Universidade Europeia
LAUREATE INTERNATIONAL UNIVERSITIES

Despacho

PROVAS PARA OBTENÇÃO DO GRAU DE MESTRE

Por proposta do Conselho Científico da Universidade Europeia (instituição que integrou, em 21 de novembro de 2016, o IADE-U Instituto de Arte, Design e Empresa - Universitário), e nos termos do artigo 9º do Decreto-Lei nº 239/2007, de 19 de junho, nomeio o seguinte júri para as provas de obtenção do grau de mestre em **Design e Cultura Visual** requeridas por **Saara Emília Helkala,** com o Tema: *"I'LL WRITE YOU A NOTE - WHY WRITING BY HAND BE RELEVANT FOR THE FUTURE?"*.

Presidente
Doutor Flávio Henrique de Almeida
Professor Auxiliar do *IADE-Universidade Europeia*

Vogais
Doutora Susana Margarida Álvares de Carvalho de Andrade Campos
Professora Auxiliar na Faculdade de Arquitetura de Lisboa

Doutor Eduardo Alberto Vieira de Meireles Côrte-Real
Professor Associado com Agregação do *IADE-Universidade Europeia*

Data: 16 de novembro de 2017

O Reitor

Pedro Barbas Homem

Universidade Europeia

LAUREATE INTERNATIONAL UNIVERSITIES

2017

SAARA EMILIA HELKALA

I´LL WRITE YOU A NOTE – WHY WRITING BY HAND WILL BE RELEVANT IN THE FUTURE?

2017

SAARA EMILIA HELKALA

I`LL WRITE YOU A NOTE - WHY WRITING BY HAND WILL BE RELEVANT IN THE FUTURE?

Tese apresentada ao IADE – Universidade Europeia, para cumprimento dos requisitos necessários à obtenção do grau de Mestre em Design e Cultura Visual realizada sob a orientação científica do Presidente Flávio Henrique de Almeida, Professor Auxiliar do IADE - Universidade Europeia,
Professor Doutora Susana Margarida Àlvares de Carvalho de Andrade Campos, Professora Auxiliar na Faculdade de Arquitetura de Lisboa e do Doutor e Doutor Eduardo Alberto Vieira de Meireles Corte-Real, Professor Associado com Agregaçao do IADE

2017

o júri

presidente

Presidente Flávio Henrique de Almeida
Professor Auxiliar do IADE - Universidade Europeia

Doutora Susana Margarida Àlvares de Carvalho de Andrade Campos
Professora Auxiliar na Faculdade de Arquitetura de Lisboa

Doutor Eduardo Alberto Vieira de Meireles Corte-Real,
Professor Associado com Agregaçao do IADE

ABSTRACT

My research question in this study was How writing by hand will be relevant in the future.
In this research, I studied the history of handwriting and the significant changes in written communication throughout history, to be able to understand the possible changes coming in the near future. Since I was interested in different aspects of handwriting, I chose to interview a Neuroscientist, Early Education Expert & Teacher and a Type designer, in order to understand my topic on a deeper level.
This research is especially relevant in this time, because digitalization is having a big impact on how we write and schools all over the world are starting to adapt to it.
The findings in this research strongly point out that there are many good sides in handwriting. It is better for learning, memory and note taking, but there are also cases when typing is better. Handwriting also supports the ability to learn to read and therefore it is very important for a child´s literacy skills. Writing by hand could also make people focus better.

KEYWORDS

Graphic design, Handwriting, Hand lettering, Neuroscience, Minna Huotilainen, Jarno Lukkarila, Marja-Kristiina Lerkkanen, Future studies, Design inclusive research, Exploratory design, Calligraphy, Checking habit, Handwriting teaching, Alku Handwriting model, Finland, America.

I´ll write
you a note

WHY WRITING BY HAND WILL BE RELEVANT IN THE FUTURE?

Master thesis, Design and Visual Culture
Saara Helkala
IADE, 2017

*Your handwriting is like **the***

***accent** of your hands*

~ Anonymous

*Writing is **thinking***
on paper

~William Zinsser

INDEX

1. GLOSSARY

2. INTRODUCTION
2.1 Motivation
2.2. Introduction

3. RESEARCH QUESTION
3.1 Why writing by hand will be relevant in the future?

4. LITERATURE REVIEW

5. HISTORY OF HANDWRITING
5.1 Significant changes in communication throughout history
5.1.1 Written language
5.1.2 Printing Press
5.1.3 Typewriters
5.1.4 Internet
5.2 Handwriting and writing skills as a marker of social status
5.3 Good handwriting skills in our days

6. METHODOLOGY AND METHODS
6.1 Methodology
6.2 Methods
6.2.1 Qualitative design research
6.2.2 Exploratory design
6.2.3 Studying the future
6.2.4 Design inclusive research
6.3 Primary and Secondary data
6.4 Interviewing for Primary data
6.5 My interviews
6.6 Qualitative sampling
6.7 Data analysis
6.8 Coding

7. HANDWRITING & LEARNING
7.1 Learning to write by hand
7.2 Global differences: Finland and America as my examples
7.2.1 Finland
7.2.2 Model letters
7.2.3 Alku Handwriting Model for Finnish schools
7.2.4 America
v7.3 Effects on learning and creativity
7.4. Handwriting and literacy
7.5 Handwriting and academic success
7.6 Why good handwriting matters?
7.7 Relevant research studies: The effects of handwriting experience on functional development in pre-literate children
7.7.1 How the study was made
7.7.2 Results of the study
7.7.3 Similar studies

8. PHYSIOLOGY AND NEUROSCIENCE OF HANDWRITING
8.1 Why writing by hand is important for your brain
8.2 Typing versus handwriting

9. AMBIDEXTERITY & EXPERIMENTS
9.1 Right and left-handedness
9.1.1 Ambidexterity
9.2 Learning new skills
9.3 My ambidexterity training process
9.4 Analyze of the process
9.5 Conclusions

10. CURRENT STATE OF HANDWRITING
10.1 Debate between cursive and print
10.2 Handwritten typography trend
10.3 Designer´s point of view: Handwriting, designer skill or a basic skill?

11. FUTURE OF HANDWRITING
11.1 Uncertain future
11.2 The Checking habit
11.2.1 Is it all bad?
11.3 What unexpected positive effects handwriting might have?

12. CONCLUSIONS
12.1 Conclusions
12.1.1 Touch screens and stylus pens
12.2 How writing by hand will be relevant in the future?

13. BIBLIOGRAPHY AND PICTURES

1. GLOSSARY

PRINTING

Block letters (known as printscript, manuscript, print writing or ball and stick in academics) are a sans-serif (or "gothic") style of writing Latin script in which the letters are individual glyphs, with no joining. In English-speaking countries, children are often first taught to write in block letters, and later may advance to cursive (joined) writing. Other countries (Poland, Italy, Austria, Germany, France, etc.) focus on cursive writing from the first grade.

CURSIVE

Cursive (also known as script or longhand, among other names), is any style of penmanship in which some characters are written joined together in a flowing manner, generally for the purpose of making writing faster. Formal cursive is generally joined, but casual cursive is a combination of joins and pen lifts. The writing style can be further divided as "looped," "italic," or "connected."

FRONTAL LOBE

Frontal lobe located at the front of the brain, is one of the four major lobes of the cerebral cortex in the mammalian brain. The frontal lobe is located at the front of each cerebral hemisphere and positioned in front of the parietal lobe and above and in front of the temporal lobe. The frontal lobe plays a large role in voluntary movement. It houses the primary motor cortex which regulates activities like walking.

MRI/FMRI SCAN:

Magnetic resonance imaging (MRI) is a medical imaging technique used in radiology to form pictures of the anatomy and the physiological processes of the body in both health and disease. MRI scanners use strong magnetic fields, radio waves, and field gradients to generate images of the inside of the body. MRI is widely used in hospitals and clinics for medical diagnosis, staging of disease and follow-up without exposing the body to ionizing radiation.

FUSIFORM GYRUS:

The fusiform gyrus, also known as the (discontinuous) occipitotemporal gyrus, is part of the temporal lobe and occipital lobe in Brodmann area 37. The fusiform gyrus is located between the lingual gyrus and parahippocampal gyrus above, and the inferior temporal gyrus below. Though the functionality of the fusiform gyrus is not fully understood, it has been linked with various neural pathways related to recognition. Additionally, it has been linked to various neurological phenomena such as synesthesia, dyslexia, and prosopagnosia.

MOTOR CORTEX:
Motor cortex is the region of the cerebral cortex involved in the planning, control, and execution of voluntary movements. Classically the motor cortex is an area of the frontal lobe located in the dorsal precentral gyrus immediately anterior to the central sulcus.

THE POSTERIOR PARIETAL CORTEX (PPC):
The posterior parietal cortex plays an important role in planned movements, spatial reasoning, and attention. Damage to the posterior parietal cortex can produce a variety of sensorimotor deficits, including deficits in the perception and memory of spatial relationships, in accurate reaching and grasping, in the control of eye movement, and in attention.

GLOBAL PRECEDENCE
Images and other stimuli contain both local features (details, parts) and global features (the whole). Precedence refers to the level of processing (global or local) to which attention is first directed. Global precedence occurs when an individual more readily identifies the global feature when presented with a stimulus containing both global and local features. The global aspect of an object embodies the larger, overall image as a whole, whereas the local aspect consists of the individual features that make up this larger whole. Global processing is the act of processing a visual stimulus holistically.

DIGITAL DIVIDE
is an economic and social inequality with regard to access to, use of, or impact of information and communication technologies. The divide within countries (such as the digital divide in the United States) may refer to inequalities between individuals, households, businesses, or geographic areas, usually at different socioeconomic levels or other demographic categories.

The divide between differing countries or regions of the world is referred to as the global digital divide, examining this technological gap between developing and developed countries on an international scale.

CUNEIFORM

Cuneiform is a system of writing first developed by the ancient Sumerians of Mesopotamia c. 3500-3000 BCE. In cuneiform, a carefully cut writing implement known as a stylus is pressed into soft clay to produce wedge-like impressions that represent word-signs (pictographs) and, later, phonograms or `word-concepts' (closer to a modern day understanding of a `word').

HAPTICS

Haptics is any form of interaction involving touch. It can mean: haptic communication, the means by which people and other animals communicate via touching, haptic perception, the process of recognizing objects through touch or technology that interfaces with the user through the sense of touch.

UNIMANUAL AND BIMANUAL

Bimanual means performing a task using or requiring the use of both hands. Unimanual means doing the same with one hand only.

CONSTITUTION

A constitution is a set of fundamental principles or established precedents according to which a state or other organization is governed. These rules together make up, i.e. constitute, what the entity is. When these principles are written down into a single document or set of legal documents, those documents may be said to embody a written constitution; if they are written down in a single comprehensive document, it is said to embody a codified constitution.

CEREBRAL PALSY (CP)

CP is a group of permanent movement disorders that appear in early childhood. Signs and symptoms vary among people. Often, symptoms include poor coordination, stiff muscles, weak muscles, and tremors. There may be problems with sensation, vision, hearing, swallowing, and speaking

2. INTRODUCTION

2.1 MOTIVATION

After moving abroad at the age of 34, I moved in with a close friend, whom I have known for a decade. One morning she had left me a written note on the kitchen table (telling me she went to Feira da Ladra flea market) and when I red it, I realized this was the first time I have ever seen her handwriting. There was nothing wrong with her writing, the most shocking thing for me was that it looked completely strange to me. I knew her relationship history, her struggles and happy moments, her favorite everything: just not her handwriting.

Later that same summer, my 90 years old grandmother moved away from her house in the countryside to a small place in the city. She is still a strong supporter of the regular mail, so she would send me postcards regularly. After she moved to the city, which for her, was a big life change, I noticed her handwriting started to look a bit different, not so readable anymore. Later I found out from my mother, that in fact that kind of big life change in that age had not only been positive: she seemed to have aged a lot in a short time and did not function as well as she used to.

Both of these things got me thinking about personal handwriting. Is it something that will no longer be a part of you in the future? It is said that your handwriting is like the accent of your hands. What if we loose this skill as we mostly type on keyboards and smart phones these days?

With these thoughts in mind, I decided to focus my thesis on handwriting and ambidexterity. As a designer I use handwritten typography in my work a lot and I find it intriguing what might happen to the art of handwriting in the future. Will it become a skill that only a few people can master?

2.2 INTRODUCTION

In this thesis I go through the history of handwriting and written communication to find out the biggest and most significant changes in the past.

From the history part I move to handwriting and learning. This part goes through how handwriting is taught at schools and what kind of global differences there are. I chose to compare Finland and America, since they were the first two countries that started considering if handwriting teaching was relevant any more. I also wanted to compare two very different counties/continents, since comparing for example two European countries would not have had a big difference. This part also goes through the effects handwriting has on learning and creativity and one of the most relevant studies done in this field called The effects of handwriting experience on functional development in pre-literate children.

After going through my chosen interviewees, I move onto physiology and neuroscience of handwriting. One of the main focus points throughout my thesis is comparing typing to handwriting. This chapter goes through the good sides of writing by hand and what differences there are compared to typing.

In my research one main focus was on the effects of writing by hand versus typing has on people. I felt it was important to focus on the changes going from handwriting to typing and how these changes might be significant in terms of learning, memory and other brain activity. If handwriting will be a lost skill in the future, what kind of effects or problems this might bring? Or are we just going through a phase that will ultimatelwwwy lead back to writing by hand again, but on touch screens and tablets?

Since a part of my project was to do ambidexterity training on myself, I also go through ambidexterity and left-handedness briefly in this part. The training I chose to do is similar to a research study Writing

with the non-dominant hand: Cross-handedness trainability in adult individuals by Maciej Henneberg. Therefore I can compare my experience and results to the original study.

From the current state of teaching handwriting, I move on to the creative side. This part also goes through the hand lettering trend that is occurring at the same time people are writing less by hand. As hand lettering and calligraphy are more creative forms of writing by hand, should handwriting be taught in art classes only?

As my final part, I go through the possible futures of handwriting and what kind of relevancy it might have in the future. With the conclusions I got from the different chapters and from my primary and secondary data, I sum up all my conclusions to make my final conclusion and answer to my research question.

3. RESEARCH QUESTION

Why writing by hand will be relevant in the future?

4. LITERATURE REVIEW

The possible future or futures of handwriting is a very current topic. My research is especially relevant in this time, because digitalization is having a big impact on how we write and schools all over the world are starting to adapt to it.

There has been lot of discussion and articles written about it in the last few years. It has also been studied, but the studies differ a lot and the conclusions in these studies are mostly referred as "suggestions".

One of the reasons for this could be the fact that this is an ongoing phenomenon that started about a decade ago, when laptops, tablets and smart phones started to become popular and accessible. It seems there is lot of interest in researching this field, but what exactly should be researched does not yet seem as clear. Researchers also seem not to be comfortable giving "we should do this" –orders, rather just suggestions.

Based on most of the studies I have red on this subject, most agree that handwriting is an important skill. However, some experts on this field also say that loosing this skill would not be a tremendous loss and that people would still survive without it.

Some of the studies are mostly focused on relations between handwriting and learning to read, some on the importance of cursive handwriting and some on how handwriting skills affect academic success. To study this topic, it would be easiest to focus only one of these aspects, but since I want to find about the possible futures of handwriting, I believe that I should take all of these into consideration when making my final conclusion. My research is related to predicting the possible future/futures of handwriting and therefore will not have one right answer only. My conclusions will also be speculation, since it is not possible to see what happens in the future. Of course this is the case with most future related studies.

One researched fact is that learning to write by hand and learning to read are linked together, as we will learn later in this thesis. Research also shows that writing by hand is good cognitive practice and when writing by hand, you are able to remember and also recall the data better compared to typing on a computer. When looking at the articles written about handwriting and its importance in the future, seems that naturally teachers and other education experts have a lot to say about this subject. But also neuroscientists and other experts are taking their stand.

The opponents of teaching handwriting claim that it takes too much time that could be used for something more important. But no one can really say what might happen if handwriting would disappear completely. Most researches come

to the conclusion that this skill is useful, but seems like no one is daring to say if we would be able to get along without it.

In America, the debate between cursive and print has been very active during past few years, because the Common Core Standards no longer require elementary students to learn cursive handwriting. One of the main point in this conversation seems to be that if children can not write cursive, they are not able to read it either. Therefore there are old documents, for example the Constitution, that are written in cursive, would be unreadable for younger generations. I find this debate a bit irrelevant. Yes, there are good sides in cursive writing, but is it really worth it to keep it around just so children of the future can read the Constitution in its original cursive form?

In an article Käsinkirjoitus vähenee – miten se vaikuttaa meihin? (Handwriting is reduced - how does it affect us?) (Toivanen, Tuuli, 2014), Neuroscientist Minna Huotilainen (who I will interview later in this thesis), says that she is not worried about the loss of fine motor skills. If making things by hand would disappear altogether, it would have big effects, but Huotilainen does not believe in this. People will want to make this by hand (for example arts & crafts) in the future as well and this keeps our fine motor skills functioning, she says in the interview.

In another essay titled The Coming Age of Talking Computers, (Crossman, William, 1999), Crossman writes a lot more boldly about the possible future of handwriting and literacy. Crossman is an American educator and futurist speaker. In the essay he writes that "Literacy will be unnecessary by 2050, claims an expert on information technology, computers will respond to our voices and tell us what we want to know". However the truth behind this sentence seems a bit questionable, since the "expert on information technology" is not explained more specifically.

This essay, however, has very interesting points that most of other experts did not mention. Crossman is a futurist, so his ability to look at the possible scenarios is shown here.

> "It (written language) is failing us, first, because it is no longer able to do the tasks we created it to do: For most literate people, communicating, storing, and retrieving information by writing and reading is still far slower and more tedious than doing it by speaking. Second, the great majority of the world's people - by conservative estimates 80% of humanity, including many living in the so-called print-literate nations - still can't use written language effectively. Most societies in the world today are still oral cultures, and very few of the world's societies possess both the enormous human and economic resources and the political will required to fully train their populations to write and read".

The possibility of voice recognition devices replacing written language is also pointed out in many articles written about this subject. Some experts seem to believe that voice-in/voice-out (VIVO) devices could replace writing altogether. This technology would be useful for example people suffering with dyslexia.

In an article in Edutopia (Rosenberg, Robert, 2013) titled Education trends: Dictation Technology Will Change Writing Instruction by Robert Rosenberger, voice recognition devices are compared to calculators.

> "These choices are similar to those which educators already face about a number of what are now everyday technologies, from calculators to Internet research tools. The emergence of these technologies has required us to reassess the value of traditional curricula, and devise new pedagogical strategies that retain important lessons in the face of technological change".

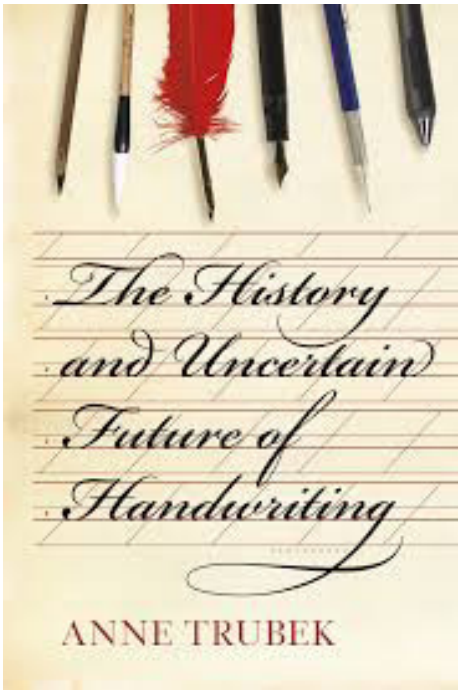
When going through my secondary data, I noticed that the study the Effects of Handwriting Experience on Functional Brain Development in Pre-Literate Children, (James&Engelhardt, 2012), is mentioned in almost every article related to the future of handwriting. This seems to be the study every other study on this field is referring to.

The authors of this study wanted to gain more information about differences in brain activation during three different letter-involving tasks: handwriting, tracing and typing. As the authors themselves put it, in an age of increasing technology, the possibility that typing on a keyboard will replace handwriting raises questions about the future usefulness of handwriting skills. This study (that I will go through later in this thesis) demonstrates that handwriting is important for the early recruitment in letter processing of brain regions known to underlie success-

ful reading. This research suggests that handwriting may facilitate reading acquisition in young children and writing by hand may also have a significant impact on our ability to retain information.

In my study, I am mostly focused on Finland and America. I am comparing these two as my main examples. When going through my secondary data, there were two names than I came across multiple times. Almost anything written about handwriting in the USA, had the name Anne Trubek mentioned. Anything related to the same subject in Finland, had another name: Minna Huotilainen.

Trubek is a writer and professor, Huotilainen is a neuroscientist. It is interesting how different these



PICTURE XX:
ANNE TRUBEK AND THE COVER OF HER BOOK.

experts are in both cultures. In my opinion, this shows that in a country like Finland, we believe someone´s word better when they are well educated on the subject and have a "deeper understanding", like here when we are linking handwriting with creativity and brain functions. Trubek´s, who is a professor and author, expertise on the matter seems a bit different, but it looks like since she is the most active and loudest in the conversation, she is considered to be the best expert.

Trubek has written several articles about the subject, including the most famous one titled Handwriting is history (Trubek, Anne, 2008). Trubek has also recently published a book called The History and Uncertain Future of Handwriting, 2016. Her book goes through the whole history of handwriting, from clay tablets to the modern alphabet as we know it. The book also notes the fact that every new innovation always seems to be a threat to the existing one. For example in ancient Athens, Socrates and his follower were against handwriting, claiming memory would be destroyed. Also Gutenberg's printing press also had opponents and struggles. From this book it is easy to understand that new methods of writing and communication have always changed and will continue to do so in the future as well. "Unsurprisingly, the most vocal opponents of new technologies are those who dominated the old," Trubek writes.

In her book, Trubek points out several studies that show the importance of handwriting compared to typing. For example studies that show a child drawing a letter freehand activates the neurological centers that reading and writing do in adults, while using a keyboard produces little effect. Children composing text by hand generate more words more quickly, and also express more ideas. Students who take notes in class by hand are better at retaining that information. After all of these results, she however still calls the science behind the new studies "fuzzy" and judges their findings unconvincing.

While this book is entertaining and educational, what remains as a bit of mystery is the author´s expertise on the subject of handwriting. In my opinion the author is also too focused on cursive handwriting, even the title of the book speaks about handwriting in general. This seems confusing to the reader, since there is a huge difference between loosing one way of writing by hand or the skill entirely. Trubek argues that "The decline and even elimination of handwriting from daily life does not signal a decline in civilization, but rather the next stage in the evolution of communication".

The importance of handwriting is not only about retaining fine motor skills. One of the most relevant studies in the field of my research question was a study done The Pen Is Mightier Than the Keyboard: Advantages of Longhand Over Laptop

Note Taking (Mueller&Oppenheimer, 2014).

The main reason for this study was to find out whether taking notes on a laptop versus writing longhand affects academic performance and to compare different ways of taking notes. According to the authors of this study, the study was divided in two parts. In the first study, participants (67 students, 33 male, 33 female, 1 unknown) watched selected five TED Talks for length slightly over 15 min and covered topics that would be interesting but not common knowledge. Each participant viewed one lecture on an individual monitor while wearing headphones. Participants in the laptop-nonintervention and longhand conditions were given a laptop or pen and paper, respectively, and were instructed that the study is about how information is conveyed in the classroom. Lectures were projected onto a screen at the front of the room and participants were instructed to use their normal classroom note-taking strategy, because experimenters were interested in how information was actually recorded in class lectures.

Next, participants were taken to a lab where they completed two 5-min distractor tasks and engaged in a taxing working memory task. At this point, approximately 30 min had elapsed since the end of the lecture. Finally, participants responded to both factual-recall questions and conceptual-application questions about the lecture and completed demographic measures. The second study aimed to replicate the findings of the first study and to determine whether a simple instructional intervention could reduce the negative effects of laptop note taking.

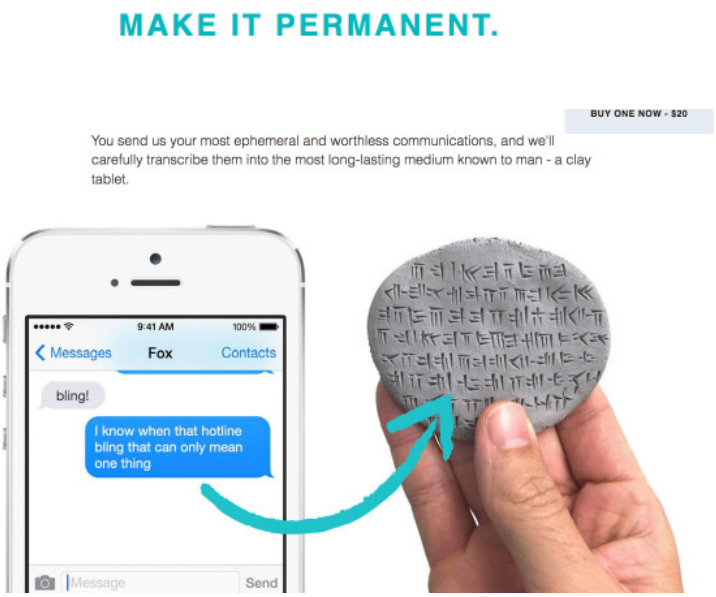
The results of this study show different facts. First of all if we look at the two types of note-taking (laptop and by hand), there is no significant difference: both performed equally well on questions that involved recalling facts. But when it comes to conceptual questions, the ones using a laptop performed significantly worse.

