- *"Tutkiminen itsessään on niin mielekästä ja palkitsevaa", että se yksissään riittää motivoimaan lapsen toimintaa*

W30

- *Lapset oppii nopeasti. Kokeileminen on yleistä, mutta vanhemmat osaavat jo kysyä apuakin.*

LEIKKIEN OHJEISTAMINEN

W25

- *Lapsille on aika tärkeää, että on tietyt säännöt ja ohjeet joiden mukaan toimia.*
- *Lapsia pitää muistuttaa säännöistä, muuten esimerkiksi lautapeleissä ne huijaa.*
- *Tukikuvien käyttö ohjeistuksessa voi auttaa jotain lapsia.*
- *Tilanteen fyysinen rauhoittaminen auttaa keskittymään.*
- *Laulut ja hassuttelu auttaa seuraamaan ohjeita.*
- *Ohjeiden pitää olla yksinkertaisia, yhden sanan, yhden lauseen ohjeita. ”Mene eteenpäin.” ”Liikuta toista kättä.”*
- *Kuvat auttavat mitä abstraktimpaan suuntaan mennään puheessa.*
- *4-5- vuotiaat uhmaa periaatteesta kaikkia ohjeita. ☺*
- *Aikuiset puhuu liikaa. Lapset ei tarvitse niin paljon.*

W28

- *Sääntöleikin opettamistilanteessa on tärkeää rauhoittaa se hetki, jolloin ohjeet annetaan. Lapset olisi keskittyneitä ja ylimääräisiä ärsykkeitä (mm. melua) ei olisi.*
- *Lasten olisi hyvä tietää mihin säännöt liittyvät.*
- *Tilanteesta on hyvä tehdä mahdollisimman positiivinen. Pukea ohjeet esimerkiksi tarinan muotoon.*
- *Sääntöjen/ohjeiden tulee olla hyvin yksinkertaisia. Vaikeuttamisen tulee tapahtua hiljalleen vähitellen yksi osa kerrallaan. Muuten lapsi turhautuu.*

- *Lasta voi yrittää motivoida keskittymään keskustelemalla miksi ei huvita. Pakottaminen ei toimi.*
- *Pienet lapset tarvitsee konkreettisen näyttämisen miten asia tehdään sanallisen ohjeen lisäksi.*
- *”Nyt kokeillaan…” lievittää jännitystä siitä ettei osaa.*
- *Jos on paljon ohjeita niin osa unohtuu, koska muisti ei ole vielä niin kehittynyt.*
- *Taito, jota halutaan opettaa pitää olla mahdollinen lapselle. Värityskuva esimerkki.*

W30

- *Ohjeet opetellaan vähitellen, yksiosaisina.*
- *Liian montaa ohjetta ei voi muistaa. Tuttuus auttaa.*
- *Jos lapsi ei kuuntele, on tilanne rauhoitettava. Katse kontakti auttaa.*
- *Liian pitkiä lörpötyksiä lapsi ei jaksa kuunnella.*
- *Lapsi voi turhautua turhasta jankkaamisesta.*

MUUTA

W25

- *Haastateltavan mielestä on hyvä, että Kinetic Stories on lineaarinen. Lapsen on hyvä harjoitella asian loppuun asti saattamista. Vaikeustaso on tärkeä, että ei ole liian vaikea lapselle.*

- *5–6- vuotiaat pystyy täydellä panostuksella pelaamaan. Pelin antaman palautteen pitää olla välitöntä ja saumatonta, jotta nuorempi lapsi jaksaa edes yrittää.*

W28

- *Pystyykö laite reagoimaan saumattomasti lapsen liikkeisiin? Koneen reagoiminen on kuitenkin rajallista. Miten vuorovaikutus toimii?*
- *Voiko lapsi itse hakea vaikeustasoa?*
- *Aikuinen voi tulkata koneen ja lapsen välillä.*
- *Lapset on erilaisia ja siksi kaikki tilanteetkin on erilaisia.*

W30

- *Osaako lapset matkia toimintaa, jos ei ole ”aidossa” ympäristössä. Esimerkiksi uiminen.*
- *Ollaanko testattu Kinetic Kidiä niin, että lapsi ja aikuinen pelaa sitä yhdessä?*

A!

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