This is explained later on to be because when typing,

you are able to take the notes in a verbatim way. When you write by hand, you are slower, so you have to think what points to write down and that way already process the information while listening. Typing can be called as "mindless transcription". This study provides evidence that laptops may harm academic performance even when used as intended.

In this study, the scientists found an additional, interesting fact. At one point, the researches in this study told some of the laptop users not to simply transcribe the lectures word-by-word. However, this intervention failed completely. The laptop users still made verbatim notes writing down everything the teacher said and it diminished their learning. According to the authors of this study:

> "The results of this study suggest that longhand notes not only lead to higher quality learning in the first place; they are also a superior strategy for storing new learning for later study. Or quite possibly, these two effects interact for greater academic performance overall" (Mueller & Oppenheimer, 2014).



PICTURE 2: A WEBSITE WHERE YOU CAN GET YOUR TWEETS TURNED INTO A CUNEIFROM.

5. HISTORY OF HANDWRITING

How writing has developed throughout history captures our attention. The very first signs of handwriting date back to 1800 BC. (History of Handwriting). The importance of writing development is in allowing cultures to record events, history, laws, theories in math, science, medicine and to create literature.
Writing started to develop within 3 major cultures, 1200 years of each other. Sumerian had cuneiform that dates back to around 3000 BC, Egyptian hieroglyphs around 2800 BC and the precursor to Kanji Chinese around 1800 BC.

In the beginning, simple pictograms were used to represent people, places and things. As this technique developed, different pictographs were combined to represent ideas. These later became ideographs: abstract symbols that evolved beyond the original drawings.

Sumerian scribes used to write on long, vertical tablets of wet clay, from top to bottom, right to left. Having invented the first writing system, the Sumerians also established the first schools to teach writing (Trubek, Anne, 2016). Around 2400 BC, the Egyptians started using papyrus and reed brushes for writing. (History of Handwriting). Hieroglyphs were simplified about 1500 BC, and became known as hieratic script (priestly writing). Like the Sumerians, Egyptians sent children to school exclusively to learn how to write, but only boys from the most elite families had this option (Trubek, Anne, 2016).

The Celtic style of lettering involved writing the letters within 1-inch square guides, and were known as uncials. Around 600 AD, smaller half-uncials appeared, which closely resembled our modern lowercase letters. The letters were very rounded in style, and ascenders and descenders were extended on the lowercase letters. Also, word spacing was increased to improve readability.

In the late 700's AD, the ruler Charlemagne controlled most of Europe, and appointed an English monk to oversee standardized lettering practices for copying texts. Large uncials were used at the beginning of sentences (History of Handwriting) .

When Gutenberg created his movable type press in the mid-1400's, he modeled his letters upon the style of the scribes at the time. The technology advanced, and more upright letters were designed for printing.

By the mid-1700's, there were special schools established to teach handwriting techniques, or penmanship. Master penmen were employed to copy official documents such as land deeds, birth and marriage certificates, military commissions and other legal documents.

5.1 SIGNIFICANT CHANGES IN COMMUNICATION THROUGHOUT HISTORY

5.1.1 WRITTEN LANGUAGE

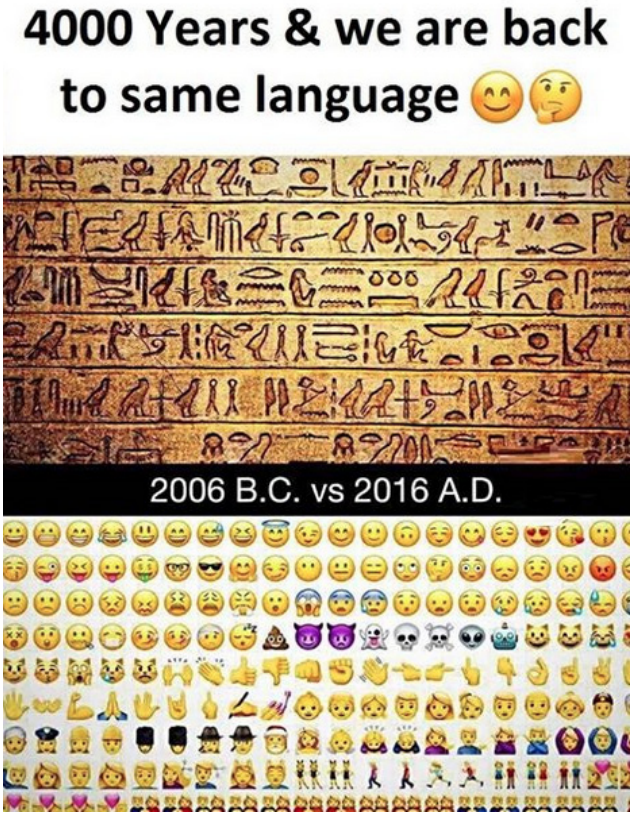
"Verba volant, scripta manen" is a Latin proverb. It basically means "Spoken words fly away, written words remain".

When looking at the history, it seems that whenever there is a new way of communicating, the old ones are threatened. It is surely not the first time (or the last time) there is something changing in the ways we communicate with written language. According to The History and Uncertain Future of Handwriting (Trubek, Anne, 2016), Socrates, the ancient Greek philosopher, was a strong supported of spoken language. He argued that writing caused humans to be less intelligent, less civilized and less creative. Socrates was afraid that by writing things down, they would "fall from the head". In his words "A reader must be singularly simple-minded to believe that written words can do anything more than remind one of what one already knows".

In the times of Socrates, many philosophers believed that speech was the most rarified form of knowledge and expression. Also because in writing, there is no communication like in speaking. Despite these opinions of philosophers, writing continued to be a good way to maintain information.

5.1.2 PRINTING PRESS

According to the study titled From Gutenberg to Grandin: Tracing the Development of the Printing Press by Keith J. Wilson, the Chinese are credited with first carving wooden blocks and using them to print symbols and images as early as 175 AD. Significant change came around 1440, when the Printing Press was invented by the German Johannes Gutenberg (Chappell & Bringhurst, 1999). Gutenberg was a goldsmith by profession. He developed a complete printing system, which perfected the



PICTURE 3:
HISTORY REPEATING
ITSELF.

printing process through all of its stages by adapting existing technologies to the printing purposes, as well as making groundbreaking inventions of his own. This new technology made possible the precise and rapid creation of metal movable type in large quantities. This was the key element in the profitability of the whole printing enterprise.

Gutenberg´s press was replicated and his technology spread quickly. Within just fifty years of his first press, over twelve million books had been printed in more than one thousand print shops (Chappell & Bringhurst, 1999). The operation of a press became so synonymous with the enterprise of printing that it lent its name to an entire new branch of media, the press.

Before Printing Press, the authors were not important and sometimes not even mentioned. Printing Press also changed the process of reading, moving it from oral readings to silent, private reading. The wider availability of printed materials also led to a dramatic rise in the adult literacy rate throughout Europe. For democratization of knowledge, Printing Press was also very important step. (Chappell & Bringhurst, 1999) Naturally when more people had access to knowledge, both old and new, more people were able to read and discuss these works.

But as for the monks who created books in the pre-printing era, printing press overturned their livelihood. However the printing press created new professional possibilities for those who were good at handwriting (Trubek, 2016). Scribes that

used to write books by hand, noticed they had to do something else with their skills, so they started to teach penmanship to others through tutoring, classes and books. These new writing masters traveled through Europe and eventually the occupation rose higher in prestige than most scribes ever attained: writing masters became wealthy professionals.

5.1.3. TYPEWRITERS

According to Michael H. Adler´s book The Writing Machine, A History of the Typewriter, the earliest patent for a typewriter-like device was filed in England in 1714 by Henry Mill. After that, the earliest extant example of typewriting was composed by a blind Italian countess, Carolina Fantoni, on a machine made for her by her friend, Pellegrino Turri (Adler, 1973).

According to Adler, typewriters had a big impact on communication: typed text was faster and more legible. It also increased the efficiency in political administration because of the standardization of documents.

When typewriters became more common and affordable, some people were worried about losing the skill of handwriting, a bit like today. (Trubek, Anne, 2016) In 1924, a school administrator of Pittsburgh expressed his concern about that "Since the introduction of a typewriter in our junior high schools, there is a tendency to minimize the importance of teaching of handwriting". Also an article in the New York Times claimed in 1938 that "Writing with own´s hand seems to be disappearing and the universal typewriting may swallow all".

According to The Woman and the Typewriter: A Case Study in Technological Innovation and Social Change Milwaukee Public Museum, (Hoke, Donald, 1975), typewriters also brought good new job options, especially for women: from 1880´s onward typewriting business opened up higher-paying stenographer and typist jobs for women as an alter-

PICTURE 4:
TYPEWRITER AD
FROM 1800´S.

native to factory positions. By 1881, typing courses for women were offered by various organizations, including the Young Women's Christian Association. This was an important step toward female economic empowerment or independence. Because typewriters made document creation more efficient, they were quickly adopted by business managers. Typewriters increased accuracy in typing diplomatic documents. Authors also used them to write more quickly.

5.1.4 INTERNET

Of course one of the biggest changes in written communication in recent decades was when the Internet was invented and became popular in the late 1990´s. Internet has changed the ways people communicate tremendously.

Before Internet, many ways of communicating were slower and more expensive, for example sending documents to another country. Nowadays we are able to do that with one click through email. Email also does not have limited length and many email programs highlight spelling mistakes, which make it easier to write better. Also things like Google and translating websites/apps have made things that we used to have, like encyclopedias and dictionaries, almost entirely useless. Internet has also introduced us to many other things we did not have before:

PICTURE 5:
TYPEWRITER AD FROM 1800´S.

Blogs and other social media. These both are very text based and also more about communicating than just writing. The biggest part of social media, for example, is in interacting with others, not just writing stuff for others to read silently.

5.2 HANDWRITING AND WRITING SKILLS AS A MARKER OF SOCIAL STATUS

Handwriting has been closely linked with association of personal identity, intelligence, social status and virtue (Trubek, Ann, 2008), making it more than simply a fine-motor skill and form of communication. Through times, handwriting has been linked to social status. According to Trubek, in the American colonies, a "good hand" became a sign of class and intelligence as well as moral righteousness.

During the colonial period, cursive writing occurred as "self representation but not self-expression". Male handwriting indicated a gentleman's integrity while for women it was a form of artistry (Thornton, Tamara Plakins, 1996).

Benjamin Franklin, one of the Founding Fathers of the United States and the founder of Academy of Philadelphia, was also a proponent of proper handwriting. To enter the Academy of Philadelphia, it was required to "write a legible hand." However very few Americans were eligible to enter Franklin's academy. In Franklin´s times, places like this were only open for men. You also needed to know how to write, which was not so common those days. Many women and non-wealthy men were only taught to read, but not write.

According to Trubek, even when public schooling began, writing was not always included in the curriculum, so many colonists could read but not write. It was not until the beginning of the 19th century that schooling became universal. Then, handwriting was finally taught to American schoolchildren.
Today, the importance of literacy skills has not gone anywhere. The book Adult Literacy in America: A First Look at the Findings of the National Adult Literacy Survey (Kirsch, Irwing S. & al., 1993), says that

> "Many Americans cannot read well enough to take full advantage of the benefits of society—or to contribute fully to its sustenance. Those who are low in literacy are paid less, are more often out of work, are less likely to vote, are less informed about civic affairs, are less able to meet the health-care needs of their families, and are more likely to have trouble with the law or to become ensnared in other socially harmful activities".

According to the authors of this study, literacy is important part of every sphere of our daily lives: reading sign for directions, writing emails, buying something over the internet, taking part in a religious service or following a medical prescription.

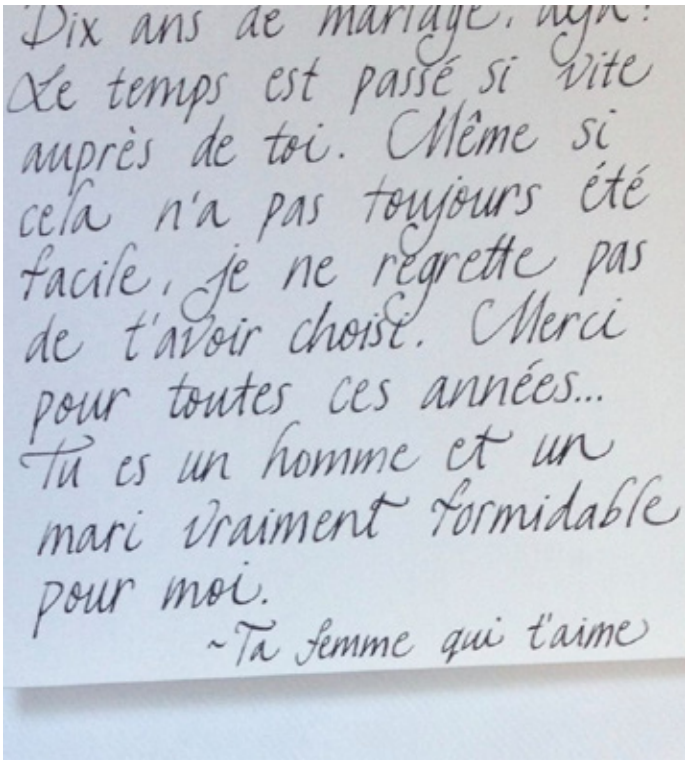
This brings us to one of the problems with bad and illegible handwriting. A report by the Institute of Medicine called To Err is Human,1999, states that medical errors cause at least an estimated 44,000 preventable deaths annually in the United States of America alone, of which 7,000 deaths are attributable to sloppy handwriting.

5.3. GOOD HANDWRITING SKILLS IN OUR DAYS

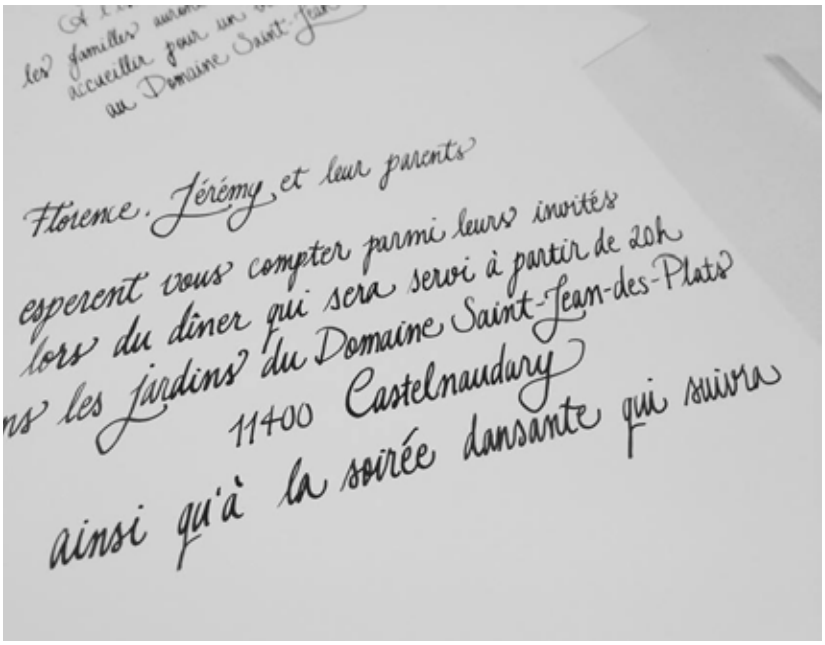
Despite all the technology, there are still people who make a living writing by hand. Calligraphy is an example of this practice.

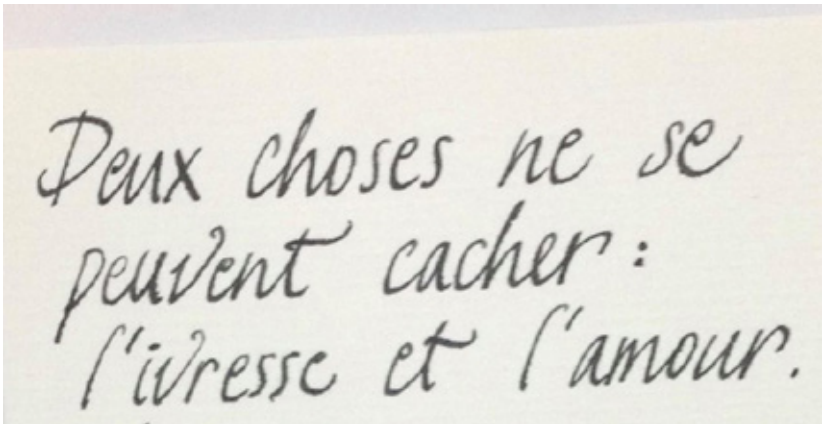
Finnish graphic designer and calligrapher Maria Vilenius lives in Paris and she used to work as a full time calligrapher. Vilenius studied graphic design in Paris and after graduating, she made a living writing by hand. In Paris, London and other fashion capitals, calligraphy is still a big business.

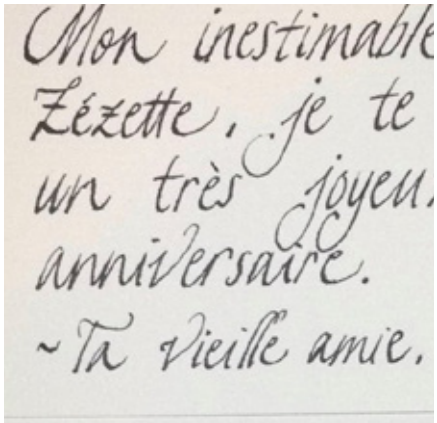
"My clients have been big fashion brands. I´ve been doing calligraphy for Dior for example", she says in the interview in Helsingin Sanomat. (Mattila, Raisa, 2016).



PICTURE SET 6:
CALLIGRAPHY
MADE BY MARIA
VILENIUS







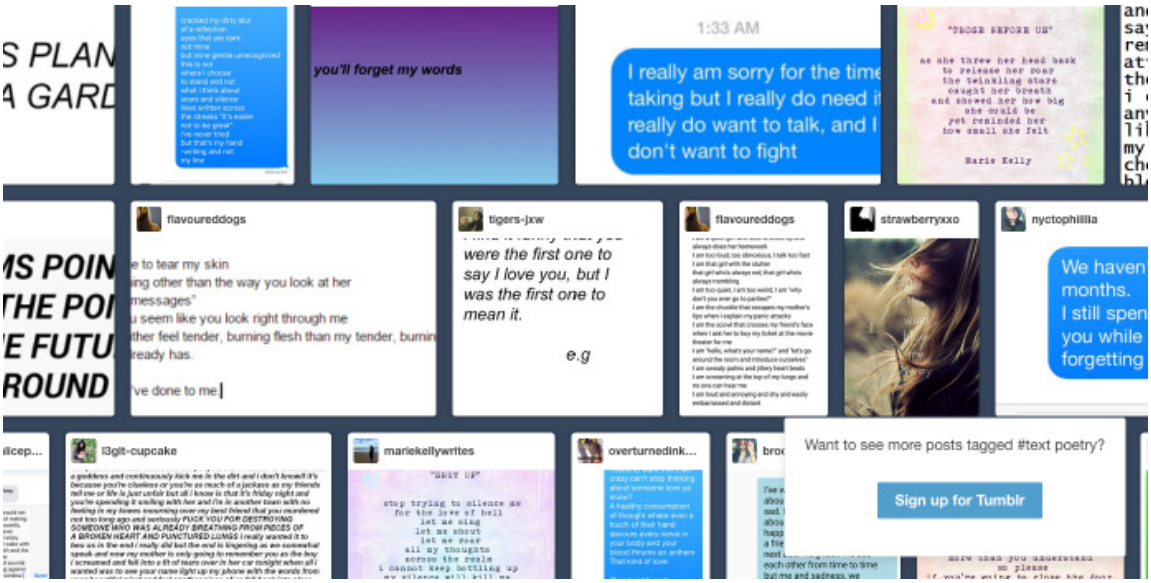
PICTURE SET 6:
CALLIGRAPHY MADE BY MARIA VILENIUS

"The busiest time of the year is during Fashion Week, since we do invitations, seating cards and other assignments related to the event

In my short interview with her, she said that in Paris, where lots of luxury brands are located, calligraphy is quite wanted as a service, so you can quite easily find little comissions to do every now and then. Even calligraphy was not taught to her when she studied graphic design in Paris, she feels it is great to know calligraphy because there are not that many people who do that as a profession. "I do not know how many calligraphers there are in France but I have heard there are something like 20 professionals in Paris area". According to Vilenius, "old fashioned" calligraphy is not at all wanted. Clients mostly want just beautiful handwriting that is clean and fluent. "The company where I worked as a calligrapher, proposed 5 different handwritings to the clients. We all had to learn these 5 styles, but everyone had their own way to do these styles. Some clients wanted me to imitate someone´s handwriting. It's not evident to write exactly like somebody else if you have little time to learn it, so you'll do as best as you can, as close as you can".

"Time is, and has always been the biggest luxury. That is why luxurious brands hire professionals to write by hand. When the text has not been printed, but written by hand instead, it shows respect to the receiver", Vilenius says in the interview of Helsingin Sanomat.

In 2013, luxury fashion brand Louis Vuitton held an exhibition called Correspondences in Espace Culturel in Paris. It presented correspondences between different artists in different decades, handwritten of course. This made me wonder, what can we do in the future: have an exhibition presenting text messages? Most likely. There are already websites based on text message conversations between people and as much as I would like to romanticize the handwritten word, in the end I believe it is the content that counts, not the format.



PICTURE /:
POETRY TEXT MESSAGE TUMBLR

PICTURE 8:
CORRESPONDENCES EXHIBITION IN ESPACE CULTUREL IN PARIS

6. METHODOLOGY AND METHODS

6.1. METHODOLOGY

The main goal of my research was to find out what will happen to handwriting in the future. I wanted to focus on three different aspects:

1. How handwriting skill is relevant in learning?
2. How would the loss of handwriting effect people?
3. The creative side of handwriting.

My research is both theoretical and practical. Theoretical part of my research was researching through archives of academic papers, studies, books and other data written about my subject in the near past. The practical part of it consists of interviewing experts in different fields connected to my research. By analyzing these answers and reflecting that data to my secondary data, I was able to reach a conclusion and answer to my research question.

6.2 METHODS

My research method is qualitative design research. A qualitative study seeks to learn why or how, so as research method, I used qualitative research, since I wanted to answer a "how this might be in the future" – related question.

6.2.1 QUALITATIVE DESIGN RESEARCH

Qualitative research is defined as an umbrella term covering an array of interpretative techniques which seek to describe, decode, translate and otherwise come to terms with the meaning, not the frequency, of certain more or less naturally occurring phenomena in the social world. Qualitative research methods are also suitable in cases where it is difficult to develop a standardized conclusion due to the lack of knowledge on the phenomenon. This was the case with my research as well, since it is an ongoing process.

6.2.2 STUDYING THE FUTURE

When talking about the future in this project, I am referring to time happening in next 5-10 years. One common rule of future related studies is that "the accuracy of a prediction decreases in relationship to the distance of time in the future for which the prediction is being made. Inherently, a prediction made for the next 5 years is likely to be more accurate than a prediction made for the next 500 years" (WFS, World Future Society). Other common principle of future related studies is that changes are large part due to the so called Butterfly Effect where small variations or factors create minor changes that grow larger as time goes on. Greater complexity then leads to greater difficulty in accuracy (Scholarpedia).

When talking about the changes going on in the world that are related to writing by hand, I am also referring to the changes that have happened in the past 5-10 years. In future related studies, it is very relevant to look at the history and changes happening throughout time to be able to get an idea how history might repeat itself. If I am for example trying to evaluate something over the next ten years, it is best to derive a trend from the last ten years and maybe additional few decades before that. According to basic trend study principles, by utilizing the data in ten year increments you can make reliable trend predictions (Aarshay, Jain, 2016).

6.2.3 EXPLORATORY RESEARCH

Qualitative research is primarily exploratory research. Exploratory research is research conducted for a problem that has not been studied more clearly, establishes priorities, develops operational definitions and improve the final research design (Stebbins, Robert A, 2001).

Social exploratory research "seeks to find out how people get along in the setting under question, what meanings they give to their actions, and what issues concern them. The goal is to learn 'what is going on here?' and to investigate social phenomena without explicit expectations." This is very close to my research, which in fact could be considered as a phenomenon.

Exploratory research is used to gain an understanding of underlying reasons, opinions and motivations. It provides insights into the problem or helps to develop ideas or hypotheses for potential quantitative research. Qualitative research is also used to uncover trends in thought and opinions, and dive deeper into the problem. Qualitative data collection methods vary using unstructured or semi-structured techniques. The sample size is typically small, and respondents are selected to fulfill a given quota (Ex-

ploratory Research in the Social Sciences).

These types of research methods involve describing in detail specific situation using research tools like interviews, surveys, and observations. This method is well suited in this case, since producing exploratory research work and practicing my research skills in this project is very important for my possible PHD studies. This research is also important to myself and my career, because in the future I want not only to be a designer but also use my research skills in my future job. When research aims to gain familiarity with a phenomenon or to acquire new insight into it in order to formulate a more precise problem or to develop a hypothesis, exploratory studies (also known as formulative research) come in handy. The results of exploratory research are not usually useful for decision-making by themselves, but they can provide significant insight into a given situation (Kothari, C.R, 2004).

6.2.4 DESIGN INCLUSIVE RESEARCH

According to the paper titled Comparison Of Three Methodological Approaches Of Design Research by Imre Horváth, Design research enables us to build a testable body of knowledge by systematic investigations through observation and reasoning. A distinguishing feature of design research is that it is done with a dual goal in mind. On the one hand, design research seeks to provide insights in, and theoretical explanations of, all phenomena related to design (Horváth, Imre, 2008). On the other hand, it is done in order to increase the problem solving intelligence, and to provide tools and methods for practical design activities. In my research, this is however not the goal.

According to Horváth, in design inclusive research, it is widely accepted that the only objective of fundamental research is advancement of knowledge. It is driven by the researcher's curiosity, interest or hunch, and is conducted without having any practical end in mind. Using design inclusive research I intend to construct understanding of the world by interpreting phenomena also in design context.

6.3 PRIMARY AND SECONDARY DATA

PRIMARY DATA

As my primary data, I gathered information through personal interviews of chosen experts of this field and analyze the data gathered from these interviews. I reflected that data to my secondary data.

SECONDARY DATA

As this subject is difficult to study, due to the fact that it is an ongoing process and there are no ready answers for it, my research is mainly focused on data and research written and done about it the near past. I used this as my secondary data.

I included a brief history of handwriting in my study, but since my aim is to focus on the future and to study this subject as a phenomenon, the part of history remains small. The most important fact from the history will be the understanding how our ways of communication have changed, are changing and will continue to change in the future.

6.4 INTERVIEWING FOR PRIMARY DATA

In qualitative research, interviews are the most common techniques used to gather research information. There are three types of interviews: structured, semi-structured and unstructured. For my research, I chose to use semi-structured interviews. Semi-structured interviews elicit people's own views and descriptions and have the benefit of uncovering issues or concerns that have not been anticipated by the researcher (Kumar, Ranjit, 1999).

When choosing the people to interview, I wanted to have experts on different fields to make sure that my research will not focus on just one perspective. My main focus will be on Finland, since it is a country with advanced education system and it was the first country to remove cursive writing from their curriculum.

As my experts, I chose to interview Jarno Lukkarila, the type designer who designed new model letters to Finnish primary schools together with Finnish National Board of Education. From him, I got the basic knowledge of the past and present of model letters and also to understand the process of simplifying and modernizing them to meet the current needs.

By choosing teachers and experts on early educa-

tion as other experts to interview, I wanted to get the "hands on knowledge" how this phenomenon is really effecting the schools at this moment. I interviewed an early education expert and teacher Marja-Kristiina Lerkkanen.

As I am also interested in the creative and neuroscientific side of handwriting, I chose to interview a neuroscientist Minna Huotilainen, who works as a research professor in the Institute of Occupational Health in Finland.

In my interviews, I decided to use open questions, since my aim is also to get opinions from the experts, not just results based on researches. Since the people I will interview are the experts of their fields, I am able to rely on their personal opinions more than I could if they were "regular people". By having open questions, I intend to get their personal opinions and suppositions since this is a subject that also revolves around predicting the future.

As the interviewer in a semi-structured interview, I had questions and a framework of themes to be explored and discussed. In this case interviews are the appropriate tool to be used since the research is also concerned with personal believes and the available evidence on the subject is limited. In my research it is important to allow new ideas or predictions to be brought up during the interview as a result of what the interviewee says.

In my research and interviews, I would have wanted to do more comparisons between different countries, but even finding people to interview from my own country was a challenge enough. Half of the people I was planning to interview, never replied, even they agreed to the interview in the first place. So I found myself in the situation where simply because of time management issues I had to cut the number of interviews smaller than it was in the beginning. My original plan was to use the Delphi method and interview more people just on the subject of the future of handwriting, but in a few mini-interviews I made, I found out that people, even experts on this field, did not really want to say anything else than the same things I have had already red from multiple researches. I reached the saturation point and found that I was just getting the same answers from different experts and the answers did not give me any new information. It also seemed like this topic was not pleasant for people to give their own personal opinions. Therefore I made the decision not to use this method.

6.5 MY INTERVIEWS

Perspectives on handwriting from neurosciences

Minna Hutoilainen,. Neuroscientist, Research Professor in the Institute of Occupational Health in Finland. Interview on Skype, 12/2016, in Finnish. Interviewer: Saara Helkala.

Designing the model letters for handwriting

Jarno Lukkarila. Typographer, Typolar. Interview through email, 2/2017, in Finnish. Interviewer: Saara Helkala.
The current state of handwriting in Finnish primary schools
Marja-Kristiina Lerkkanen. Adjunct Professor, PhD, Faculty of Education / Department of Teacher Education, University of Jyväskylä. Interview through email, 11/2016, in Finnish. Interviewer: Saara Helkala.
How do you see the future of handwriting?
Rosemary Sassoon, Designer, Author, Handwriting teaching expert
Sheila Lowe, American Handwriting Analysis Foundation
Maria Vilenius, Designer and professional Calligrapher, Paris France
Small interviews through email, 2/2017, in English. Interviewer: Saara Helkala.

6.6 QUALITATIVE SAMPLING

As a designer and researcher, I chose my interviewees based on their expertise on the topic. I wanted to have experts from different fields related to handwriting.
There are no specific rules for sample size in qualitative inquiry. In other words, sample size depends on the aim of the study and what is possible, given the time and resources available.
From the interviews, I gathered knowledge how writing by hand effects learning among children. I wanted to find out how digital world is affecting and changing the process of teaching handwriting. My study is focused on the effects of handwriting. What kind of positive effects it has and what might happen if it disappears in the future?

6.7 DATA ANALYSIS

The most common analysis of qualitative data is observer impression. That is, expert or bystander ob-

servers examine the data, interpret it via forming an impression and report their impression in a structured and sometimes quantitative form.
From the primary data and the data collected from interviews, I was able to make conclusions that answers my research question.

6.8 CODING

Since the people I interviewed, are experts from different fields, I expected that they might have different opinions on this subject. When going through the data I got from the interviews, my goal was find the things they agree and disagree about. It is important to keep in mind what difference in opinions has to do with their different professions and what has to do with just different opinions.

7. HANDWRITING & LEARNING

7.1 LEARNING TO WRITE BY HAND

Writing is said to be "an immensely important and equally complex and sophisticated human skill commonly ascribed a fundamental role in children's cognitive and language development, and a milestone on the path to literacy". (Mangen & Velay 2010).

According to National Association for the Education of Young Children (NAEYC), learning to write and read as a process starts to develop like this: Young babies make sounds that imitate the tones and rhythms of adult talk; they "read" gestures and facial expressions, and they begin to associate sound sequences frequently heard – words – with their referents.

The study Literacy in Early Childhood and Primary Education (3-8 years) explains the process of learning to read and write:

> "The letters of the alphabet are complex abstract symbols and children can't begin to write their letters until they can draw a circle. If they can't draw a circle then they can't form letters like a, b, d, o, p, q. This ability to draw an enclosed shape is a very important marker of both cognitive and physical development, and it is a skill that emerges from their scribbles. So drawing, scribbling and playing with crayons and pencils are an important part of learning to write".
>
> (Kennedy & Dunphy & Dwyer & Hayes & McPhillips & Marsh & O'Connor & Maura & Gerry, 2012).

William Klemm, Ph.D., a senior professor of Neuroscience at Texas A&M University, explains the process of learning to write by hand. Even if it is just printing, learning to write by hand, the brain must:

- Locate each stroke relative to other strokes.
- Learn and remember appropriate size, slant of global form, and feature detail characteristic
of each letter.
- Develop categorization skills.

(Klemm, William, 2013). Why Writing by Hand Could Make You Smarter

The ability to write one's name is an important indicator of early literacy, according to the National Early Literacy Panel (NELP Report, 2008). NELP identified name writing as "an indicator related to later reading ability, even after controlling for IQ and socioeconomic status". Name writing appears to be based on the alphabetic principle. "Study made by Weinberger (1996), found children's

skills in naming letters and writing their name at five years was linked with their reading skills at age seven" (Clark, Gloria Jean, 2010).

In Finland, along with learning how to hold the pencil and draw letters, children are also taught how to unite paths from dots to dots, do labyrinth assignments along with coloring and drawing shapes that help them in the learning process. (Lerkkanen, Marja-Kristiina, interview, 2017). Letter copying might seem like a simple task, but according to Stevenson and Just, it´s quite a complex task that requires a lot from the child:

> "When copying letters and words, children need not only control the fine movements and force of the fingers and hand, but attend to the relevant stimulus, keep in working memory the target to be copied, coordinate visual and manual movements, and integrate this perceptual and motor information with linguistic rules about orthographic structure (for example in English, letters are written successively from left to right). Coordinating all of these elements when copying letters and words will help ensure that handwriting is fluent, automatic and legible".
> (Stevenson & Just, 2014).

It´s common that handwriting skills of girls develop faster than those of boys. It´s also more common for boys to have illegible handwriting than girls. There can be multiple reasons for these differences (Lerkkanen, Marja-Kristiina, interview, 2017). "Boys usually tend to be slower in developing any motor skills. Also when it comes to practicing writing by hand, boys tend to practice less and have less interest towards writing altogether", says Lerkkanen in my interview.

7.2 GLOBAL DIFFERENCES: FINLAND AND AMERICA AS MY EXAMPLES

What kind of letters are taught to school children, naturally varies between different countries. According to an article titled Cursive Handwriting and Other Education Myths by Philip Ball in Nautilus.us, 2016, many countries, including the US and Canada, teach print letters in the first grade and are cursive from second or third grade. In France children are taught to write already in kindergarten and in cursive. In Mexico, only print letters are taught. "

> "The U.S. and United Kingdom leave some discretion for when cursive is taught, but there is the assumption that it will become the pupil's normal mode of writing. When cursive is taught, it may become compulsory, so children may be marked down if they don't write this way. In France, the cursive form is virtually universal and highly standardized, and children are discouraged from developing their own handwriting style".
> (Philip Ball: Cursive Handwriting and Other Education Myths).

In this upcoming part, I am comparing Finland to the US in order to find out the differences in teaching handwriting.

7.2.1 FINLAND

In Finland, "The main purpose of educational evaluation is to support the development of education and improve the conditions for learning" (Act on Basic Education, 1998).

Nevertheless, many international assessments also play a role in the developing the education system in Finland. The Ministry of Education and Culture is the highest educational authority in Finland and they also draft all the legislations on education. The next level of the administrative hierarchy is the National Board of Education, which is responsible for the national curricula. In Finland, teaching cursive handwriting is now optional. Teachers can decide if they want to teach it after teaching print letters, but the national curricula no longer requires it to be taught.

> "Municipalities with their local authorities are obliged to organize education in practice, constructing municipal curricula in accordance with the above-mentioned national guidelines and steering documents. Finally, at the school level each school drafts its own curriculum founded on both the national and the local one. This means the teachers are also involved in developing the school-based curriculum, and the schools have a chance to adjust the curriculum to the local circumstances. The Finnish education system is characterized by a combination of national

and local control"

(Harju-Luukkainen & Vettenranta & Ouakrim-Soivio & Bernelius, 2016).

"The National Curricula defines what is taught to children in schools. Different cities and schools can have their own emphasis on these things, but all teaching should be based on the National Curricula", says Marja-Kristiina Lerkkanen in my interview.

7.2.2 MODEL LETTERS

7.2.3 ALKU HANDWRITING MODEL FOR FINNISH SCHOOLS

School handwriting fonts (often called model letters) have been used in Finland since the 1930s. They were originally designed by architect Toivo Salervo. Since autumn 2016, first class pupils (aged 6-7) are taught to learn to print upper and lower case letters, form words with these letters and practice keyboard skills. The new curriculum encourages pupils to develop versatile and modern writing skills that they will need during their lives.

According to Finnish National Board of Education (FNBE), it was noted that students in junior high and high schools mostly used print letters, not cursive. This was one of the reasons for the new model letters, which replaced separate print and cursive letters that were taught before. Since the year 2016, Finland is using new model letters that are not cursive anymore. It is possible to combine letters in kind of a cursive manner, but it is not required. (Lukkarila, Jarno, 2015).

These letters were designed by typographer Jarno Lukkarila together with Finnish National Board of Education. He studied the history of Finnish handwriting for the design assignment.

According to a Case study Lukkarila´s website, Finnish National Board of Education (FNBE)

published a new recommendation for teaching handwriting in 2015. (Lukkarila, Jarno, 2015). This writing model was introduced to Finnish primary and pre-primary school across the country from August 2016 on. Only print writing will be provided by FNBE, leaving the joined-up cursive writing in the past. Also starting from the year 2016, the Matriculation examination in Finnish schools has been done partly by typing on a keyboard. In 2019 it will be typed completely. These changes were done based on the changes going on in the world. Finland was the first country to remove mandatory cursive writing from their curriculum.

Finland is practically a bilingual country with a majority of Finnish speakers and a large Swedish speaking minority. Apart from these two national languages three native languages (Inari Sámi, Northern Sami and Skolt Sami) and two autochthonous languages (Finnish Romani and Karelian language) are also spoken. Alku letterforms are primarily designed for these languages, which all belong to Latin writing system. Many alphabets and numbers have two or more equally acceptable shapes, which are preferred according to regional customs. For a good handwriting model it is crucial to firstly introduce shapes, which are easy to draw and secondly minimize confusion between them. Executing these principles escalates in capital 'I', number one and lower case 'l', explains Lukkarila.

> "Before starting the process of designing these model letters, there had already been some decisions made about the letters. The new model letters would not be cursive anymore and it also had been decided to add crossbars to some of the letters. In the group (with Finnish National Board of Education) we decided how to develop these letters to meet today´s needs better". (Jarno Lukkarila, interview 2/2017).

"Each letter can be written with one single movement, and its character is as simple as possible to draw," Lukkarila says in Helsinki Design Week interview (Kukkapuro, Ida, 2016). "Instead of having two different styles, it´s better to have just one style of model letters. These letters work as the basis when learning how to write by hand and later as the basis on personal handwriting development", FNBE explains.

The new model letters are based on the groundwork that was done with other Nordic countries. Before these changes in 2016, previous changes in model letters were done during 2002-2004. In 2004, Finnish schools started to teach print in addition to so called cursive writing.

> "The whole process of learning to write was made simpler with these letters. Now there are only one alphabet for the children to learn, not two different kinds anymore. The letter forms themselves are not really more simple than the old ones, but there were some changes. For ex-

> ample we wanted to highlight the meeting points of straight and curved lines",

Lukkarila explains in my interview (Lukkarila, Jarno, interview, 2017).

Left-handed children were also taken into consideration: When learning these letters, left-handedness should be considered in the position of writing and also how to hold the pen. The tilting of the letters is optional and without it these letters might be easier to some left-handed children, Lukkarila says in my interview.

These model letters were sketched and designed drawing and writing by hand, so that the shapes and curves would be based on a natural hand movement. Letters were mostly sketched using similar pencils and markers that are used at schools. After sketching by hand, the process was continued with a computer. In this process the part of sketching and designing by hand was a lot bigger than for example when making a regular body text font, Lukkarila tells about the project in my interview.

During the design process, these model letters were tested in Majakka -school groups by National Board of Education. These groups consisted of approximately 25 classes of students. The user feedback based on this testing had a significant role in designing and finalizing these letters. "We wanted to get the feedback from both students and teachers on the changes that were to be made for the letters", says Lukkarila in my interview.

Also throughout the whole process the shapes of these letters were evaluated by a group of experts in Finnish National Board of Education. The group consisted of experts on early education and handwriting teaching. (Lukkarila, Jarno, interview, 2017).

According to designer Jarno Lukkarila, the new model was introduced to improve handwriting skills within children who are natively accustomed to keyboards in early age. Letterforms are designed as

neutral, obvious and unambiguous as possible. They don't combine, but some elements in letterforms are borrowed from cursive handwriting to improve the flow of writing. Strokes usually end up straight without upward hooks to avoid messy text especially in Finnish with many double letters such as 'ii', 'll', 'nn' and 'mm'. This provides a good basis for coherent and legible writing style, where each student will add they own personal mark on. As writing skills improve and speed up, joined letters or ligatures are welcome to appear spontaneously.

7.2.4 AMERICA

In the United States The Common Core State Standards is an educational initiative that details what K–12 students should know in English language, arts and mathematics at the end of each grade. Today, the Common Core Standards no longer require elementary students to learn cursive handwriting. (American Handwriting Analysis Foundation, 2016). As a result, some schools are dropping handwriting instruction from the curriculum. As of May 2016, only 15 states require the teaching of cursive handwriting in their Core Curriculum Standards. The remaining states, districts, principals, school boards, and teachers must choose for themselves whether or not to teach cursive handwriting or any form of handwriting at all.

According to Sheila Lowe, President of American Handwriting Analysis Foundation, handwriting training usually begins in 3rd grade, when children are 8 years old. There are differences in different states. Several years ago most states adopted the Common Core Curriculum, which did not require cursive handwriting training. Since then, about 13 states have returned the requirement, and more have legislation pending (Lowe, Sheila, interview, 2017).

Anne Trubek writes in the article Let's face it — handwriting just doesn't matter, Gulf news, 2016, that for example in Alabama, in June 2016, the state required the teaching of cursive in public schools by the end of third grade by way of "Lexi's Law". This is named for the granddaughter of state Representative Dickie Drake, who believes "cursive writing identifies you as much as your physical features do". This means that he believes "our script reveals something unique and ineluctable about our inner being". (Trubek, Anne, 2016).

While in Finland children are learning new model letters designed in 2016, children in the US are taught mostly the D'Nealian model as model letters that date back to 1970´s. The other models used are Zaner-Bloser model and New American Cursive and Cursive Logic, which are mostly used in homeschooling. USA Today reported that in 1999, homeschoolers made up a tiny sect of the American population. "An estimated 850,000 students nationwide were being homeschooled. By 2011-12, that number had more than doubled to 1.77 million." For comparison, in Finland homeschooling is very rare.

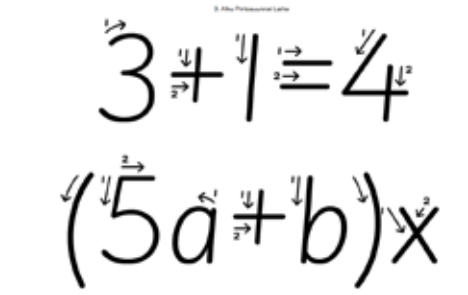
Preliterate children in typical American schools spend less than twenty minutes each day on activities targeting pre-reading skills, only one minute of which is spent on handwriting activities (Pelatti, Piasta, Justice & O'Connell, 2014). Same study shows that "increasing the prevalence of handwriting practice in preschool curriculums may lead to earlier attainment of pre-reading skills and, in turn, facilitate successful reading acquisition".

In the article Let's face it — handwriting just doesn't matter, 2016, Anne Trubek writes once again about handwriting debate in America.

> "Some (also) argue that learning cursive teaches fine motor skills. And yet so did many other subjects that are arguably more useful, such as cooking, sewing and carpentry, and few are demanding the reintroduction of those classes. These arguments are largely a side show to the real issues, which are cultural".

According to Trubek, in April (2016), when the Louisiana Senate voted to put cursive back into the public school curriculum, senators yelled "America!" in celebration, as though learning cursive was a

PICTURE 9:
ALKU HANDWRITING MODEL: HOW TO JOIN THE LETTERS (OPTIONAL)



PICTURE 10:
ALKU HANDWRITING MODEL: EXAMPLES

patriotic act. Now the situation with different states having different opinions about the importance of handwriting or cursive handwriting seems to remain the same. In July 2016, Louisiana and 10 other states, including Virginia, California, Florida and Texas, have cursive writing requirements in their state education standards.

"Yes, let's put handwriting back in schools, but just enough to let us get on with the real business of writing and communicating," says Virginia Berninger, a professor from University of Washington who has co-authored studies on the topic, in the same article.

7.3 EFFECTS ON LEARNING & CREATIVITY

According to Sandra Sülzenbrück in the Journal of Motor Behavior called "The Death of Handwriting: Secondary Effects of Frequent Computer Use on Basic Motor Skills.", the effects of writing on a keyboard instead of hand are remarkable: "Individuals who primarily used keyboards and computers to produce written texts exhibited slower performance in a task measuring the precision of continuous arm–hand movements than people who regularly practiced the skill of

handwriting," Sülzenbrück says. It gets worse: "More importantly, the results presented in this study imply that the use of computers not only affects the specific skill of handwriting, but also similarly affects fine motor skills and thus more general features of the human behavioral repertoire." (Sülzenbrück, Sandra, 2012).
What Sülzenbrück and her team found out in the study, shows that the use of computers, navigation systems and electronic organizers can have a fundamental changes in basic psycholotor and cognitive skills of people.

> "As neuroscientists observe the brain changing and developing as it works, they affirm that movement, mental activity, and the genes involved in learning are interdependent. In particular, they have found that neural connections are developed and strengthened when children write by hand. Research also indicates that handwriting influences reading, writing, language and critical thinking"
> (Peverly, Stephen 2012).

In an article Learning handwriting is more about training the brain than cursive script by Mark Mon-Williams, a Professor of Cognitive Psychology, University of Leeds, many important facts about handwriting skill are pointed out with simple examples. "Handwriting underpins many other skills. It requires children to learn to control the forces they apply to objects held in their hands. It requires the use of visual feedback to correct errors and the ability to make predictions about the consequences of the commands the brain sends to the hand. These are fundamental control processes required in many other situations – think of using cutlery, tying shoelaces and playing ball sports for example". (Mont-Williams, Mark, 2015).
This also applies to mathematics. A study titled Early numeracy in cerebral palsy: review and future

research, shows that the process related to writing numbers also supports mathematical skills. (Rooijen, Maaike, Verhoeven & Steenbergen, 2010).

These studies point out that the process of doing things by hand is very relevant in the learning process.

7.4 HANDWRITING AND LITERACY

As noted before, children usually learn to write by the age of 8-10. Literacy was traditionally understood as the ability to read, write, and use arithmetic. The modern term's meaning has been expanded to "include the ability to use language, numbers, images, computers, and other basic means to understand, communicate, gain useful knowledge and use the dominant symbol systems of a culture" (UNESCO, Education for All: A Global Monitoring Report, 2006).

As the longer version, The United Nations Educational, Scientific and Cultural Organization (UNESCO) defines literacy as the "ability to identify, understand, interpret, create, communicate and compute, using

PICTURE 11: THE MODEL LETTERS TAUGHT IN AMERICAN SCHOOLS

printed and written materials associated with varying contexts. Literacy involves a continuum of learning in enabling individuals to achieve their goals, to develop their knowledge and potential, and to participate fully in their community and wider society".

According to an article titled One in four young people in developing countries unable to read, in the Guardian (Provost, Claire, 2014), estimated 250 million children are not learning basic reading and math skills, even though half of them have spent at least four years in school. This "global learning crisis" costs developing countries billions of dollars a year in wasted education funding, the article warns. And literacy among adults is not looking much better . "Adult literacy has remained stubbornly high over the past decade, the report adds. In 2011 there were 774 million illiterate adults, a decline of 1% since 2000. This figure is projected to fall only slightly, to 743 million, by 2015", says the article.

Illiteracy is a problem in many Asian and African countries, but also in the US. In America, there are studies that show that students who don't read well enough by the 3rd grade are 4 times more likely to drop out of school The study titles Students Who Don't Read Well in Third Grade Are More Likely to Drop Out or Fail to Finish High School by the Annie E. Casey Foundation, 2011, says that illiteracy is also costing a lot to government: 75% of Americans who receive food stamps perform at the lowest 2 levels of literacy, and 90% of high school dropouts are on welfare. 2/3 of students who cannot read proficiently by the end of 4th grade will end up in jail or on welfare. Over 70% of America's inmates cannot read above a 4th grade level, the same study shows. (The Annie E. Casey Foundation, 2011).

A survey of teachers randomly selected from across the United States (first through third grade) indicated that only 12% had college-level courses that prepared them to teach handwriting (Graham, et al. 2008). If teachers are not provided effective instruc-

tions on what and how to teach, they are not able to teach children properly and therefore leave them at-risk for handwriting problems. "When students do not have effective instruction in handwriting, they frequently struggle with writing and lack the skills necessary for legible and fluent writing" (Marr & Cermak, 2002, Clark, Gloria Jean, 2010).

Marr & Cermak also studied the consistency of student's handwriting performance from the beginning of kindergarten through the middle of first grade. The study found out that "42% of the kindergarteners who were in the low handwriting group were still performing in the low group in the first grade, 70% of the kindergarteners who were performing in the middle group were still in the middle group, and only 38% of the kindergarteners performing in the upper group were still in the upper group". The authors of the study claim that "these results highlight the probability that without early intervention, students who are struggling early in kindergarten will continue to struggle".

The same study by Gloria Jean Clarke, titled A relationship between handwriting, reading, fine motor and visual-motor skills in kindergarteners, 2010, claims the same thing:

> "Little is known about handwriting development in kindergarten, yet it is a critical life skill. As a result, there is little known about the early handwriting skills of kindergartners and the relationship among early reading skills, early handwriting skills, visual-motor skills and fine motor skills. Knowing the variables that predict writing performance is essential to allow educators and occupational therapists to screen students early to identify those at-risk for writing delays, provide skill-building interventions, and monitor their performance".

7.5 HANDWRITING AND ACADEMIC SUCCESS

Opponents of teaching handwriting say that learning to write by hand, especially both, cursive and print letters, takes too much time from the actually important subjects at school. Proponents on the other hand claim that one important thing about handwriting skill is that it might affect person´s life in various ways, including academic success later in life.

"Students who struggle with writing by hand will avoid writing tasks; this avoidance means that they do not enjoy the same results from composing, they compose less, and they struggle with spelling because of a lack of practice", says the paper titled Handwriting in the middle years: A strategy for academic & professional success (Zaner-Bloser).

It goes without saying that nice looking and legible handwriting is easier and

more pleasant to read than a messy one. But does this really matter in life, especially in today´s digital world, where kids know how to use a tablet before they can speak properly and later just type everything?

"Handwriting quality may be used, albeit unfairly, to judge a student's intelligence or achievement." (Sheffield, 1996, Scanlon-Dise, Joan, 2008).

It has been studied that person´s handwriting might also be effecting their grades. In an exam, if two people write the same answers, the one with good handwriting gets better grade than the one with bad handwriting. "In studies…the quality of handwriting did affect grading by experienced markers regardless of the papers' content." (Sheffield, 1996, Scanlon-Dise, Joan, 2008).). Of course it should be noted that nowadays, in some countries, most tests are done with computers, so the importance of these results does not apply that much in the school world anymore.

For example in Finland, starting from the year 2016 the Matriculation examination has been done partly by typing on a keyboard. In 2019 it will be typed completely. In a way, moving towards a school system where mostly everything is typed, can be a good thing. It certainly takes away grading based on your handwriting, which can be considered to be quite unfair.

Even the situation might have changed in the school world, in life, there are still situations when you need to write by hand and might be judged by it. In some countries, like France, it is not uncommon that when applying for a job, you are asked to write a motivation letter by hand. And you will be judged by not only for the things you have written, but also by your handwriting. Some people strongly believe that sloppy handwriting means sloppy personality.

"The effects of poor handwriting can carry over into adult-

hood in job applications or materials for admission to college or trade school. Illegible handwriting continues to be a source of judgment: sloppy handwriting is often interpreted as sloppy thinking"
(Handwriting in the middle years: A strategy for academic & professional success).

In academic success, early handwriting skill is also an important factor. When it comes to teaching handwriting it is very important to give children positive learning experience and make them feel like it is still a useful skill, not just something from the past.

"The main point is to make handwriting seem like something important, not just an extra skill from the past that no one really needs. When teaching handwriting, it´s also very important to be aware that motor skills can develop in very different pace among children. There can be children in the 1st or 2nd grade who have learnt these skills better at home. For example if you´ve learned crocheting, writing by hand will be easier and therefore gives you a positive learning experience and most likely make you stand out from the crowd and earn admiration. It´s important not to give children positive learning experiments instead of negative".
(Huotilainen, Minna, interview, 2016)

7.6 WHY GOOD HANDWRITING MATTERS?

The problem with illegible handwriting is not just aesthetic. According to Gerry Conti, Assistant Professor of Occupational Therapy at Wayne State University, "Illegible handwriting is a problem for a large number of children…it can affect [children] not only personally (their self-esteem), but also academically, and their careers in the future. So, it's got a very long trajectory" (Conti, 2012, Saperstein Associates, Handwriting in the 21st Century).

Other study called Development of Early Handwriting: Visual-Motor Control During Letter Copying claims that the frequency with which kindergarten children make printing errors involving a change in letter shape is correlated with reading, language, and mathematics achievement in kindergarten and first grade. (Maldarelli, Kahrs, Hunt & Lockman, 2015.)

7.7 RELEVANT RESEARCH STUDIES: THE EFFECTS OF HANDWRITING EXPERIENCE ON FUNCTIONAL DEVELOPMENT IN PRE-LITERATE CHILDREN.

When going through my secondary data, I noticed that this study by Karin James & Laura Engelhardt is mentioned in almost every article related to the future of handwriting. In this study by Karin H. James and Laura Engelhardt, (2012), Trends in Neuroscience and Education, Columbia University, the main

thing to investigate was the difference between brain activity with typing, tracing and writing by hand.

As the authors themselves put it, in an age of increasing technology, the possibility that typing on a keyboard will replace handwriting raises questions about the future usefulness of handwriting skills. The authors in this study wanted to gain more information about the differences in brain activation during three different letter-involving tasks: handwriting, tracing and typing.

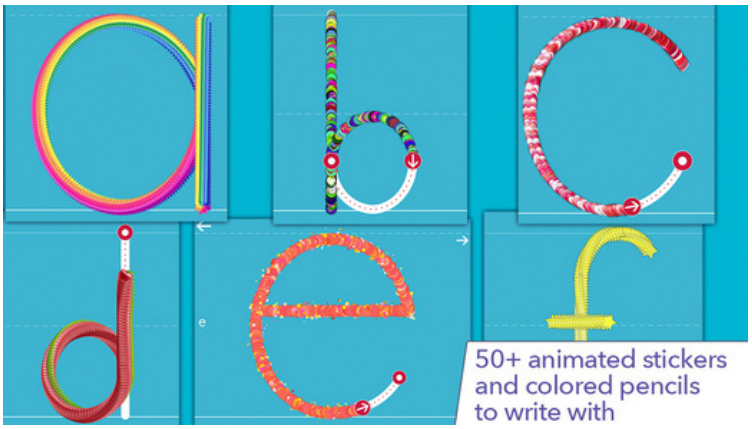
Hypothesis of this study is that after self-generated printing experience, letter perception in the young child recruits components of the reading systems in the brain more than other forms of sensor-motor practice, such as tracing of typing.

To put it simply: after printing practice, the brain activates a network used for reading and writing. This study found that the "doing" part of drawing letters by hand increases activity in three areas of a child's brain that adults use when they read and write. The results showed that perceiving the letters activated brain regions known to underlie reading and writing — including the inferior frontal gyrus, the fusiform gyrus, and the posterior parietal cortex — but only for those letters that had been practiced by hand. The study therefore suggests that writing by hand is a better option for children than typing.

In the beginning of the article, authors claim that individual letter processing is an especially important component of both reading asquisition and skilled reading. Research suggests that writing by hand may also have a significant impact on our ability to retain information. But these claims are only suggestions.

7.7.1 HOW THE STUDY WAS MADE

In this study, psychology researchers Karin James and Laura Engelhardt, asked 15 preliterate 4- and 5-year-olds to practice various motor skills: These skills included tracing, drawing, and typing capital



PICTURE 12: WRITING WIZARD - KIDS LEARN TO WRITE LETTERS, ALPHABET & WORDS

letters and shapes. The children then passively viewed letters and shapes while lying in an fMRI scanner.

A "reading circuit" was recruited during letter perception only after handwriting-not after typing or tracing experience.

In each condition, children were shown a letter or shape on an index card and asked to draw, trace or type the item without it being named by the experimenter. Participants were provided with squares with dotted outlines of the letters for the tracing condition, a page of blank squares for the drawing condition, or a blank white 8.5 x 11 page on a computer screen for the typing condition. Typing was performed via Microsoft PowerPoint 12.1 on a Mac OSX 10.4.2 laptop. The laptop was connected to a modified keyboard so that children could easily identify the shapes and letters in these conditions. Letter and shape stimuli were counterbalanced across all conditions. In total, each participant had direct motor experience with twelve letters (Y, U, D, T, S,W, P, L, C, H, R, K) and twelve shapes (flower, crescent, circle, parallelogram, leaf, rectangle, semicircle, triangle, star, raindrop, arrow, pentagon)—four of each in each condition. An additional 12 letters and shapes were used as controls, in that they were not practiced during training, but were shown.

7.7.2 RESULTS OF THE STUDY

The age of increasing technology will make inevitable changes in the way we write. And in fact, it has already made them. In the study of the Effects of Handwriting Experience on Functional Development in Pre-Literate Children, James and Engelhart show that preliterate children recruit well established reading related brain regions, during letter processing but only after handwriting practice compared to typing or tracing.

This study clearly shows that when manually creat-

ing letter forms, the motor experience helps children to discriminate the essential properties of each letter. This seems to lead to more accurate representations in skilled letter recognition. This study points out that understanding the underlying neurological mechanisms in handwriting is important for two reasons: first its independent relevance to educational achievement. Secondly for its supportive role in successful acquisition of other language skills such as reading.

To put it simply: after printing practice, the brain activates a network used for reading and writing. It is explained in this study, that the so-called "doing part" of actually drawing the letters by hand increases activity in three areas of a child's brain that adults use when they read and write. So the results showed that perceiving the letters activated brain regions known to underlie reading and writing. But this only applies to those letters that were practiced by hand. Therefore this study clearly suggests that writing by hand is a better option for children than typing.

I find this study is relevant, but the question remains is it relevant enough for people to take action on spending a lot of time learning handwriting in schools. The study claims that learning handwriting could make you smarter and learn to read faster, but writing by hand also takes a lot of time. Children spend a lot of time learning handwriting and this time could also be used to teach them something more valuable than this ancient skill. On the other hand, handwriting skill is still important even in other ways than early learning experience. For example doctors, who still write descriptions by hand and it´s crucial to be able to read them.

It is also important to remember, that the "global digital divide" means that only 40% of the world's population has access to digital technology, making it premature to suggest an "either or" solution in which handwriting is totally endorsed or discarded.

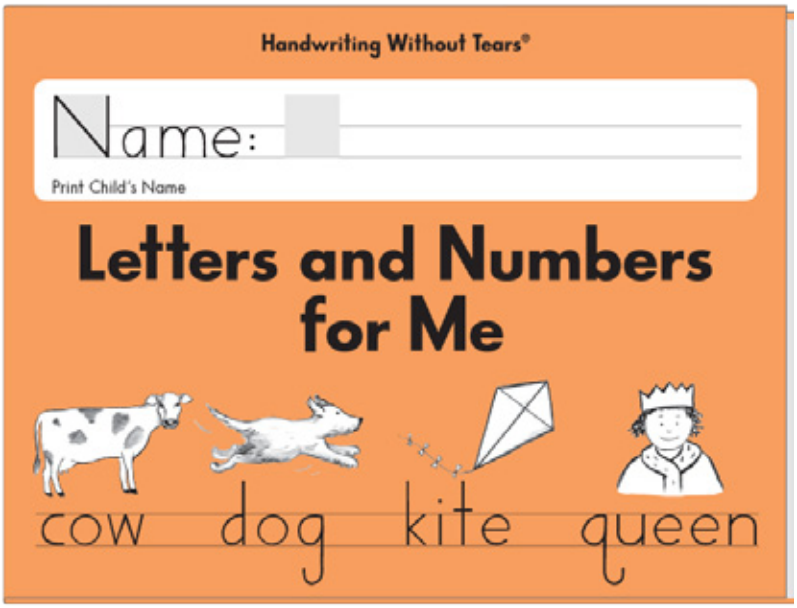
7.7.3 SIMILAR STUDIES

There are multiple researches that show similar results. Another study, done at the Université Paul Sabatier in France by Marieke Longcamp and her colleagues, is showing the we build a strong internal model of letters through the act of actually writing them by hand. This study also found out that this process is not limited to children only:

> "Adults who were exposed to previously unfamiliar characters from the Bengali and Gujarati alphabets were better at recognizing the characters they had practiced writing by hand than those they had practiced typing" (Longcamp & Zerbato-Poudou & Velay, 2005).

According to Associate professor Anne Mangen at the University of Stavanger's Reading Centre, the process of reading and writing involves a number of senses. When writing by hand, our brain receives feedback from our motor actions, together with the sensation of touching a pencil and paper. This kinds of feedback is significantly different from those we receive when touching and typing on a keyboard.

> "When writing by hand, the movements involved leave a motor memory in the sensorimotor part of the brain, which helps us recognize letters. This implies a connection between reading and writing, and suggests that the sensorimotor system plays a role in the process of visual recognition during reading"
> (Mangen & Vealy, 2010).



PICTURES 13 & 14:
HANDWRITING TEACHING IN
FINLAND AND IN AMERICA

8. PHYSIOLOGY AND NEUROSCIENCE OF HANDWRITING

8.1 WHY WRITING BY HAND IS IMPORTANT FOR YOUR BRAIN

The benefits of writing by hand are researched facts. When you write by hand, you remember better the things you have written. Also when going back to your notes, you are able to recall the information better than from typing.

> "This is because when writing by hand, for example in a lecture, it is not possible to write down everything the professor says. When writing by hand, you have to pick the most important things already while making the notes. This is more effective than just writing down everything" (Huotilainen, Minna, interview, 2016).

"What are the few words I will write, you have to decide fast. This is processing (of what you hear) on a deeper level already while listening and this is actually a really good for you", she adds.

Writing by hand coordinates the left part of the brain as well as the right part. Naturally we use both parts of our brain in other ways too, but when writing by hand, we use them both at the same time. According to Dr. Virginia Berninger, Professor of Educational Psychology at the University of Washington, "Because handwriting necessitates physical sequential strokes to form just one letter (as opposed to a single strike in hitting a single key), massive regions in the brain are activated, including areas of thinking, language and temporary in formation storage and management" (Garber, Lisa, 2013).

The movements involved when handwriting, "leave a motor memory in the sensorimotor part of the brain," which helps the person recognize letters and establish a connection between reading and writing. (Mangen, Ann, 2011). The researchers believe since writing by hand takes longer than typing on a keyboard, the temporal aspect may influence the learning process.

The positive effect of writing by hand instead of typing, are not only limited to children. "As noted before, for young children, writing by hand is an imperative tool in improving cognitive skills. For adults, it also has positive effects, for example sharpening aging minds. Writing by hand is good memory improvement practice" (Mueller & Oppenheimer, 2014).

There are also researches about calming effects of handwriting. When writing by hand, you are obviously less distracted by other things than when writing on a computer. In a society filled with smart phones and laptops, handwriting can be sort of an offline experience. "By recruiting all of the senses to participate in the writing-by-hand process, little room is left for multitasking. Writing by hand therefore could make you more focused and present" (Chemin, Anne, 2014).

8.2 TYPING VERSUS HANDWRITING

One of the biggest differences between writing by hand and typing is the movement involved. Naturally, handwriting involves a different type of motor movement than typing. "Movement generally organizes the perception of the world by attributing properties to it". (Longcamp & Zerbato-Poudou & Velay, 2005).

Experts on writing and teaching handwriting claim that pen and keyboard influence different kind of cognitive process. "Handwriting is a complex task which requires various skills – feeling the pen and paper, moving the writing implement, and directing movement by thought," says Edouard Gentaz, Professor of Developmental Psychology at the University of Geneva, in an article titled Handwriting vs typing: is the pen still mightier than the keyboard, The Guardian, 2014. "Children take several years to master this precise motor exercise: you need to hold the scripting tool firmly while moving it in such a way as to leave a different mark for each letter", the article explains. (Chemin, Anne, 2014).

When we are children, we have a need to touch (and taste) everything. Getting something in your hands makes you understand it better. When you touch an object, you are able to determine the structure and temperature of it, for example. "By moving a hand and writing the letter down physically, a person is able to memorize the structure of the character" (Hopman, Linsey, 2014).

Operating on a keyboard is not the same thing, because it is basically just pressing the key. This can of course be learned a lot faster than writing, but the movement is a lot different.

Studies like Handwriting or Typewriting? The Influence of Pen or Keyboard-Based Writing Training on Reading and Writing Performance in Preschool Children (Kiefer, Schuler, Mayer, Trumpp, Hille &

Sachse, 2015) show that the brain is involved with movement corresponding to recognition of letters, but it does not fully prove that movement is needed for recognition. It only proves evidence in that direction.

In Japan, children write down characters over and over again to memorize them and many adults memorize characters by writing them in the air. In my own experience, I do the same when trying to memorize correct spelling of a foreign word. It seems easier to remember the correct spelling when writing it, mostly because when learning a new language, I have always found the best way to memorize things by writing them down over and over again. In the same way handwriting apparently attributes to memorizing characters if you do it repeatedly (Hopman, Linsey, 2014).

As the study Handwriting or Typewriting? The Influence of Pen or Keyboard-Based Writing Training on Reading and Writing Performance in Preschool Children shows, even when there is no movement involved, viewing of pictures, a premotor cortical area is activated. "The area in the brain involved in movement helps recognizing these images, which shows that movement, perception and even images are related to one another. This is where handwriting comes in: while characters, or letters, are not objects in the sense that a person can touch them, they work in a similar manner", authors explain.

In Finnish as well as in English, we use the word grasp (käsittää in Finnish, as käsi means a hand) to explain the act of deeply understanding something.

> "Learning with your hands is the key here. How a hand and motor skills developed in evolution, was a big part of the development of intelligence and mind. These merged together and that´s why we use the word grasp: only when you get something in your hands you´re really able to understand it. This learning by hand method is often used in teaching. For example in math, it´s easier for children to learn how to count, if they can use touchable aid, for example balls that they can count to really understand the idea of it",

Huotilainen explains in my interview.

That is not the only metaphor including hands and haptic modality. Numerous expressions for understanding and comprehension consist of terms and concepts referring to dexterity: expressions such as "to get a hold of someone," "to handle a situation," "to grasp a concept" all point to the paramount influence of our hands and fingers in dealing with the environment (Mangen & Velay, 2010). And the fact we use the expression "point out", also points out the importance of hands.

Today, most of our writing is done with digital writing devices rather than

writing by hand. "The switch from pen and paper to mouse, keyboard and screen entails major differences in the haptics of writing, at several distinct but intersecting levels". (Mangen & Velay, 2010). The Handwriting is by essence a unimanual activity, whereas typewriting is bimanual, which means that handwriting uses one hand, typing uses two. Typically, handwriting is also a slower process than typewriting.

There are two types of note taking: generative and non-generative. Generative means summarizing, paraphrasing and concept mapping the data, non-generative means verbatim copying. Laptop use makes students take verbatim notes, since it is faster, so you are able to write down everything without having to process the data like in handwriting. Verbatim note taking can therefore be seen as more shallow cognitive processing of the data.

Studies have shown that especially on integrative and conceptual items, verbatim note takers have poorer performance (Mueller & Oppenheimer, 2014). Therefore taking notes by hand is better than taking notes on a computer.

PICTURE SET 15:
MY AMBIDEXTERITY
TRAINING PROCESS

9. AMBIDEXTERITY & EXPERIMENTS

9.1 RIGHT AND LEFT-HANDEDNESS

Most humans (70 percent to 95 percent) are right-handed, a minority (5 percent to 30 percent) are left-handed. Indeterminate number of people are described as ambidextrous.

Simply put: right hand is connected to left brain—the side responsible for language, judgment and intellect. Left side is connected to right brain, the source of creativity, perception and empathy.

There are many theories for how a person becomes right- or left-handed. These theories can be divided into different categories: evolutionary theories, biological theories, genetic theories, societal and environmental theories. Most of these theories are researched, but still not proven to be right.

One of the theories that dates back to 1945, is called Vanishing Twin Theory. It claims that every left-hander was once a twin whose right-handed mate did not make it through gestation. Other theories claim that left-handedness could be caused by birth trauma, position in the womb or testosterone levels.

The two major studies into the frequency of left-handed children according to the handedness of the parents are by Chris McManus and Phil Bryden (An Investigation of Handedness - Some Myths, Truths, Opinions and Research), which show that left-handed children are more likely to be born to left-handed parents than right-handed parents. "The McManus study indicates that about 9% of the children of two right-handed parents are likely to be left-handed, about 19% of children of one left-handed and one right-handed parent, and about 26% of the children of two left-handed parents. The equivalent figures in the McKeever study are 16%, 20% and 40%, substantially higher but still indi-

cating a similar significant genetic effect. In both studies, left-handed mothers are more likely to have left-handed children than left-handed fathers". According to Carl Hale, Psy.D., neuropsychologist with Neuropsychology and Learning Associates in Merrillville and Fishers, Indiana, "We're frequently right-handed because we're language-dominant creatures and the left side of our brain—the part that processes the sound of speech—is usually larger and more dominant." (An Investigation of Handedness - Some Myths, Truths, Opinions and Research).

Some researchers believe that our position in the womb determines our handedness. They guess that the ear, which faces out of the womb receives the most stimulation, which then stimulates the corresponding side of the brain.

Researches show left-handed people are usually more creative than right-handed. Researchers also claim that because left-handed people have to survive in the world that is designed for right-handed people, they learn to be more creative. Some researchers disagree and believe it is deeper in the genes.

In my interview, neuroscientist Minna Huotilainen explained that being left handed has some good sides, like creativity, but also some negative. Looking at the statistics, left-handed people die younger, for example. According to her, it is mostly caused by accidents, but there are also some gene related factors like diseases that are more common with left-handed people.

9.1.2 AMBIDEXTERITY

Ambidexterity is the state of being equally adapted in the use of both the left and the right hand, and also in using them at the same time (Oxford Dictionary). Only about one percent of people are

naturally ambidextrous. The degree of versatility with each hand is generally the qualitative factor in determining a person's ambidexterity.

9.2 LEARNING NEW SKILLS

The reason I was interested in doing ambidexterity training on myself, was the use of non-dominant hand and the positive effects it might have. My interview with neuroscientist Minna Huotilainen strengthened my belief in this matter.

> "Everything you do with the non-dominant hand, is good motor practice and therefore good for you and your brain. There are small things to do to "train your brain" all the time and maybe even prevent memory problems like dementia. One simple thing is to open your door with a key in your non-dominant hand. It might seem like something easy, but it´s not. Things you do all the time have developed a motor pattern in your brain and therefore you don´t have to think about them at all while doing them. Doing new and different things is good for you and writing with the non-dominant hand is a good example of this".
> (Minna Huotilainen, interview 12/2016).

She explained that when doing everyday tasks a bit differently, for example writing with your non-dominant hand or drawing through the reflection of the mirror, you are in a way putting yourself in a state of a student. For teachers, this is a good method in understaning your students better.

Some people think being ambidextrous is like having an insurance, Huotilainen also pointed out in my interview. If you can function with both of your hands, of course it gives you lot of benefits. Using both hands is also good for your creativity.

> "When training the weaker hand, you need to use te frontal lobes of your brain in a different way. For example drawing: if you think you can´t draw and whenever you pick a pen, there are the same stick figures every time. But if you try your non-dominant hand, it can free your mind. You can decide that now I´ll draw something abstract, for example love. And just start doing it and notice that you don´t automatically do the same things you would do with your right hand".

Therefore doing things with your non-dominant hand can boost your creativity and make you express yourself more freely, Huotilainen sums up in my interview.

Basically, our hands are connected to our brain. In a nutshell: The right side of our brain is known for being responsible for language, judgement and intel-

ligence. Left part is responsible for creativity, perception and empathy. Right hand is connected to left side of the brain and left hand to the right side.

9.3 MY AMBIDEXTERITY TRAINING PROCESS

As part of my thesis, I did an ambidexterity training process on myself. The reasons why I wanted to include this training process in my thesis were following: First of all, I wanted to find out if using my non-dominant hand and trying to become ambidextrous would affect me in any way. Ambidextrous people are said to be more creative, because using your both hands also uses both sides of your brain.

I wanted to have a perspective on learning to write by trying to teach my non-dominant hand to write. It made me remember the times I actually learned to write as a kid. How clumsy the hand was at first and how quickly it became better if I just trained it enough. But also the fact that it requires constant practice in the beginning, otherwise it will not go to your "muscle memory".

This is a thing some teachers use as their educational method. For example, when teaching a child play a musical instrument, teachers themselves go learn to play an instrument they are not familiar with. This brings them back to the memory of what it felt like to start from scratch and makes them better teachers because they are able to put themselves in the position of a student. However this training period was a bit different since I already know how to write, just not with my non-dominant hand.

My training process was similar to the study Writing with the non-dominant hand: Cross-handedness trainability in adult individuals by Maciej Henneberg in Psychology Press. (Henneberg, Maciej, 2015). I wanted to do a similar training process as some "real study" to be able to compare my process to other people´s similar one.

The main reason for Henneberg´s research was to

study whether one hand is preferred over the other because it is more skilled, or one hand is more skilled than the other because it is preferred. In Hennenberg´s study, adult volunteers (8 males and 13 females) aged 20-56 years, both right- and left handed, were asked to train their non-preferred hand to write two standard sentences by practicing daily over a 28-day period. At the end of this period their non-preferred handwriting was of good quality and participants felt quite comfortable performing this task. The quality of non-preferred handwriting achieved was unrelated to age. Authors of the study suggest that handedness, in terms of actual performance, may be less pronounced than is suggested by studies of hand preference.

In the study, after the 28-day training period was completed, the workbooks were collected and each day's entry was scored. It was compared with the person´s preferred handwriting from the beginning of the study. The legibility score was assigned to each day's entry, with 1 being the furthest away from the participant's preferred-hand writing and 10 being identical to the participant's preferred-handwriting. According to the authors of the study, analysis was performed in one sitting by one individual, by comparing letter slant, size, spacing, shape, and smoothness as well as overall word spacing.

My ambidexterity training included writing the same sentence twice a day. I also did little extra optional training by writing different letters and training hand movement. For writing, I chose the same sentence as in the study: A quick brown fox jumps over the lazy dog.

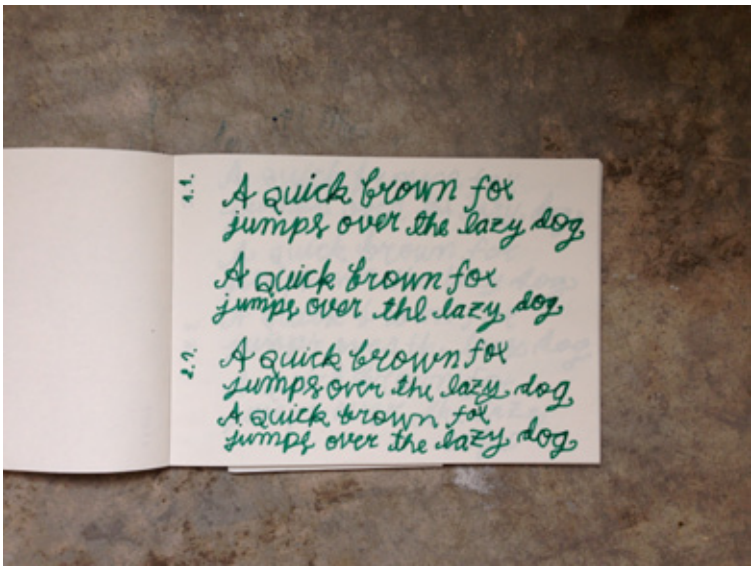
"A quick brown fox jumps over the lazy dog" is an English-language pangram—a sentence that contains all of the letters of the alphabet. It is commonly used for touch-typing practice, test typewriters and computer keyboards, show fonts, and other applications involving text. Owing to its brevity and coherence, it has become widely known.

9.4 ANALYZE OF THE PROCESS

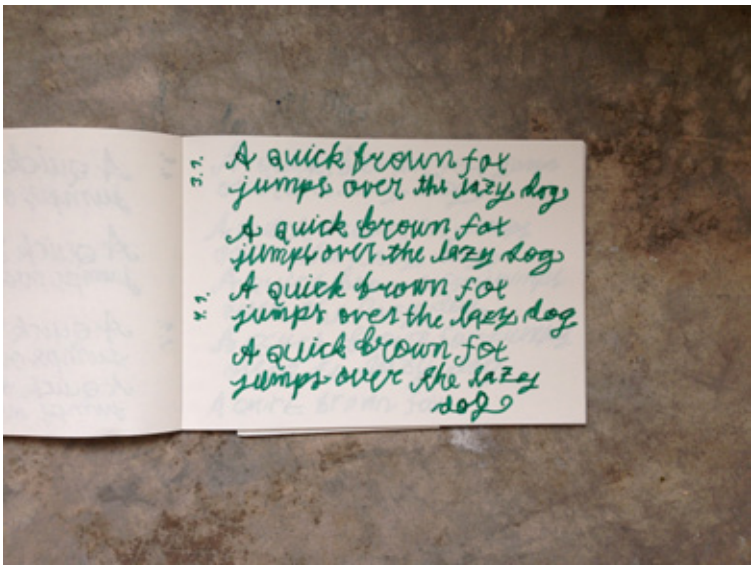
I tried to do my training as close as possible to the original study by Maciej Henneberg in Psychology Press. The process included daily practice of writing the same sentence with my non-dominant hand.

In my experience, when writing with your non-dominant hand, it is easier to write with a big marker than with a small pen. However the study of Hennenberg did not have exact the same opinion: Some participants felt that they were

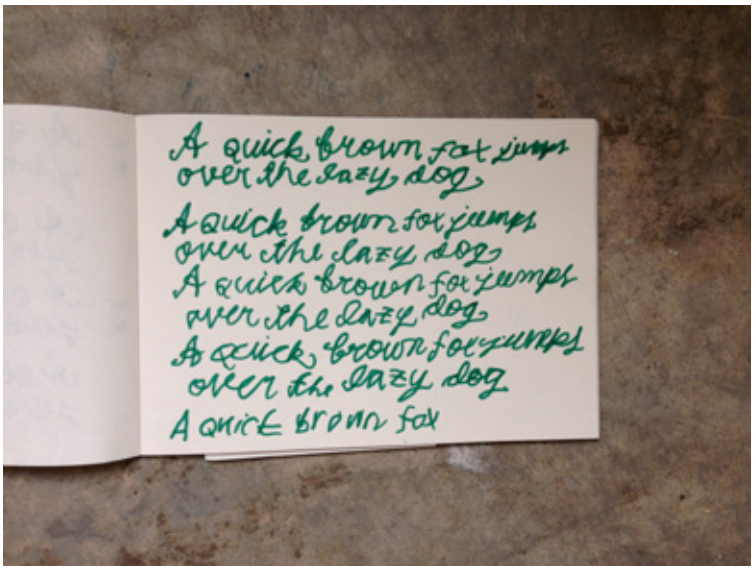
PICTURE SET 15:
MY AMBIDEXTERITY TRAINING PROCESS



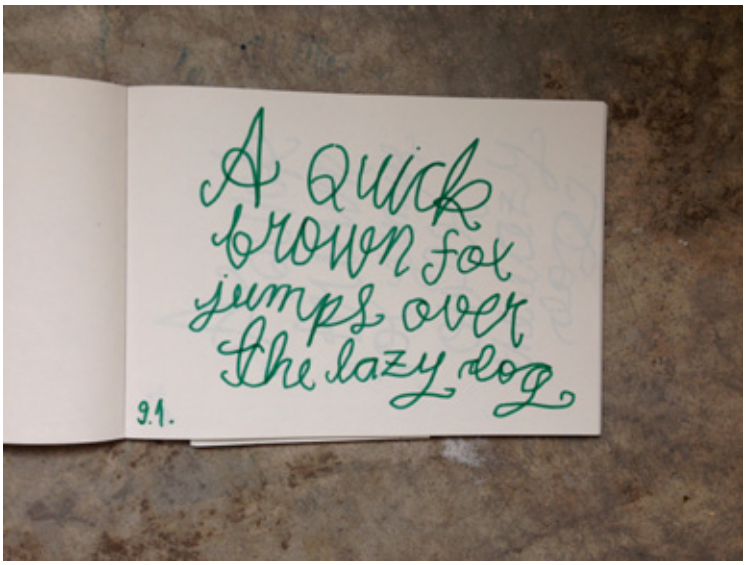
WEEK 1



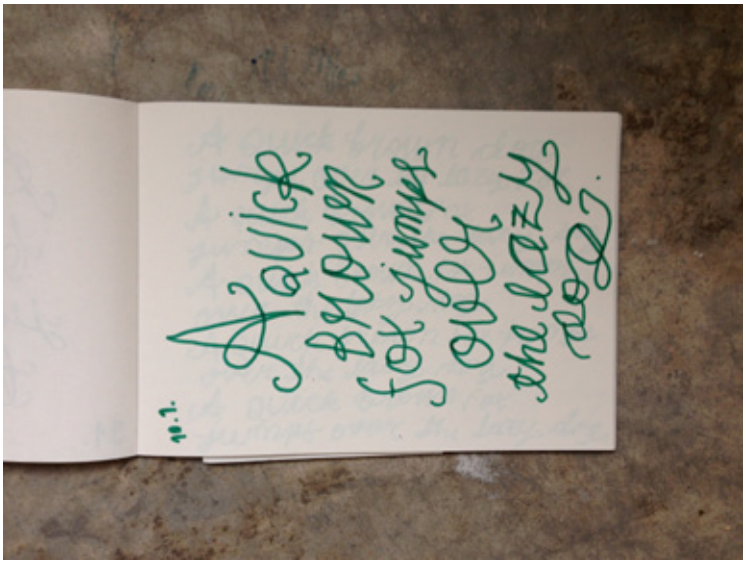
WEEK 1



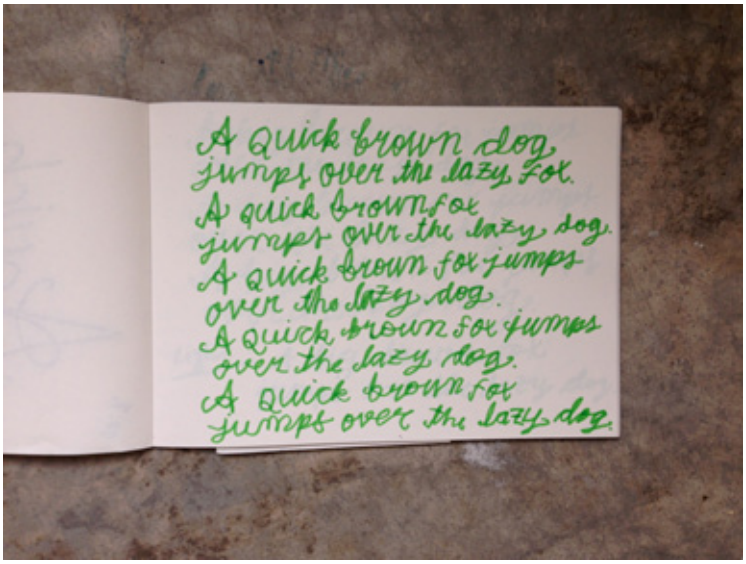
WEEK 1



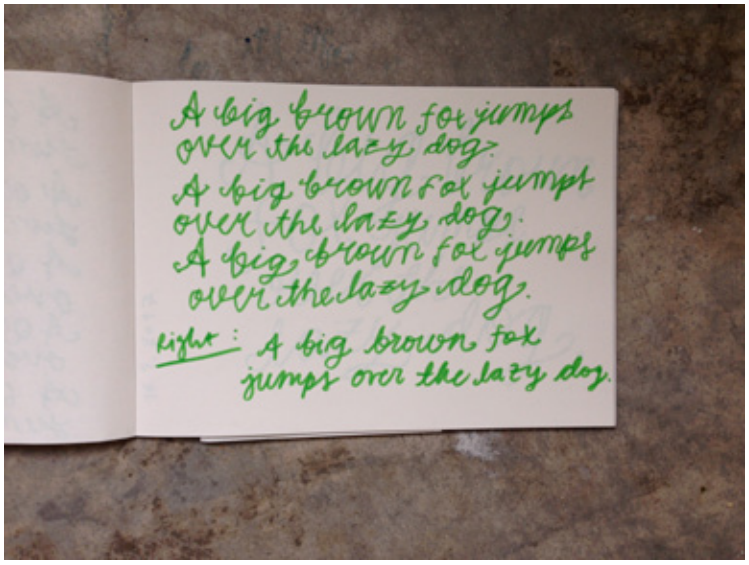
WEEK 2



WEEK 2
BIGGER TEXT

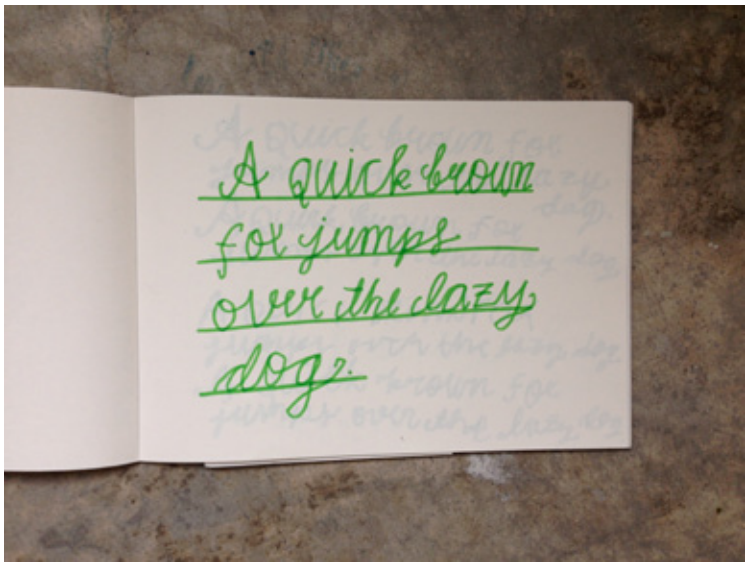


WEEK 2

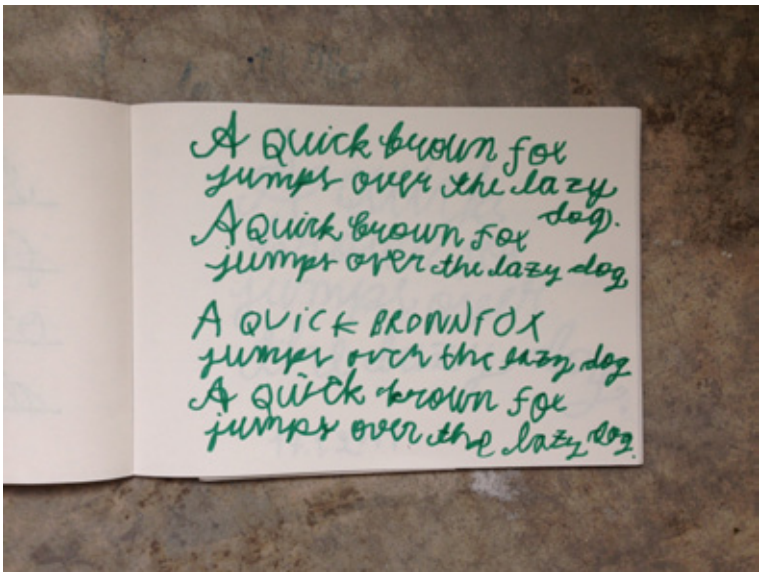


WEEK 3

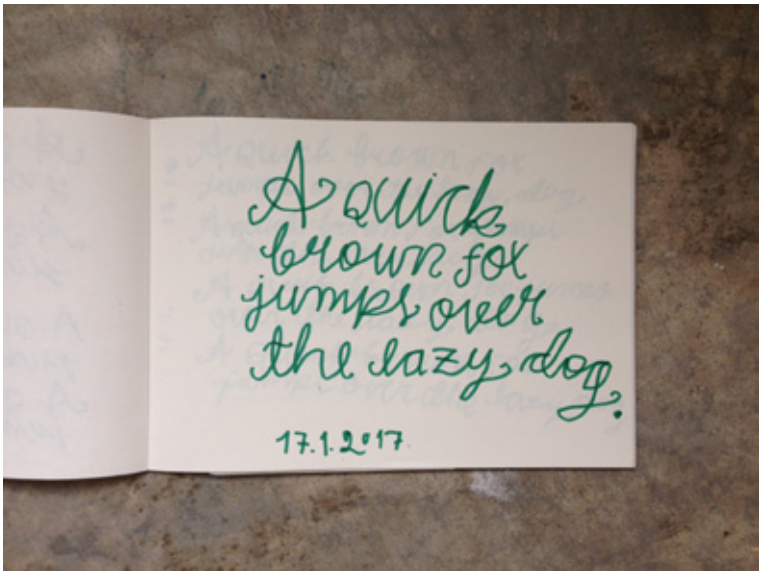
WEEK 3
BIGGER TEXT



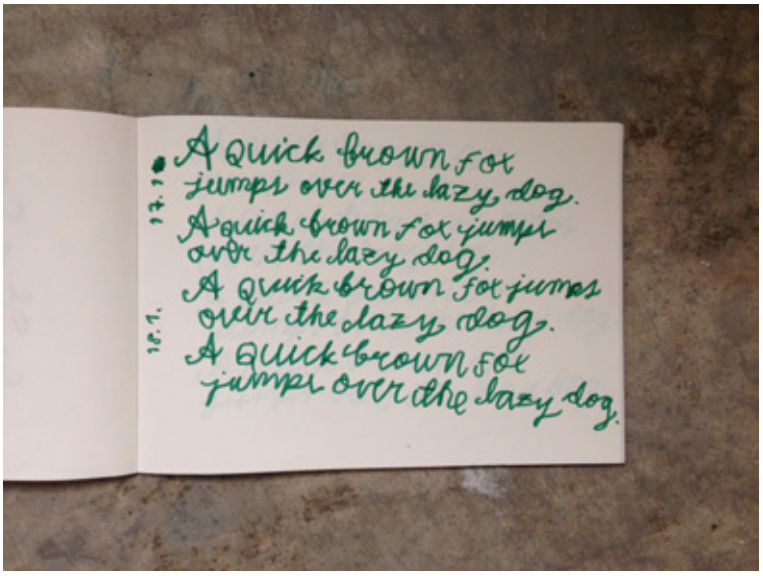
WEEK 3
BIGGER TEXT



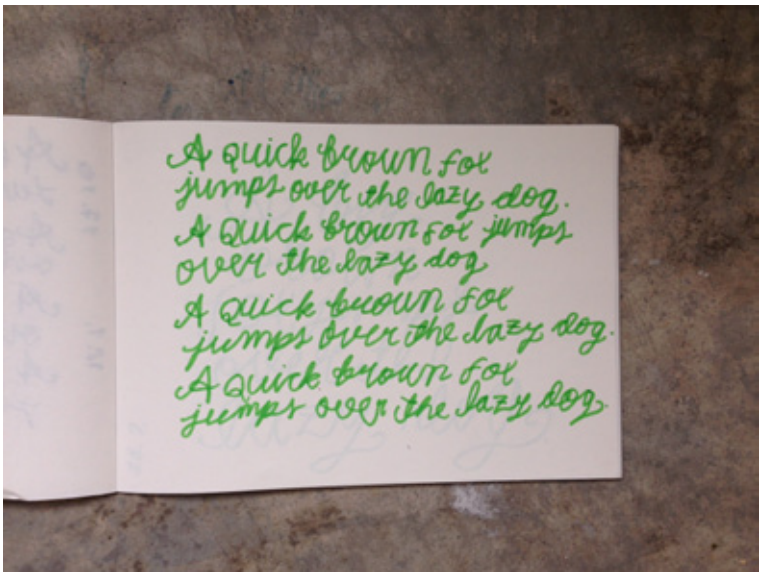
WEEK 4



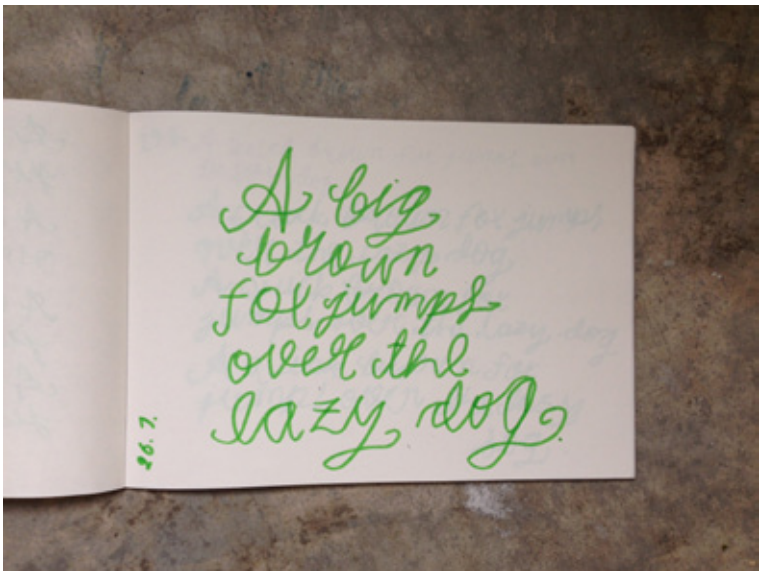
WEEK 4
BIGGER TEXT



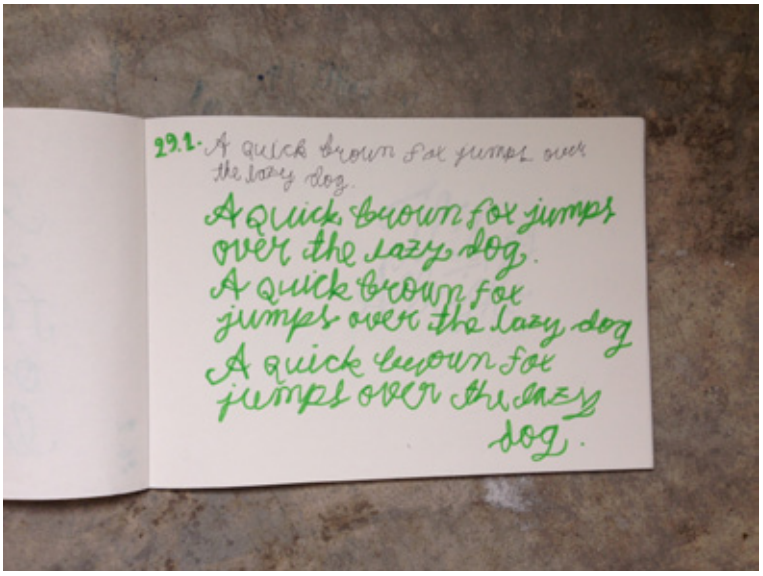
WEEK 4



WEEK 5



WEEK 5
BIGGER TEXT



WEEK 5
BIG AND SMALL TEXT

less comfortable holding a thicker pen while completing the study than if they wrote with a thinner pen (Henneberg, Maciej, 2015). From my experience, the bigger the pen is, the easier it is to get a hold of it. I also noticed that with my left (non-dominant) hand, I hold the pen very differently than I would with my right hand and this bit of an awkward hold was better on a bigger pen. It seemed that it was also easier to write cursive, but since I normally write cursive with my right hand, it could also be the reason why cursive felt easier for me. In that way, this training did not make my handwriting more creative: the style was pretty much the same. If it boosted my creativity in any other way, it is kind of impossible to say.

With my dominant hand, I have a very pretty and decorative handwriting, but I am also able to adapt and copy many other styles. With my left hand, I was quickly able to write with the similar style as my right hand. In fact, it was easiest to make the letters in that specific style that I am used to having when writing.

Round letter shapes were the easiest to make and trying to write without lifting the pen from the paper too much made writing easier than writing single print letters. It was easier to write with a thick pen and it was also easier to write the letters in big size. Drawing really small sized letters with a very thin pen seemed to be very difficult to me. I also struggle this sometimes with my dominant hand: whenever filling up papers for example at the doctor´s office, it is very hard for me to be able to fit my handwriting to the given space. My handwriting style is the kind that takes a lot of space. Apparently that is also the case with my non-dominant hand handwriting.

During my experiment, I did not notice significant progress when writing with my left hand. I was ok in the beginning, a bit more legible and fluent in the end. Some days I was able to write more legible letters, some days it seemed impossible. Sometimes I was better on the day before, so the more I trained did not necessarily improve my writing. Of course there can be other things and distractions that affect my daily training process, for example the fact that original study pointed out: "Circadian rhythm can influence an individual's performance while completing a task that involves coordination, such as writing" (Henneberg & Walker, 2007).

However, the slower I wrote, the better the letters looked like and I was able to make letters that reminded more my normal, dominant hand handwriting.

> "The fact that the form and style of the letters and words written with an individual's non-preferred hand are extremely similar to those written with the individual's preferred hand suggests that in the process of learning to write with the non-preferred hand there is sharing

of information between hemispheres" (Lindemann & Wright 1998; Henneberg & Walker, 2007).

"When a dialog occurs between the left and right hemispheres of the brain, both emotions and thoughts are more fully expressed and understood," says Lucia Capacchione, the author of a book called The Power of Your Other Hand (Ranegar, Kim, 2011).

What I noticed during the process was that using my non-dominant hand this much felt very tiring. After 15 minutes of training, which was the amount of time I usually spent on this process daily, my hand would have been able to do more, but I felt really tired. It somehow felt like my brain was doing all the work.

In my interview with Minna Huotilainen, she mentioned things that help you learn new skills. "Doing things over and over again, so called drilling, is important. Doing things over and over again in a fast pace makes you learn better", she explained. Based on only 28 days of training, I would sum up that if I had to, I could easily train my left hand to write, not as good as the right hand, but I would survive with it. I did not really notice any changes in my right hand writing or any positive or negative effects because of the training. I write and draw quite a lot by hand, so I think it should also be taken into consideration, that maybe this was a good help for me to be able to write pretty easily with my non-dominant hand as well. For a person who hardly ever uses their hands for drawing or writing, it would probably been lot harder.

9.5 CONCLUSIONS

As far as my findings from my personal ambidexterity training, I agree with the authors of the original study. It looks like it is quite easy to get legible and comfortable performance of handwriting with the non-preferred hand.

According to Hennenberg, the author of the study,

"…this indicates that handedness, as expressed in actual performance, may be less pronounced than is suggested by studies of hand preference. With training, performance of each hand may be improved. This indicates that the often-observed strong dominance of one hand over the other may result from the reinforcement of initial slight biological or social preference by constant use leading to improved performance, rather than being predetermined. The findings of the present study may have implications for rehabilitation and highly specialized skill training that requires use of the non-preferred hand in complex tasks".

My experience shows the same results. While doing the training period, I was more tempted to use my non-dominant hand for other easy tasks too, because I was thinking about my left hand a lot more than normally. In that way, this training period made me change my mind about being 100% right handed. My left hand seemed to be able to do lot more than just occasional assistant jobs for my right hand.

For learning any kind of new skills, was it either learning to write or learning to do something else new, sleeping is a very important factor in learning.

"When you´re learning something new, during the day you´ll do the learning, but only during your sleep the new information actually transforms into your brain. Therefore it is good to study/train just before going to sleep, because the last things you learn before falling asleep are the first thing to transfer to the memory section of your brain when you fall asleep. But also keep in mind that this process of learning you do before sleeping should not be stressful. If it´s stressful, it will affect your sleep and then it´s not good for you at all"

Minna Huotilainen explains in my interview.

10. CURRENT STATE OF HANDWRITING

10.1 DEBATE BETWEEN CURSIVE AND PRINT

"For me, writing print letters feels like talking, writing cursive is more like singing", told a friend to me when talking about the subject. "Cursive is so fluent, it just comes without having to think about it". In my opinion, this sums up beautifully how fluent handwriting skill is, on its very best.

In America, the debate between whether cursive could be removed and replaced with only print letters, has been a lot more active than in Finland. Seems that the United States has divided in opponents and proponents and both feel very strongly about the subject. Most states in the US still teach both: cursive and print.

Opponents consider cursive handwriting to be an ancient, unnecessary skill that should not compete with reading, composition, math, and science for the limited instructional time available. (The Truth About Cursive Handwriting: Why it matters in a digital age, 2016).

Proponents of cursive often claim the fact that language learning has been shown to be mastered more quickly with handwriting than keyboard use. Proponents of cursive also say that many of the country's historical documents were written in the fancy script, including the Constitution and the Declaration of Independence. They say that future historians who lack the ability to read cursive might not be able to study original historical documents. (Shapiro, T. Rees, 2013).

In the same article from the Washington Post, Steve Graham, an education professor at Arizona State University writes that he has heard every argument for and against cursive. "I have to tell you, I can't remember the last time I read the Constitution," Graham says. "The argument for keeping cursive around centers more on tradition than practicality", he adds.

In the same article, Deborah Spear, an academic therapist based in Virginia, says that cursive writing is an integral part of her work with students who have dyslexia. Because all letters in cursive start on a baseline, and because the pen moves fluidly from left to right, cursive is easier to learn for dyslexic students who have trouble forming words correctly.

There are many good sides in cursive handwriting that still should be taken into consideration. In an article in Psychology Today, Dr. William Klemm argues that

> "Cursive writing helps train the brain to integrate visual, and tactile information, and fine motor dexterity. School systems, driven by ill-informed ideologues and federal mandate, are becoming obsessed with testing knowledge at the expense of training kids to develop better capacity for acquiring knowledge." (Klemm, William, 2016).

In my opinion, however, many studies argue that handwriting is important, which I totally agree with, but for me handwriting is not exactly the same as cursive. Many good sides of handwriting can also be accomplished with print letters. Therefore I think the decisions made in Finland about the subject, have many relevant points. In Finnish schools, the new model letters that are taught, are print letters, but they could be joined in a "cursive manner". Teachers can also teach optional cursive, after children have learned enough print to be able to express themselves. Learning cursive and print letters at the same time is a bit too much for children that age.

> "We don´t want to burden the students (with two different model letters). As soon as they learn the print letters, they can start writing longer texts. When it comes to typing on a computer, we have more time to teach the writing process and polish the content, "

says Minna Harmanen from the National Board of Education in Finland (Euronews: Handwriting and the digital age, time for change in schools? –mini documentary, 2015).

10.2 HANDWRITTEN TYPOGRAPHY TREND

What is interesting about diminished use of handwriting, is that at the same time it is happening, handwritten typography seems to become more and more popular. Handwritten typography, often called hand lettering, can be either made actually drawing by hand and then scanning and tracing it on a computer or using digital stylus pen to draw directly into a graphic program like Illustrator. One option is to use typography that looks like handwritten. There are also programs that help you turn your personal handwriting into a font. Hand lettering itself is an old idea: before computers, things like logos, signs

PICTURE 16:
HANDLETTERIN IN AMERICAN MAGAZINE COVERS
FROM 2015 AND 2016

and ads were mostly created by hand, since there was really no other option.

The attraction of hand lettering and fonts that look hand made, can be seen as part of the organic/ DIY movement going on in the world. Nowadays handwritten typography is not only used by small and "artsy" brands anymore, it seems to be everywhere. Hand lettering is also increasingly seen in magazine covers.

Looking at the best covers of recent years voted by American Society of Magazine Editors for example, many magazines are using handwritten typography in cover designs. It is surely not the most legible option, but handwritten typography takes advertisement from corporate and cold and makes it look more personal. Magazines sometimes use this trick creatively. It is common make two versions of the cover: hand lettered headlines on the cover for subscribers, "normal", more legible font on the cover that is sold in the newsstand.
Designer and hand letterer Martina Flor also agrees in an article 3 Typography Experts Weigh in on the Recent Hand-Lettering Boom:

> "I've noticed a steady growth of interest in lettering along with new areas in which it's used. While commissions used to come predominantly for logo or packaging design, they have spread strongly into advertising and media in the past years, so the use of lettering has broadened into other applications".
> (Grant, Angelynn, 2015).

According to designers and hand lettering experts in this interview, one of the good sides of hand lettering trend is overall interest towards typography and lettering. Also the Internet and social media have triggered enormous interest in typography and hand lettering. However all of the experts in this article, 3 Typography Experts Weigh in on the Recent Hand-Lettering Boom, agree that hand lettering is more like drawing than actual type designing.

> "The reasons to attend a lettering workshop might be initially the aim of being able to create lettering commercially, but many get to realize that mastering the practice requires much more than a workshop. However, it does train their eye to work with typography in general and understand the prin-

PICTURE 17:
HAND LETTERING WORKS FROM ALE PAUL,
MARTINA FLOR AND KEN BARBER.

> ciples in letter design, which is a great tool for the creative work of a graphic designer"

says designer Martina Flor.

> "While there are still relatively few schools offering post-graduate study in the field, that hasn't stopped people from making their own fonts. As compared to lettering, however, typeface design requires a fair amount of technical know-how, not to mention a considerable time commitment. My guess is that the training, experience, and dedication usually required to produce high-quality fonts deters more from doing it full-time"

designer Ken Barber explains.

"Design is a response to a need for communication. What works in Pinterest will likely not work for a butcher", as Ale Paul wisely puts it in the same article. Like lettering, typefaces should have a clear voice that supports what's being communicated without detracting from it, he adds.

If we look at popular typefaces of the last few years, handwritten typography trend is strongly seen there. The article 20 Typography Trends to Pay Attention to, (Virgillito, Dan, 2016), listed script, watercolor and hand drawn fonts on the top of their list in 2016.

However, in my opinion, there are also negative effects about this trend. First of all: it is a trend. When thinking about branding and logos for example, designer should always be aware that good design should not be too trendy in order to last, of course always depending on the brand and its needs. Also branding is too often reduced to only a logo, a color palette and fonts or to stationery design. Designers and brand owners should be aware that it is much more than that and it requires competitor research,

deciding brand values and the tone of voice and also consumer behavior research. To put it simply: logo design, marketing and advertising are the results of branding:

> "Here is another point that applies to both artists and other creators, as well as businesses. Hand lettering is now a trend, like it or not. Trends start small and innocently, then sweep entire industries and end up being exaggerated parodies of themselves. This is bound to happen with hand lettering. Ten years from now, we'll look back and laugh at all the brands trying to force hand lettering into their visual identities,"

says Brand developer Michael Keesee in his blog post about The Effects of the Hand Lettering Trend. (Keesee, Michael, 2016).

10.3 DESIGNER´S POINT OF VIEW: HANDWRITING, DESIGNER SKILL OR A BASIC SKILL?

During the last few years, Instagram and Pinterest have been partly in charge of the handlettering boom. One of the biggest hand lettering communities on Instagram is called @Goodtype, with 720 000 followers (1/2017).

The founder of Goodtype, Brooke Bucherie is a designer from Texas. Bucherie and her account Goodtype are also in charge of the #KeepCursiveAlive contest, that the account held in 2015. The reason for the contest was very simple:

> "When I found out that over 40 states in the U.S. no longer require public schools to teach cursive reading or writing, I was shocked. So I decided to host a #KeepCursiveAlive contest with designer and letterer Dennis Cortes, the curator for Calligritype. In 10 words or less, and in your best cursive handwriting, you had to tell us why teaching cursive in schools should be mandatory, or give us a relevant quote. The runner-up received a "Follow Your Bliss" limited-edition, signed print by Scott Biersack, and the grand-prize winner won a hand-painted saw by Zachary Smith. It was incredible. We had great feedback and a ton of insane entries. It felt good to positively impact so many people by encouraging them to practice a somewhat lost art, and to start the conversation of how important it is to keep cursive alive."
> (Potts, Emily, 2015).

In America, some of the strongest opponents of handwriting teaching (especially cursive), claim that handwriting should be only taught in art class.

In my interview with designer Jarno Lukkarila (the designer behind the model letters taught in Finnish schools), he agrees on the importance of writing by

hand. He pointed out that handwriting skill is also important because of its communicational purpose. And it is of course a big part of fine motor skill development. Writing by hand is also a part of our culture, so it has other purposes than just practical things, he says in my interview.

> "Today´s technology requires typing fluently on a keyboard and it´s also an important skill. I believe that in the future, having a good handwriting will be more and more like a special skill. But the situation has already been like this for a while. Normal handwriting skill is not considered to be anything special, but if handwriting is done very well and it shows practice and special skills, it stands out from the crowd. Handwriting also absolutely boosts the skill of focusing. Learning good handwriting requires lot of practice and focus. These are the main challenges of learning. You need to be able to really focus on it". (Lukkarila, Jarno, interview).

Should handwriting be only taught in art classes then? I asked this question from Rosemary Sassoon, who has studied handwriting of school children and written several books about it.

> "To me handwriting is purely a skill to record ones thoughts – perhaps that is a bit too strong and many people would protest, but stressing that young kids letters should be more beautiful, neater of nearer to any model often represses the desire to write at all… Legible it must be!! Calligraphy in its real meaning as beautiful handwriting is indeed an art. So, I would certainly not recommend ordinary handwriting being taught in art classes. My own view is that everything goes in cycles. The multitude of font available makes graphic design simple – but the uniformity it produces stifles individuality. The situation, even now is making the desire for more

expressive letterforms valuable, hopefully encouraging letterform designers not to give up". (Sassoon, Rosemary, interview, 2017).

In my opinion, that makes sense. Writing by hand is about communication and note taking. Calligraphy or hand lettering is more like art.

10.4 IN FAVOR OF CURSIVE

Especially in America, the debate on the importance has been very active during last few years. In Finland, the situation remains more calm.

"Is cursive worth saving? My personal answer, for what it's worth, is yes. To me, cursive is worth saving, even at the expense of precious classroom time to learn it", says designer Marla Moore, who works as an Art Director at Amazon and also as a freelance hand letterer. Designer Moore explains why she feels so strongly about cursive:

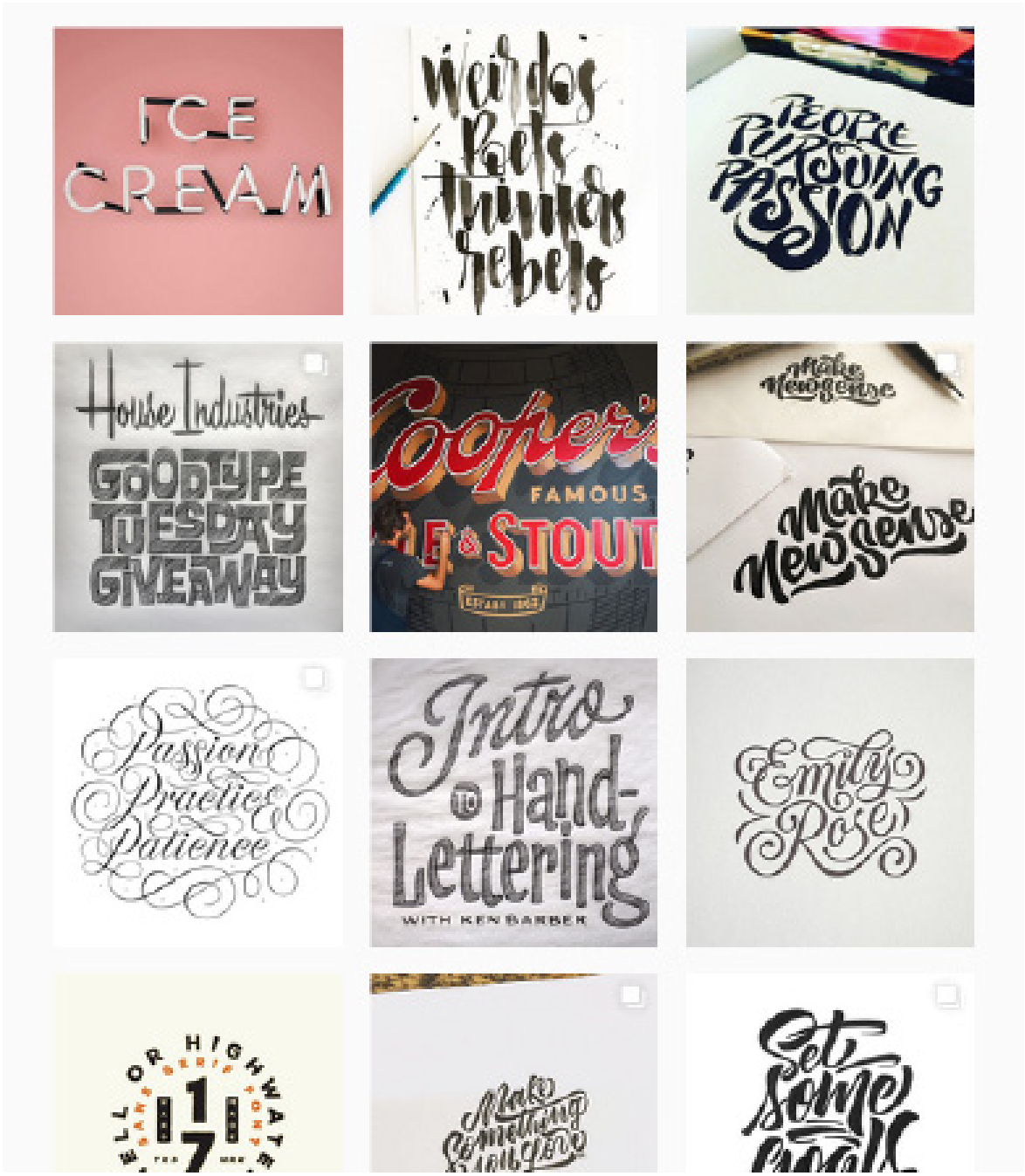
"Cursive was more than just a source of pride when I was young. Cursive was a way to express my individualism during a time when everybody around me was learning the exact same things as I was; being graded on the same scale, expected to produce the same results. As a form of art, cursive was a vestige of identity in a sea of standardization. Even more so than that, it was understood and encouraged for cursive to become mine, to morph into my own form of the alphabet; still read and recognized as the same 26 letters as everyone else's, but uniquely and whole-heartedly mine".
(Marla Moore, In favor of Cursive interview, 2014).

In my opinion, this clearly proves the same thing that I found out in my interview with early education expert and teacher Marja-Kristiina Lerkkanen. Positive learning experiences are very important, especially in the early age, when the child is constructing his or her self-esteem.

If a child has developed motor skills and writing by hand therefore feels easy, it gives positive learning experience that can have long-term effects. Therefore it seems very important to be aware of the fact that motor skills of children develop in a very different pace and it should be noted when teaching handwriting.

Early learning experiences can have a big impact on a child´s life. This should naturally be considered when teaching handwriting. As from my personal experience, I was a child who was very good at drawing and I did it a lot. Therefore I had good fine motor skills already going to the first grade. Handwriting and drawing were therefore easy for me and gave me a lot of positive feedback and admiration.

Naturally this made me want to continue to do these things. If I look back on that now and think about my career choices: I became a graphic designer and illustrator much because of that. The things you feel good about doing, boost your confidence. If I have had negative learning experiences with drawing and writing, I would probably have chosen a different career.



PICTURE 18: @GOODTYPE INSTAGRAM ACCOUNT

11. FUTURE OF HANDWRITING

11.1 UNCERTAIN FUTURE

As noted before, when typewriters became common and affordable, people were worried what happens to handwriting. But it survived.
I had a priviledge to ask a few questions on the subject from Rosemary Sassoon. Sassoon is an American designer and expert of handwriting teaching, specialized in early education. She has written many books and articles on the subject, for example Practical Guide to Children's Handwriting, 1983 and Handwriting of the Twentieth Century, 1999.

I asked her how she sees the uncertain future of handwriting and if she thinks the skill will disappear.

> "I cannot see it dying out completely in the future as it is the most immediate form of graphic communication, I can see a two tier population – some people will only be able to communicate via various technological means whereas others will choose to retain the ability to write and therefore have two means of communication. Even if educationists choose to stop the teaching of handwriting there will still be those whose parents have chosen to teach them and those who choose to learn by themselves later on".

She also pointed out that it will be many years before those in poorer countries will be able to forsake the written trace – interesting comparisons – who will then be the better educated or equipped for life?

As far as technology goes, it is almost impossible to try to guess what will happen in the future. Many new technologies became very popular very fast and were no predicted by any future experts. It is also possible that some devices or things we use a lot now, will die out just as fast, we cannot be sure about that either. What is relevant here, in my opinion is the fact that how quickly we should react to these changes in technology and ways of communicating.

> "I believe that things with a good user interface survive better. In pen and paper, this user interface is pretty good. People will continue to invent new things all the time, but only the ones that are user friendly will survive. For example (computer) mouse and a keyboard are maybe not the most user friendly interfaces and therefore they might disappear in the future. I strongly believe that pen and paper will continue to be good in the future also. There are still things that are best done by pen and paper, for example drawing a mindmap. I don´t think writing by hand will disappear, but as the tools will be mostly digital, of course the importance of it will decrease, "

Minna Huotilainen says in my interview.

What seems relevant here is the fact that the devices we use for writing, laptops and smart phones are in fact faster and more handy than writing by hand, but what is being constantly online and surrounded with all kinds of notifications will eventually do to people in the long run?

11.2 THE CHECKING HABIT

The reason I was interested in this part of handwriting, was the fact that some researches claimed that writing by hand could make you focus better than writing on a computer. One of the reasons is that when writing on a computer, you are very easily distracted by all notifications from different things. It is quick and easy to check your web browser every once in a while, so that is what you end up doing. People are so used to this so-called checking habit, that they hardly even notice doing it. People might think they are being efficient and even multitasking, but in reality, this so-called multitasking ability does not even really exist.

> "There´s really only one target of attention. If you do multiple things at the same time, you have to change that target from one thing to another. Even we would be only focused on one thing, we are still aware of the other things that need attention and just their existence takes up the memory capacity from our brain. People these days have this constant checking habit, which is not good for our brain".
> (Huotilainen, Minna, interview 2016).

A study titled Beyond Self-Report: Tools to Compare Estimated and Real-World Smartphone Use done in Nottingham Trent University, wanted to gain more information about this checking habit. Andrews & Ellis & Shaw & Piwek, 2015).

Authors of this study simply asked participants (aged 18 to 33) to estimate the amount of time they spend on their phone and then compared their self-reports to their actual usage. After the study and its results, Dr Sally Andrews, a psychologist in Nottingham Trent University's School of Social Sciences, said: "Our study has shed light on some important details in relation to people's phone-checking behavior. People have very little awareness of the frequency with which they check their phone".

The authors of this study found out that an average person checks their device 85 times a day, which adds up to 5 hours a day, third of the time a person is awake. It is also twice and as often as many people realize. The issue with multitasking and its possible consequences is becoming a big concern at schools, since students are very commonly using their laptops and smart phones during the lessons.

Another study titled The Laptop and the Lecture: The Effects of Multitasking in Learning Environments (Hembrooke & Gay, 2003) explored the effects of engaging in multiple tasks simultaneously on traditional outcome measures of performance. In this study there were two groups of students who heard the same exact lecture and the study tested how they follow the lecture. One group of students was allowed to use their laptops to engage in browsing, search, and/or social computing behaviors during the lecture. Students in the second condition were asked to keep their laptops closed for the duration of the lecture.

Students who had their laptops open, suffered decrements on traditional measures of memory for lecture content. A second experiment replicated the results of the first. Data were further analyzed by "browsing style." In my opinion it should also be noted this study is from 2003, time before Facebook and other social media, so I can only imagine that the results would be even worse these days.

Switching from books to computers and from pen and paper to the Internet back and forth is very common in classrooms these days. Use of laptops and smart phones of course also have positive effects: they make data searching very easy. But looking at these results and experts opinions, seems that there might be a need to set boundaries and establishing "tech-etiquette" for using wireless technologies in the classroom.

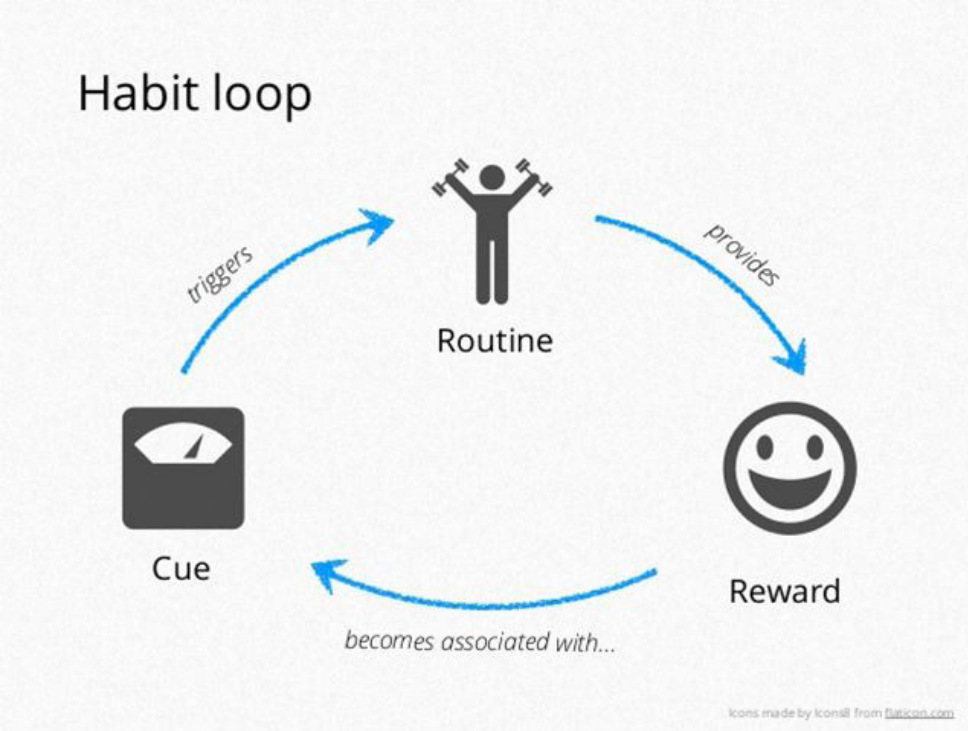
11.2.1 IS IT ALL BAD?

Daniel J. Levitin is the author of a book The Organized Mind: Thinking Straight in the Age of Information Overload and also a neuroscientist. He summarizes the latest research into the neurological effects of these actions.

> "Prolonged multitasking spread among devices creates a cycle of chemical addiction in which the brain rewards itself with pleasure signals for fulfilling checking tasks while simultaneously diluting focus. One consequence is that new information a person attempts to learn is stored in parts of the brain where it can't be accessed as easily. Meanwhile, the brain more rapidly burns through chemical fuel it needs to concentrate."

(Levitin, Daniel J., 2014). Even though we think we're getting a lot done, ironically, multitasking makes us less efficient, he adds.

The checking habit that leads to attempt of multitasking has been found to increase the production of the stress hormone cortisol as well as adrenaline,



PICTURE 19:
HABIT LOOP
http://bodysoultraining.com/components-of-habit/

which can over stimulate your brain and cause mental fog or scrambled thinking. According to Levitin, multitasking creates a dopamine-addiction feedback loop, effectively rewarding the brain for losing focus and for constantly searching for external stimulation. (Daniel J. Levitin, 2014)

There are different kinds of attention related disorders: Attention Deficit/ Hyperactivity Disorder (ADHD), which is a chronic disorder, meaning that it affects an individual throughout life. Attention Deficit Disorder (ADD) is also a diagnosed neurological state, much like ADHD. The third one is called Attention Deficit Trade (ADT), which has similar symptoms to these, but it is actually self-inflicted state.

> "ADT affects the way we perform in different tasks. It´s common that Attention Deficit Trade state "stays on", for example if you´re busy at work and trying to multitask in order to be able to get home on time. Afterwards you go pick your kids from daycare, come home and you´re still on this same state of fussing. Eventually your kids, your husband and even your dog get in that same state".

neuroscientist Minna Huotilainen explains in my interview with her.

It goes without saying that this habit is not good. When writing on a computer, it is also especially easy to go on this state. Writing on text editing program, having multiply tabs open on your browser, checking the notifications and sounds immediately… and then wondering why you are not able to finish what you started.

These problems are not just related to writing. Also reading seems to be suffering. Some cognitive neuroscientists believe that humans seem to be developing digital brains with new circuits for skimming through information online. In an article in a Finnish newspaper Helsingin Uutiset, titled Aivotutkija: Käsin kirjoittaminen auttaa oppimaan, (Moisala, Minna, 2017). Neuroscientist Minna Moisala explains that it has been studied that reading text from a paper makes you remember it better than reading it from the screen. This is said to be because of the chronological order makes the information stick in your memory better. Remembering where things were on paper, makes you memorize them better. When reading from the screen, this same thing does not happen.

> "We're spending so much time touching, pushing, linking, scrolling and jumping through text that when we sit down with a novel, your daily habits of jumping, clicking, linking is just ingrained in you," says Andrew Dillon, a University of Texas professor who studies reading, in an interview by the Washington Post. "We're in this new era of information behavior, and we're beginning to see the consequences of that." (Rosenwald, Michael, 2014).

> "Of course the internet has changed the way of reading a lot. Before internet, the only distractions in text were the pictures. Now there are hyperlinked text, videos, keywords, scrolling up and down and all the other interactivity, that gives more information, but also makes it harder to focus on the text"

writes Maryanne Wolf, a Tufts University cognitive neuroscientist and the author of "Proust and the Squid: The Story and Science of the Reading Brain." (Ferris, Jabr, 2013).

However, all of this so-called multitasking is not bad for you. In my interview with Minna Huotilainen, I wanted her to explain why it feels like while listening to a lecture for example, it seems easier to focus if you are doing something simple with your hands at the same time. In my own experience for example, while listening to a lecture, it is easier to focus if I am drawing at the same time.

"I would not call this multitasking", Huotilainen says. "While you are listening the lecture and you draw at the same time, the fact that you are doing something effortless and easy with your hands, keeps your alertness level up. This makes you focus better". According to her, the reason for this is a bit unexpected:

PICTURE 20: CHINESE CALLIGRAPHY
ARTIST ZHANG GUO DONG

> "This could be something that dates back to the Hunter-Gatherer era. In that era, if you were sitting in the back of a cave and it was safe and you had no tasks to do, there was no harm in falling asleep. But when you were doing something that had to be done, like a lot of things back then that had to be done with your hands, it was not good to fall asleep while doing them. Some researchers believe that the need to do something small with our hands in order to focus, dates back from that time and it´s still part of our brain. Of course it´s not possible to show this assumption is true, but it could explain this".

My other interviewee Marja-Kristiina Lerkkanen also agreed that writing by hand could boost the skill of focusing, because it is not easy to do other things while you are writing by hand. Therefore you are putting your focus in only one thing, which is good for your brain.

11.3 WHAT UNEXPECTED POSITIVE EFFECTS HANDWRITING MIGHT HAVE?

A study called The effects of Chinese calligraphy handwriting and relaxation training in Chinese Nasopharyngeal Carcinoma patients: A randomized controlled trial (Yang & Li & Hong & Kao, 2009), was made to research the possible therapeutic effects of calligraphy handwriting.

In this study the practice of traditional Chinese brush writing was found to have therapeutic effects on people suffering from certain diseases. Some authors argued that calligraphy might have relaxation effect.

The main point in this study was to compare the effects of calligraphy handwriting with those of progressive muscle relaxation and imagery training in Chinese Nasopharyngeal Carcinoma patients. Results of this study showed that both of calligraphy and relaxation training demonstrated slow-down ef-

fects on physiological arousal parameters. Based on this study, calligraphy practice lowered participants´systolic blood pressure and respiration rate at pre- and post-treatment measures. According to the authors of this study

> "Both of calligraphy and relaxation training had certain symptom relief and mood improvement effects in patients. Relaxation was effective in relieving symptom of insomnia and improving mood disturbance, calligraphy elevated level of concentration and improved mood disturbance… The final conclusion was that similar to the effect of relaxation training, calligraphy demonstrated a gradually build-up physiological slowdown, and associated with heightened concentration and improved mood disturbance. Calligraphy is also inexpensive, easy to practice, and involved an innate art appreciation and cognitive facilitation process. Calligraphy handwriting offered a promising approach to improved health in cancer patients".

This is only the result of one study, but it shows promising results of what kind of benefits handwriting, especially the more artistic part of it could offer. In my interview with Minna Huotilainen, she also pointed out that writing by hand or any other kind of activity that goes on for a long time and has continuity, like reading a book, is good practice for focusing and relaxation. The way we have to focus when we are writing by hand, we are forcing ourselves to focus with our meta-skills, she explains.

According to the authors of the original study, one major limitation of the current study was that although calligraphy has its roots in orient culture, there are difficulties to generalize to other cultures, for people who are unfamiliar with its use, may feel stressful to conduct it. However, these results could possibly be applied to other ways of handwriting.

Another supporter of similar theory is a professional calligrapher Heather Held. She explains the problem of these days very well in Teachmag article called Cursive Writing: Beneficial Or Lost Art? (Meagan Gillmore, 2016). "Children's constant reliance on technology means "their mind is constantly active," she says. The thoughtful, meditative space handwriting creates is one reason Held will continue to practice and teach cursive handwriting even as she watches regular cursive use diminish.

> "Writing gives children a chance to be still. Constant activity impairs their ability to sit quietly, putting undue pressure on students, parents, and teachers", says Held. The child who can't stop fidgeting or who needs to doodle to stay alert, needs to learn handwriting, she says. According to Held, handwriting creates room for peace. "Calligraphers can lower their heart rate just sitting in front of their paper to work," Held adds. "You can't do it if you're fighting, if you're agitated. You have to be at peace."

The calming effect of handwriting is also called graphotherapy. Graphotherapy or graphical re-education is "a branch of graphology, whose goal is to modify the graphical gesture in a conscious way, in order to produce changes in personality at a subconscious level to improve innumerous challenges" (Graphotherapy: Change your Handwriting). Supporters of this theory believe that handwriting can do a lot more than just calm you. Marc Seifer, a handwriting expert and writer of a book The Definitive Book of Handwriting Analysis, says that scribbling a sentence like 'I will be more peaceful' at least 20 times per day can have a calming influence on the writer.

According to Seifer, graphotherapy is most useful to those with attention deficit disorder because it trains the brain to calm down and focus, spreading a feeling of calm across a racing mind. Graphotherapy believes that writing by hand can improve ability for concentration, memory, school performance with the consequent improvement in self-confidence and self-esteem in children. However, graphotherapy is considered to be pseudoscience, but there are other researches that show similar results.

Some researches in this field show that calligraphy used as therapy may improve behavioral and psychosomatic disorders (Kao & Chen & Chang). Calligraphy is also found to have a therapeutic effect on hypertension and other diseases, such as type 2

diabetes (Kao & Chen & Chang). It has also been found that intellectual leisure activities in later life, including calligraphy, may delay cognitive deterioration. (Leung & Fung & Tam et al., 2011).

12.1 CONCLUSIONS

As technology develops fast these days, schools might find it hard to keep up with the current technology. In my opinion, it is very important to be aware of even the small changes in order to be "on the same page" with what is happening. This has to do with the fact how schools and the rest of the society are linked together.

In my interview with neuroscientist Minna Huotilainen, she sums up the importance of following closely what is going on outside the school world:

> "School can´t be like a detached part from the rest of the society. If this happens, its ability to influence people weakens tremendously. When children come to school, they feel like boarding on a plane: phones off, all other connections to the outside world off. This makes them feel like going back in time, when they´re inside of the school building and this should not be the case. Schools and educational influencers should pay attention what is happening in the rest of the world and adapt to that, if necessary".
> (Interview, Minna Huotilainen, 2016).

Huotilainen also pointed out that right now, we are living through this "experiment". Lot of things are changing at the same time: the ways of doing, the ways of learning, ways of communicating… And it is impossible to know how things continue to change in the near future.

Because history often repeats itself, in my opinion, it is wise to look that way. One thing we can learn from the past changes in communication, is that new technology usually does not entirely kill the old one. The world and people just need to adjust to new things.

> "Looking at the history of writing and the history of technology, there was always loss with change. Written language had its opponents, but without written language, there would not be a possibility to look something up. Written language also helped to remain important information throughout history. There was a loss when printing press was developed, since after that the skills of scribes were not so useful anymore. But as the scribes and monks who used to do the book writing by hand before, moved on to teaching handwriting skills, they made the most of their skill in the new environment".

Trubek puts it in her book The History and Uncertain Future of Handwriting (Trubek, Anne, 2016).

In my opinion, looking at the history and the "big picture" is important. There has always been changes in the way we write and what devices we use to produce text and we do not even have to go back hundreds of years. When text messages were first introduced around 1994, these messages had a limited 160 characters and some people claimed then that writing these messages would destroy well-written language. People had to put a lot of information in those characters and typing with cell phone buttons was slow and difficult, so people were using a lot of shortening of words. Did this effect writing a lot? There is really no evidence of that. Decade later came social media, for example Twitter with limited 140 characters.

When doing my interviews, teacher and expert on early education Marja-Liisa Lerkkanen mentioned that because of Twitter, blogs and other social media, young people are in fact writing more than ever. Trubek seems to agree and writes in her book The History and Uncertain Future of Handwriting: "One of the most surprising aspects of the digital revolution, in fact, is how text based it has been".

In my opinion, it should also be noted that writing today is more similar to speaking. Chats, blogs and Twitter and other social media is basically all about expressing our opinions and having discussions about them. That way it is far from silent reading or writing. People write more and written words become a discussion and that discussion gets shares, likes and dislikes, and even more conversation, but just through the screens of our phones and laptops. Also the use of shortened expressions like IRL and LOL, for example, bring written text closer to conversation again.

In my interview, Marja-Kristiina Lerkkanen also pointed out that she has done research on the language of text messages among 4th graders and noticed that text messages are very much like the spoken language and also often contain other sym-

bols than text (old fashioned smiley faces and modern emojis). However, children in already very early age seem to understand the difference in which kind of language to use in which assignments, for example in texting or in school assignments.

An article written by Anne Trubek called Let's face it — handwriting just doesn't matter, 2016, notes the same thing.

> "There is no evidence that "text speak" like LOL has entered academic writing, or that students make more errors as a result. Instead, there is evidence that college students are writing more rhetorically complex essays, and at double the length, than they did a generation ago".

In the same article she points out that in fact we write more than ever: "Choosing to write to one another over social media or text message instead of talking on the phone or visiting".

12.1.1 TOUCH SCREENS AND STYLUS PENS

At the same time handwriting is becoming less used, tablets and computers have started to have possibilities to write with your finger or a stylus pen on a touch screen, so maybe we are in fact going back to writing by hand at some point? Or maybe there is some other kind of new technology on its way?

When doing my interviews with neuroscientist Minna Huotilainen, a Research Professor in the Institute of Occupational Health in Finland, she also mentioned same thing that I found going through my secondary data. Voice recognition devices are most likely to become better and more common in the near future and they might change the way we communicate, once again.

The voice recognition devices make correcting errors quite difficult, which leads to that when using these devices, you actually have to think what to say before saying it. This process can be thought to be similar to the times before computers, when we did not have such easy ways to undo and cut and paste and other things.

"In a way, voice recognizing devices might just be the purest "writing" technology, since talking is something we learn usually by nature, it doesn´t have to be taught" (Trubek, Anne, 2016) "and actually voice recognition devices bring us back to the time of Socrates and scribes they used", she adds.

In my interview, Huotilainen also pointed out that voice recognition devices might not even require speaking in the future. The device could just pick the sentences by the movement on their neck by the person mounting them without a voice.

Voice recognition devices could also be very helpful for people suffering from dyslexia for example. But still, before these devices spread all over the world, it will take time.

> "However imperfect at present, these speech-to-text and text-to-speech technologies are already transforming the lives of people who, because of visual, hearing, or motor impairments, or because of dyslexia, have difficulties writing or reading. The obvious reason why millions of illiterate people around the world don't also take advantage of these technologies is just poverty - which explains why they are illiterate in the first place",

says Dan Sperber in his presentation The Future of Writing the Virtual Symposium Text-E, 2001-2002, organised by the Association Euro-Edu, in France (Sperber, Dan, 2001).

Other benefits of these vivo (voice in, voice out) devices are listed in an article Education trends: Dictation Technology Will Change Writing Instruction (Rosenberg, Robert, 2013).

• If the future of writing lies in dictation, then it would be important for teachers to help students refine their dictation-based writing skills.
• Since individual students respond differently to different teaching styles, we may find that writing through dictation helps some students to learn composition skills better. Such technologies are already proving to be of assistance to visually impaired students.
• Lessons that include writing through dictation may additionally train students' speaking skills. That is, the activity of thoughtfully composing text through voice may have the added effect of helping students to become more thoughtful speakers.

However, in my opinion, the situation with writing, communication and new technology is very unpredictable, and therefore it is almost impossible to do anything else than guess how things might be in the future. There could be new technology that becomes popular very fast, or something that simply dies out because it was not good or handy enough to use.

12.2 HOW WRITING BY HAND WILL BE RELEVANT IN THE FUTURE?

As we have learned from this thesis, there are researched facts that show the relevancy of handwriting.

Relevancy 1:

It is better for learning and memory than typing

Benefits of writing by hand are clear. When you write by hand, you remember better the things you have written. Also when going back to your notes, you are able to recall the information better than from typing. As we learned earlier in this thesis, this is based on the fact that when writing by hand, you are not as fast as typing and therefore need to process the information in order to decide what is worth writing down. In my opinion, claiming that typing is better since it is faster, therefore is not entirely true. You might type faster than write by hand, but if you need to re-read your notes multiple times in order to recall what the lecture was all about, it makes more sense to write them by hand in the first place and process the data already while writing.

Relevancy 2: It makes us focus better

As this thesis shows, that is not the only benefit of writing by hand. There are also other good sides: learning to focus better and multitask less, which is a good thing in today´s digital world. Also any kind of activity that we do with our hands is good for our brain. Especially the kind that lasts for a long time. Writing by hand is also good memory practice. In my opinion, one of the most important things handwriting teaches us, is to focus on one thing at the time. The problem with the checking habit most people have, dealing with all the devices, is something that we most likely look back after a few decades and wonder "How did we manage to get anything done back then?".

Relevancy 3: You might be judged by it

Sloppy handwriting can be dangerous in the working world: especially if you are a doctor writing prescriptions by hand, but also when you are applying for a job and might get judged by your handwriting. In my opinion, teaching handwriting is important, but the time spent on teaching it should be efficient. Children don't need to master in perfect cursive, but their handwriting should be fluent and legible. And they should learn that it is still an important skill, not just something

ancient from the past.

Relevancy 4: It affects your academic success

There are negative consequences with bad handwriting, such as lower self-esteem, worse academic success and also: bad handwriting is difficult to read. Most significant thing however seems to be this: handwriting has been shown to have important role in recognizing characters and letters, which is important in learning to read and categorize. Researches show that out of all pre-reading skills, "letter recognition is the strongest predictor of successful reading acquisition in fourth grade and is facilitated by experience hand-printing individual letters" (James & Engelhardt, 2012). Negative learning experiences might affect child´s self-esteem and therefore their whole life in terms of education and success in working life. Handwriting is very important in early literacy skills, both reading and writing and it is good for the child to learn writing early on. If handwriting teaching would be removed altogether, it would most likely have significant consequences on children´s literacy.

Apart from these researched facts, there are also aspects about this phenomenon that I am especially interested in. First of all, the relations between drawing and writing.

As a designer, when talking about writing by hand, the thing that intrigues me the most is the relation between drawing and writing. Designer work is often about both of these. But what is the difference in these two actions?

When children learn to pick up a pen and to draw something, at some point they will also start to draw letters. But when will drawing letters actually becomes writing? According to Russian psychologist Lev Vygotsky, it happens like this:

> "When children begin to draw, their first drawings are merely the traces of deictic gestures, made by a hand. At

> some point there will be the critical moment when the child discovers that the mark he has made on paper is a depiction of something and also that this thing bears a name as a letter. Still writing calls for one further shift: the discovery that letters can be arranged in meaningful combinations to form words. This discovery marks the births of the child´s capacity to read. Only when he can read can he also be truly said to write".
> (Ingold, Tim, Lines – A Brief History).

In his book, Ingold also describes the differences between drawing and writing: "First, writing is in a notation; drawing is not. Secondly, drawing is art; writing is not. Thirdly, writing is a technology, drawing is not. Fourthly, writing is linear, drawing is not". But then as he still notes: "None of these distinctions are entirely trustworthy".

This is where I agree with him. For example writing itself may not be art, but hand lettering or calligraphy can be considered that. As some anonymous once said: "Person´s handwriting is like an accent of his hands". It is unique, nobody else has the exact same.

Some writers claim that writing by hand also makes them produce different text that writing on a laptop, especially in creative writing. Also the act of writing for some writers needs actually be writing, not typing. For example William Bake, the famous poet wrote his poems by hand, in fact he engraved them.

An article titled Why creative writing is better with a pen, goes through the same thing.

> "I can understand this idea of the pen and notepad evoking the idea of craft. For me, writing longhand is an utterly personal task where the outer world is closed off, just my thoughts and the movement of my hand across the page to keep me company. The whole process keeps me in touch with the craft of writing. It's a deep-felt, uninterrupted connection between thought and language which technology seems to short circuit once I begin to use it".
> (Rourke, Lee, 2011).

When we use the word write, we are referring to the action of pen on paper, at least in English. The word write actually sounds like the action on paper. "Words for "write" in most Indo-European languages originally mean "carve, scratch, cut" such as Latin scribere, Greek graphein, glyphein, Sanskrit rich" (Online Etymology Dictionary). In Finnish, I say I am writing a blog, writing with a keyboard, writing a text message whereas in English I would use the word typing more.

As my personal observation, the reason why I feel strongly about handwriting, is also due to being a designer. The most amazing (and often neglected) thing

about writing by hand is how easily you can go from writing to drawing and then back to writing. I claim that note taking with paper and pen is superior to note taking on a laptop because of this. I would call writing on paper "same surface note taking". This is something that (at least) I need in my work a lot.

As a designer, working on something is often going from writing to drawing, back and forth. First, I might write the brief down and then have to do a quick sketch to show something to the client for example. When having just a pen and paper on my hands, switching from writing to drawing is very simple. I can just do it in a second. If I am on my laptop, I have to switch from program to another. If I do not have all the programs open, I also have to wait for them to open. Or if I want to show something to a client that does not have the same software, it can be difficult. With pen and paper, it is easy and fast and it works every time, even when the battery is dead, which seems to happen more and more these days. Then I also have all my notes and sketches at the same place, on paper, not in different files, programs and folders.

I am absolutely not arguing that computers and other technology is bad or useless in any way, but I still strongly feel that pen and paper have something very strong and unique. Even with the modern technology, it should be considered as a very good option for note taking and writing. Working with a tablet that has a stylus pen could be considered the same, but in my opinion, the operating system of pen and paper is still better.

And it is also very safe. An article called Why Pen and Paper Are Making a Surprising Comeback in Baseline magazine, (Elgan, Mike, 2015) also points out the safety issue about this ancient way of retaining information.

> "I think that as major hacks continue, some IT departments will prepare for worst-case scenarios by working some days (or weeks) without a network at all. That may involve plans to return to the pre-network days of sneakernet, or even the pre-PC days of pen and paper. Several trends in mobile computing, cyber-security and fraud protection are getting people to do things the old-fashioned way: with pen and paper. The futurists never saw that trend coming".

Safety is also one interesting fact that supports the use of pen and paper. An article titled Take Care of Your Little Notebook, (Simic, Charles, 2011) in The New York Review of Books, also points out one fact about handwriting:

> "Just think, if you preserve them (notebooks), your grandchildren will be able to read your jewels of wisdom fifty years from now, which may prove exceedingly difficult, should you decide to confine them solely to a smart phone you purchased yesterday".

Not only to worry about safety, but technology is changing rapidly all the time. We can store things to a cloud now and it will be safe there forever. Or will it? When digital cameras became accessible and popular, people started to take a lot more pictures. And where are these pictures now, about 10-15 years later? In CD format in a storage somewhere, since we have reached the time of laptops that no longer even have a built- in CD station. Anything you put on the Internet is said to "be there forever" but I am not so sure if this is true either.

When looking at the past of technology development and how fast and also unpredictable it has been, there is really no way of knowing how we store our data even in the near future. Should we still have photo albums with photos actually glued to the pages and real notebooks with written text just to be able to save something for the future generations?

An article Why Pen and Paper Beats a Laptop Every Time for Taking Notes (MacLachlan, Matthew, 2016), points out the same fact that many other researches do. When writing by hand, you are able to remember and recall the data a lot better than when writing on a keyboard. But what about tablets and stylus pens? Maybe that will be the best solution in the future?

"Developing more user-friendly smart pens that imitate actual pens more closely than the 'scratchy' unfriendly ones we have today could be the answer", MacLachlan writes in the article. However, the biggest problem with any electronical devices these days is the distractions.

> "The obvious concerns of using laptops are the distractions they pose that interfere with active listening. Social media are only a click away, be they Facebook, Twitter or Linkedin. However, avoiding these distractions by turning off the Internet does not solve this problem", the article explains. If you are on your laptop, even the knowledge of the possible notifications will distract your thoughts and make you want to check your social media, email and other things. This "checking habit" is so common these days that we hardly even notice doing it, as studies pointed out already earlier in this thesis.

Also one thing that makes me wonder is this: It is mentioned in many studies that taking notes by hand is better than typing them, because you type faster and therefore are able to make verbatim notes and do not need to process the information that much. However in society that is based on using keyboards of different appliances, maybe one option is to teach children better note-taking strategies rather than forcing them to write by hand "just because it is proven better".

In a Bold Talk –video called "The Pencil and the Keyboard: How The Way You Write Changes the Way You Think", (Thompson, Clive, 2015), Thomson talks about the differences between typing and writing by hand. According to his studies, there is better time for both of these actions: "Handwriting is great for note taking and big picture thinking. So, when you're at lectures, in meetings, or you're brainstorming ideas, scribble or doodle in your notebook". This is what I agree with. Writing by hand makes me think and arrange my thoughts better. For example making a mind map seems to only work when having pen and paper in my hands.

But when it comes to other kind of writing, typing is better option: "Typing is great for producing knowledge for other people, say, writing an article.

The faster you type, the better your ideas will be. There's a thing called transcription fluency, which boils down to: when your fingers can't move as fast as your thoughts, your ideas suffer." Thompson claims. "And therefore if you help people increase their typing speed, their thoughts improve".

"We would surely be doing a disservice to a generation if we failed to teach them the basics of textual communication and forced them to become reliant on electronics and the availability of printers", says Mark Mon-Williams, a Professor of Cognitive Psychology, University of Leeds in an article titled Learning handwriting is more about training the brain than cursive script, 2010.

It has also been studies that taking notes by hand helps children develop their reasoning skills.

"Writing encourages children to be active deciders," says Jan Z. Olsen, founder and developer of Handwriting Without Tears and author of numerous books about handwriting teaching. (McAllister, Jamie, 2016).

Even if I do not believe that handwriting skill would disappear completely in the near future, it is still interesting to think what this drastic change would do to us.

If we would not teach children how to write by hand, it would be harder for them to learn how to read. As I have learned from my primary and secondary data, handwriting has become less important during the last 5-10 years and will continue to do so in the near future (most likely). There are negative consequences with bad handwriting, such as lower self-esteem, worse academic success and also: bad handwriting is difficult to read. Most significant thing however seems to be this: handwriting has been shown to have important role in recognizing characters and letters, which is important in learning to read and categorize. Handwriting is very important in early literacy skills, both reading and writing and it is good for the child to learn writing early on. If handwriting teaching would be removed altogether, it would most likely have significant consequences on children´s literacy.

Handwriting is a motor skill and letter recognition is a cognitive skill. These both skills are very important for developing children. However, even if children would not write by hand, they would probably still draw, which would be good for developing fine motor skills. The loss of this skill might have the biggest changes in our brains. When writing by hand, different parts of the brain are activated than when just typing. However, it is impossible to say if peoples brain would just adapt to the change or if there would be some kind of problems. If all doing things by hand would disappear, it would have a bigger impact, since everything we do with our hands, boost our creativity.

It is possible to imagine this anyway. When you are in a restaurant and you

want to ask for the check, you would not do the classic "writing a signature" –hand sign anymore. You would just show your finger, which is likely to be how we sign our names in the future, just with a fingerprint recognizing device. (This was also how illiterate people signed their name way back in the history: with a finger print). No one would write notes or write on a chalk board at school. Everything and everyone would rely on machines, which is one of the scary things to imagine.

The relevancy of handwriting in the future is not so clear I could just sum it up to one sentence. In my opinion, the relevancy lies in realizing the importance of this skill in many different ways and not just claiming its uselessness in the digital world.

Of the many aspects I pointed out in this thesis, I believe the question of what the constant being online and connected to devices is doing to us, becomes one of the most important. As the whole Slow/DIY -movement, that became popular in the late 2000´s with downshifting and for example slow food, showed that people are also searching for alternative ways to live and work. It is already seen as an upcoming trend that people are getting tired of being constantly online and doing everything on their phones/tablets/laptops. There are already hotels offering social media detox by offering guests rooms without Internet access. Some even go further: there is no Internet, but also no mobile reception or TV. In my opinion, the relevancy of handwriting in the future is closely linked to learning to focus better and also boost your creativity while doing so. And not rely on machines in everything.

I strongly hope that in 25 years, someone will read this text and think: *Oh, how funny that we thought handwriting might disappear.*

Aarshay Jain: A comprehensive beginner's guide to create a Time Series Forecast (with Codes in Python) 2016. Retrieved from: https://www.analyticsvidhya.com/blog/2016/02/time-series-forecasting-codes-python/ (5/2017).

Act on Basic Education, Finnish National Agency for Education, 1998. Retrieved from: http://www.oph.fi/english/education_system/basic_education (3/2017).

Adler, Michael H, The Writing Machine, A History of the Typewriter

American Handwriting Analysis Foundation, The Truth About Cursive Handwriting: Why it matters in a digital age (2016).

An Investigation of Handedness - Some Myths, Truths, Opinions and Research. Retrieved from: http://www.rightleftrightwrong.com/theories_genetic.html (372017).

Andrews, Sally, Ellis, David A., Shaw, Heather and Piwek, Lukasz: Beyond Self-Report: Tools to Compare Estimated and Real-World Smartphone Use (2015), Nottingham Trent University. Retrieved from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4625000/ (1/2017)

Ball, Philip: Cursive Handwriting and Other Education Myths. Nautilus.us, 2016. Retrieved from: http://nautil.us/issue/40/learning/cursive-handwriting-and-other-education-myths (5/2017).

Berninger, Virginia, The "Write Stuff" For Preventing and Treating Disabilities, University of Washington, Seattle (1999) Retrieved from: http://www.wrightslaw.com/info/write.stuff.htm#sthash.3eR9svdy.dpuf (2/2017).

Chappell, Warren & Bringhurst, Robert, A Short History of the Printed Word, 2000. Retrieved from: https://archive.org/details/robert-bringhurst-warren-chappell-a-short-history-of-the-printed-word (1/2017)

Chemin, Anne: Handwriting vs typing: is the pen still mightier than the keyboard? The Guardian, 2014. Retrieved from: https://www.theguardian.com/science/2014/dec/16/cognitive-benefits-handwriting-decline-typing (5/2017).

Clark, Gloria Jean: The relationship between handwriting, reading, fine motor and visual-motor skills in kindergarteners, 2010, Iowa State University. Retrieved from: http://lib.dr.iastate.edu/cgi/viewcontent.cgi?article=2432&context=etd (3/2017).

Connelly, Vincent, Dockrellb, Julie E. and Barnett, Jo, The Slow Handwriting of Undergraduate Students Constrains Overall Performance in Exam Essays (2005). Retrieved from: http://psych.brookes.ac.uk/ewsc/connelly2005.pdf (2/2017).

Conti, Gerry. "Handwriting Characteristics and the Prediction of Illegibility in Third and Fifth Grade Students." Presented at Handwriting in the 21st Century?: An Educational Summit, Washington, D.C., 2012. Retrieved from: http://discoveryprogram-inc.com/learning-center/national-handwriting-day-lets-make-john-hancock-proud/ (12/2016)

Crossman, William, The Coming Age of Talking Computers, 1999. Retrieved from: https://www.questia.com/magazine/1G1-58055045/the-coming-age-of-talking-computers (12/2016).

Deborah Y. Zemlock, Learning About Letters through Handwriting Practice, Department of Psy-

chological and Brain Sciences, Indiana University – Bloomington (2016)

Developing Early Literacy – Report of the National Early Literacy Panel, 2008.

Elgan, Mike: Why Pen and Paper Are Making a Surprising Comeback, 2015, Baseline magazine. Retrieved from: http://www.baselinemag.com/mobility/why-pen-and-paper-are-making-a-surprising-comeback-2.html (5/2017).

Euronews: Handwriting and the digital age, time for change in schools? –mini documentary, 2015. Retrieved from: http://www.euronews.com/2015/02/27/a-sign-of-the-times-why-some-schools-are-erasing-cursive-writing

Ferris, Jabr, The Reading Brain in the Digital Age: The Science of Paper versus Screens, 2013. Retrieved from: https://www.scientificamerican.com/article/reading-paper-screens/ (4/2107).

Finnish PISA 2009 data, 2016. Retrieved from: http://omalinja.fi/wp-content/uploads/2016/03/29413-219476-1-PB.pdf (2/2017).

Garber, Lisa , How Cursive Writing Uniquely Helps Brain Development, Natural Society, 2013. Retrieved from http://naturalsociety.com/how-cursive-writing-affects-brain-development/ (2/2017).

Gillmore, Meagan, Cursive Writing: Beneficial Or Lost Art? 2016. Retrieved from: http://www.teachmag.com/archives/8603 (4/2107).

Grant, Angelynn, 3 Typography Experts Weigh in on the Recent Hand-Lettering Boom, 2015. Retrieved from: https://eyeondesign.aiga.org/3-typography-experts-on-how-to-tell-good-hand-lettering-from-the-wannabes/ (5/2017).

Graphotherapy: Change your Handwriting, Retrieved from: http://www.handwriting-graphology.com/graphotherapy/ 12/2017).

Harju-Luukkainen, Heidi, Vettenranta, Jouni, Ouakrim-Soivio, Najat & Bernelius, Venla. Differences between students' PISA reading literacy scores and grading for mother tongue and literature at school: A geostatistical analysis of the Finnish PISA 2009 data . Retrieved from: http://omalinja.fi/wp-content/uploads/2016/03/29413-219476-1-PB.pdf (1/2017).

Harvey C, Henderson S. Children's handwriting in the first three years of school: consistency over time and its relationship to academic achievement. Handwriting Review. 1997. Retrieved from: http://scholarworks.wmich.edu/cgi/viewcontent.cgi?article=1051&context=reading_horizons (2/2017).

Hembrooke, Helene and Gay, Geri, The Laptop and the Lecture: The Effects of Multitasking in Learning Environments, Human Computer Interaction Laboratory, Cornell University (2003). Retrieved from: https://web.stanford.edu/dept/CTL/ClassroomLaptops/wikiupload/1/17/Multitasking_Hembrooke.pdf (1/2017).

Hernandez, 2012; National Assessment of Educational Progress, 2013. Retrieved from: http://www.literacyhow.com/fluency/ (12/2016).

History of Handwriting, Vletter.inc, Retrieved from https://www.vletter.com/help/font-faq/history-of-handwriting.html (1/2017).

Hoke, Donald, The Woman and the Typewriter: A Case Study in Technological Innovation and Social Change Milwaukee Public Museum, 1975. Retrieved from: http://www.thebhc.org/sites/default/files/beh/BEHprint/v008/p0076-p0088.pdf (1/2017).

Hopman, Linsey, Cursive over typeface: the importance of teaching handwriting instead of typing, Master thesis, The University of Leiden (2014). Retrieved from: https://openaccess.leidenuniv.nl/handle/1887/28826 (2/2017).

Horvath, Imre, Differences between 'research in design context' and 'design inclusive research' in the domain of industrial design engineering. Retrieved from: https://www.researchgate.net/publication/233731039_Differences_between_'research_in_design_context'_and_'design_inclusive_research'_in_the_domain_of_industrial_design_engineering (12/2016)

Horváth, Imre: Comparison of Three Methodological Approaches of Design Research, 2007.

Impacts of typewriters in history. Retrieved from: https://www.reference.com/history/impact-did-typewriter-society-cde18a1a07ca2465?qo=contentSimilarQuestions# (1/2017)

Ingold, Tim, Lines: A Brief History. Routledge, Oxon, UK (2007).

James, Karin H & Engelhardt, Laura (2012) The effects of handwriting experience on functional brain development in pre-literate children. Retrieved from http://www.sciencedirect.com/science/article/pii/S2211949312000038 (10/2016)

James, Karin H, Li Julia X, Handwriting generates variable visual input to facilitate symbol learning (2016). Retrieved from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4755885/ 1/2017)

Kao, H.S.R. Shufa: Chinese calligraphic handwriting (CCH) for health and behavioural therapy. International Journal of Psychology, 2006. Retrieved from: http://202.116.197.15/cadalcanton/Fulltext/21337_2014319_102457_251.pdf (12/2016)

Keep, Christopher , "The Introduction of the Sholes & Glidden Type-Writer, 1874, Retrieved from: http://www.branchcollective.org/?ps_articles=christopher-keep-the-introduction-of-the-sholes-glidden-typewriter-1874 (2/2017).

Keesee, Michael, The Effects of the Hand Lettering Trend, 2016. Retrieved from: https://www.linkedin.com/pulse/effects-hand-lettering-trend-michael-keesee (1/2017)

Keim, Brandon, The Science of Handwriting 2013,. Retrieved from: https://www.scientificamerican.com/article/the-science-of-handwriting/ (1/2017).

Kennedy, Eithne, Dunphy, Elizabeth, Dwyer, Bernadette Hayes, Geraldine McPhillips, Thérèse, Marsh, Jackie O'Connor, Maura, Shiel, Gerry: Literacy in Early Childhood and Primary Education, (3-8 years) Retrieved from: http://www.ncca.ie/en/Publications/Reports/ (3/2017).

Kennedy, Eithne, Dunphy, Elizabeth, Dwyer, Bernadette, Hayes, Geraldine, McPhillips, Thérèse, Marsh, Jackie, O'Connor, Maura, Shiel, Gerry,
Kiefer, Markus , Schuler, Stefanie, Mayer, Carmen, M. Trumpp, Natalie, Hille, Katrin and Steffi Sachse, Handwriting or Typewriting? The Influence of Penor Keyboard-Based Writing Training on Reading and Writing Performance in Preschool Children, Department of Psychiatry, Ulm University, Ulm, Germany (2015). Retrieved from: www.ac-psych.org/en/download-pdf/volume/11/issue/4/id/179 (1/2017)

Kirsch, Irwing S., & al, Adult Literacy in America: A First Look at the Findings of the National Adult Literacy Survey, 1993. Retrieved from: https://eric.ed.gov/?id=ED358375 (1/2017).

Klemm, William, Improve Reading & Hand-eye Coordination by Learning Cursive? Accurate high-speed visual tracking is useful for reading and fine motor skills, 2015).

Klemm, William, Why Writing by Hand Could Make You Smarter, 2013. retrieved from: https://www.psychologytoday.com/blog/memory-medic/201303/why-writing-hand-could-make-you-smarter (2/2017).

Kotenko, Jam (2013) Can pen and paper survive in a world of touchscreens and tablets? Retrieved from http://www.digitaltrends.com/web/handwriting-analysis/ (10/2016)

Kothari, C.R.: Research Methodology: Methods and Techniques, 2004.

Kukkapuro, Ida, Why letters matter, Helsinki Design Week interview, 2016. Retrieved from: http://www.helsinkidesignweek.com/weekly/why-letters-matter/?lang=en, 1/2017).

Kumar, Ranjit: Research methodology a step-by-step guide for beginners, 1999.

Leung GT, Fung AW, Tam CW, Lui VW, Chiu HF, Chan WM, Lam LC., Examining the association between late-life leisure activity participation and global cognitive decline in community-dwelling elderly Chinese in Hong Kong, 2011. Retrieved from: https://www.ncbi.nlm.nih.gov/pubmed/21157849 (5/2107).

Leung GTY, Fung AWT, Tam CWC, et al. Examining the association between late-life leisure activity participation and global cognitive decline in the community-dwelling elderly Chinese in Hong Kong. Int J Geriatr Psychiatry. 2010. Retrieved from: https://www.ncbi.nlm.nih.gov/pubmed/21157849 (3/2017).

Levitin, Daniel J. , The Organized Mind: Thinking Straight in the Age of Information Overload, 2014. Literacy in Early Childhood and Primary Education (3-8 years), 2012.

Longcamp, M. , Zerbato-Poudou, M.& Velay, J, The influence of writing practice on letter recognition in preschool children: A comparison between handwriting and typing, Acta Psychologica, 2005. Retrieved from: https://www.researchgate.net/publication/7914118_The_Influence_of_Writing_Practice_on_Letter_Recognition_in_Preschool_Children_A_Comparison_between_Handwriting_and_Typing (2/2017).

Lukkarila, Jarno (Typolar) portfolio and case study, Retrieved from https://www.behance.net/Typolar, (12/2016).

Lukkarila, Jarno, Finnish National Handwriting Model as a case study, 2015. Retrieved from: https://www.behance.net/gallery/41959877/Finnish-National-Handwriting-Model (3/2107).

MacLachlan, Matthew, Why Pen and Paper Beats a Laptop Every Time for Taking Notes, 2016.Retrieved from: https://www.communicaid.com/communication-skills/blog/writing-skillsbusiness-writing-skills/taking-notes-better-using-laptop-tablet/ (3/2017).

Maldarelli, Jennifer E., Kahrs, Björn A. Hunt, Sarah C. & Lockman, Jeffrey J. Development of Early Handwriting: Visual-Motor Control During Letter Copying, 2015. Retrieved from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4478098/ (3/2107).

Mangen, Anne and Velay, Jean-Luc, Digitizing Literacy: Reflections on the Haptics of Writing 2010. Retrieved from: http://www.intechopen.com/books/advances-in-haptics/digitizing-literacy-reflections-on-

the-haptics-of-writing (1/2017)

Marla Moore, In favor of Cursive. Retrieved from: http://www.marlamakesstuff.com/a-case-for-cursive/ (1/2017)

Mattila, Raisa, Kaunokirjoituksen taitaja Maria Vilenius on tienannut myös matkimalla johtajien allekirjoituksia, Helsingin Sanomat, 2016. Retrieved from: http://www.hs.fi/ihmiset/art-2000002921558.html (5/2017).

McAllister, Jamie, Is Handwriting a Predictor of Academic Success? 2016. Retrieved from: http://www.thehealthjournals.com/handwriting-academic-success/ (3/2017).

Min Xu, Henry S. R. Kao, Manlin Zhang, Stewart P. W. Lam and Wei Wang, Cognitive-Neural Effects of Brush Writing of Chinese Characters: Cortical Excitation of Theta Rhythm, 2013.Retrieved from: downloads.hindawi.com/journals/ecam/2013/975190.pdf (1/2017).

Moisala, Minna, Aivotutkija: Käsin kirjoittaminen auttaa oppimaan, Helsingin Uutiset, 2014.Retrieved from: http://www.helsinginuutiset.fi/artikkeli/471304-aivotutkija-kasin-kirjoittaminen-auttaa-oppimaan (5/2017).

Mont-Williams, Mark, Learning handwriting is more about training the brain than cursive script , 2015. Retrieved from: http://theconversation.com/learning-handwriting-is-more-about-training-the-brain-than-cursive-script-53679 (2/2107).

Mueller, Pam A. & Oppenheimer, Daniel M. , The Pen Is Mightier Than the Keyboard: Advantages of Longhand Over Laptop Note Taking, 2014, Princeton University and University of California, Los Angeles. Retrieved from: http://www.academia.edu/6273095/The_Pen_Is_Mightier_Than_The_Keyboard_Advantages_of_Longhand_Over_Laptop_Note_Taking (11/2016).

Online Etymology Dictionary. Retrieved from: http://www.etymonline.com/index.php?term=write (5/2017).

Oxford dictionary: Ambidexterity. Retrieved from: https://en.oxforddictionaries.com/definition/ambidextrous (5/2107).

Peverly, Stephen. The Relationship of Transcription Speed and Other Cognitive Variables to Note-Taking and Test Performance. Presented at Handwriting in the 21st Century?: An Educational Summit, Washington, D.C., (2012).

Porter, Jim, Why technology matters to writing: A cyberwriter's tale (2002)Michigan State University. Retrieved from: http://www.rhetcomp.gsu.edu/~bgu/8121/Reading-Porter.pdf (1/2017)

Potts, Emily, How @Goodtype Made Hand Lettering Instagram-famous, 2015. Retrieved from: https://eyeondesign.aiga.org/how-the-goodtype-made-hand-lettering-instagram-famous/ (5/2107).

Provost, Claire, According to an article titled One in four young people in developing countries unable to read,, 2014. The Guardian, Retrieved from: https://www.theguardian.com/global-development/2014/jan/29/illiteracy-education-young-people-developing-countries (2/2017).

Ranegar, Kim: Using your 'other' hand benefits your brain, 2011, Retrieved from: http://www.nwitimes.com/niche/shore/health/using-your-other-hand-benefits-your-brain/article_6da931ea-b64f-5cc2-9583-e78f179c2425.html (3/2017).

Righleft, rightwrong? An investigation of handedness – some facts, myths, truths, opinions and research, 2012. Retrieved from: http://www.rightleftright-wrong.com/theories_biological.html (1/2017)

Rosenberger, Robert: Edutopia, Education trends: Dictation Technology Will Change Writing Instruction, Edutopia, (George Lucas Educational Fundation), 2013. Retrieved from: https://www.edutopia.org/blog/dictation-technology-changing-writing-instruction-robert-rosenberger (2/2017)

Rosenwald, Michael S, Serious reading takes a hit from online scanning and skimming, Washington Post, 2014. Retrieved from: https://www.washingtonpost.com/local/serious-reading-takes-a-hit-from-online-scanning-and-skimming-researchers-say/2014/04/06/088028d2-b5d2-11e3-b899-20667de76985_story.html (2/2017).

Rourke, Lee, Why creative writing is better with a pen, 2011. Retrieved from: https://www.theguardian.com/books/2011/nov/03/creative-writing-better-pen-longhand (5/2107).

Rouvas-Nicoli, Catherine and Nicolis, Gregoire, The Butterfly effect, (2009), Scholarpedia Scholarpedia, The Peer reviewed open-access encyclopedia. Retrieved from: http://www.scholarpedia.org/article/Butterfly_effect, (5/2017).

Saperstein Associates, Handwriting in the 21st Century? Research Shows Why Handwriting Belongs in Today's Classroom, An Educational Summit, Washington, D.C., 2012. Retrieved from: http://discoveryprogram-inc.com/learning-center/national-handwriting-day-lets-make-john-hancock-proud/ (12/2016)

Sassoon, Rosemary, Rescuing Handwriting from Redundancy (2015) Retrieved from: http://www.nha-handwriting.org.uk/NHA/media/Public/Downloads/Rescuing-Handwriting-from-Redundancy-by-Rosemary-Sassoon.pdf (1/2017)

Schachter, Rachel E., Spear, Caitlin F. , Piasta, Shayne B., Justice Laura M., Logan, Jessica A.R. Early childhood educators' knowledge, beliefs, education, experiences, and children's language- and literacy-learning opportunities: What is the connection? 2016. Retrieved from: http://www.sciencedirect.com/science/article/pii/S0885200616300084 (12/2016).

Shapiro, T. Rees, Cursive handwriting disappearing from schools, The Washington Post, 2013. Retrieved from: https://www.washingtonpost.com/local/education/cursive-handwriting-disappearing-from-public-schools/2013/04/04/215862e0-7d23-11e2-a044-676856536b40_story.html (1/2017).

Sheffield, 1996, (Compiled by) Scanlon-Dise, Joan, Research, Academic Importance of Handwriting, Compiled (2008) Retrieved from: http://www.tmcsea.org/uploads/1/3/9/8/13988756/academic_importance_of_handwriting.pdf (2/2017).

Simic, Charles: Take Care of Your Little Notebook, The New York Review of Books, 2011. Retrieved from: http://www.nybooks.com/daily/2011/10/12/take-care-your-little-notebook/ (5/2017).

Sollisch, Jim. Multitasking makes us a little dumber (2010), Chicago Tribune. Retrieved from: http://articles.chicagotribune.com/2010-08-10/opinion/ct-oped-0811-multitask-20100810_1_iqs-study-information-overload (11/2016)

Sperber. Dan. The future of writing. Virtual symposium "text-e", 2002. Retrieved from: https://www.dan.sperber.fr/?p=75 (3/2107).

Stebbins, Robert A., Exploratory Research in the Social Sciences. Thousand Oaks, CA: Sage, 2001. Retrieved from: https://us.sagepub.com/en-us/nam/exploratory-research-in-the-social-sciences/book19377 (4/2017).

Sülzenbrück, Sandra. The Death of Handwriting: Secondary Effects of Frequent Computer Use on Basic Motor Skills (2012). Justus Liebig University, Giessen, Germany. Retrieved from: http://www.tandfonline.com/doi/abs/10.1080/00222895.2011.571727 (11/2016)

Thompson, Clive, Bold Talk –video called "The Pencil and the Keyboard: How The Way You Write Changes the Way You Think", 2015.
Retrieved from: https://www.youtube.com/watch?v=89vzfTFu1Vw (5/2107).

Thornton, Tamara Plakins. Handwriting in America: A Cultural History. New London, CT: Yale U Press, 1996. Retrieved from https://timrdoc.wordpress.com/2011/03/01/thornton-tamara-plakins-handwriting-in-america-a-cultural-history-new-london-ct-yale-u-press-1996/

To Err Is Human: Building A Safer Health System The Institute of Medicine, 1999. Retrieved from: http://www.nationalacademies.org/hmd/~/media/Files/Report%20Files/1999/To-Err-is-Human/To%20Err%20is%20Human%201999%20%20report%20brief.pdf (12/2016)

Toivanen, Tuuli, Käsinkirjoitus vähenee – miten se vaikuttaa meihin?, 2014. Retrieved from: https://yle.fi/uutiset/3-7037746 (3/2107).

Trubek, Anne, Handwriting is history, 2009. Retrieved from: https://psmag.com/handwriting-is-history-9312bc557e07#.snorfx9a6 (1/2017)

Trubek, Anne, Let's face it — handwriting just doesn't matter, Gulf news, 2016. Retrieved from: http://gulfnews.com/opinion/thinkers/let-s-face-it-handwriting-just-doesn-t-matter-1.1884091 (5/2017).

Trubek, Anne, Stop teaching handwriting, 2008. Retrieved from: https://www.good.is/articles/stop-teaching-handwriting (1/2017)

Trubek, Anne, The History and Uncertain Future of Handwriting. Bloomsbury USA. 2016.

Typing through time: Keyboard history. Retrieved from: http://www.daskeyboard.com/blog/typing-through-time-the-history-of-the-keyboard/ (11/2016)

UNESCO, "Education for All: A Global Monitoring Report", 2006. Retrieved from http://www.unesco.org/education/GMR2006/full/chapt6_eng.pdf, (2/2017).

Van Rooijen, Maaike, Verhoeven Ludo and Steenbergen Bert, Early numeracy in cerebral palsy: review and future research, 2010. Retrieved from: http://onlinelibrary.wiley.com/doi/10.1111/j.1469-8749.2010.03834.x/pdf (5/2017)

Virgillito, Dan, 20 Typography Trends to Pay Attention to in 2016. Retrieved from: https://www.elegantthemes.com/blog/resources/20-typography-trends-to-pay-attention-to-in-2016 (2/2017).

Walker, L. & Henneberg, M. (2007) Writing with the non-dominant hand: Cross-handedness trainability

in adult individuals. Retrieved from https://www.academia.edu/27861025/Writing_with_the_non-dominant_hand_Cross-handedness_trainability_in_adult_individuals (10/2016).

WFS, World Future Society. Retrieved from: http://wfs.site-ym.com/. (3/2017).

What impact did the typewriter have on society? article. Retrieved from: https://www.reference.com/history/impact-did-typewriter-society-cde18a1a07ca2465?qo=contentSimilarQuestions# (2/2017).

Why having it both ways is bad for you, Guardian 1999. Retrieved from: https://www.theguardian.com/lifeandstyle/1999/jul/20/healthandwellbeing.health3 (1/2017).

Wilson, Frank R. (1999) The Hand: How Its Use Shapes the Brain, Language, and Human Culture. Vintage; 1st Vintage Books Ed edition.

Wilson, Keith J., From Gutenberg to Grandin: Tracing the Development of the Printing Press, in Prelude to the Restoration: From Apostasy to the Restored Church (Provo, UT and Salt Lake City: Religious Studies Center, Brigham Young University and Deseret Book, 2004) Retrieved from https://rsc.byu.edu/archived/prelude-restoration-apostasy-restored-church/gutenberg-grandin-tracing-development-o (2/2017)

Xue-Ling Yang, Huan-Huan Li, Ming-Huang Hong, Henry S.R., The effects of Chinese calligraphy handwriting and relaxation training in Chinese Nasopharyngeal Carcinoma patients: A randomized controlled trial (2009). Retrieved from http://202.116.197.15/cadalcanton/Fulltext/21337_2014319_102457_251.pdf (1/2017)

Zaner-Bloser, Handwriting in the middle years: A strategy for academic & professional success, The latest research in handwriting for middle childhood and adolescence. Retrieved from: https://www.zaner-bloser.com/products/pdfs/Handwriting_in_the_Middle_Years.pdf (5/2017).

PICTURES:

PICTURE 1:
Anne Trubek and the cover of her book.
https://www.amazon.com/Anne-Trubek/e/B003RGP0AE

PICTURE 2:
A website where you can get your tweets turned into a cuneifrom.
https://dumbcuneiform.com/

PICTURE 3:
History repeating itself
https://onsizzle.com/i/4000-years-we-are-back-to-same-language-2006-11777673

PICTURES 4 & 5:
Typewriter ads from the 1800´s.
http://oztypewriter.blogspot.pt/2012/10/on-thisday-in-typewriter-history_6.html

PICTURE set 6:
Calligraphy made by Maria Vilenius. Pictures: Maria Vilenius

PICTURE 7:
Poetry text message tumblr
https://www.tumblr.com/tagged/text-poetry

PICTURE 8:
Correspondences exhibition in
Espace Culturel in Paris
http://www.myfashionjourney.com/in-exhibition-correspondences-at-espace-culturel-louis-vuitton-2/

PICTURE 9:
Alku handwriting model: how to join the letters (optional)
https://www.behance.net/gallery/41959877/Finnish-National-Handwriting-Model

PICTURE 10:
Alku handwriting model examples
https://www.behance.net/gallery/41959877 Finnish-National-Handwriting-Model

PICTURE 11:
Model letters taught in American schools
https://fi.pinterest.com/hyzenthlay/handwriting-to-emulate/

PICTURE 12:
Writing Wizard - Kids Learn to Write Letters, Alphabet & Words
https://itunes.apple.com/us/app/writing-wizard-kids-learn-to-write-letters-alphabet-words/id631446426?mt=8

PICTURES 13 & 14:
Handwriting teaching in Finland and inAmerica
https://yle.fi/aihe/termi/finto/http.wwwysofiontokokop36572/motoriikka?page=2
https://shopping.hwtears.com/category/handwriting

PICTURE SET 15:
My ambidexterity training process

PICTURE 16:
Collage: Handletterin in American magazine covers from 2015 and 2016
PICTURE 17:
Hand lettering works from Ale Paul, Martina Flor and Ken Barber.
https://eyeondesign.aiga.org/3-typography-experts-on-how-to-tell-good-hand-lettering-from-the-wannabes/

PICTURE 18:
@goodtype Instagram account (screenshot)

PICTURE 19:
Habit loop
http://bodysoultraining.com/components-of-habit/

PICTURE 20:
Chinese Calligraphy Artist Zhang Guo Dong
https://chinesecalligraphystore.com/chinese-calligraphy-artist-zhang.php