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Master's Thesis
Academic Year 2017

Project CYSLFKIA: Dyslexic Vision,
Visual Tools for Raising Dyslexia's Awareness

Keio University Graduate School of Media Design

Dolhathai Kaewsermwong

A Master's Thesis
submitted to Keio University Graduate School of Media Design
in partial fulfillment of the requirements for the degree of
MASTER of Media Design

Dolhathai Kaewsermwong

Thesis Committee:

Professor Masa Inakage	(Supervisor)
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Abstract of Master's Thesis of Academic Year 2017

Project CYSLFKIA: Dyslexic Vision,
Visual Tools for Raising Dyslexia's Awareness

Category: Design

Summary

We are now live in the golden ages of information, where we can easily have access to any information in a few clicked away, but yet it so intriguing and thought-provoking that most of us still have a hard time understanding and empathizing with reading disability or dyslexia. Sadly, not everywhere in the world recognize dyslexia as a mental disability, especially in Asia.

Dyslexic individual can often being lump into the stereotype of being unintelligent and often the society blame parents or teacher for not properly teach the children, this misconception and misunderstanding may leads to many other problems in the future, not only for dyslexic individual but society as a whole.

CYSLFKIA, (Pronounce, dyslexia) is the visual tools and application in showcasing the physical and visual characteristic of what extreme dyslexia would look like, the visual is projected by using Augmented reality, aiming to raise awareness towards individual about reading disability. CYSLFKIA is to be use as awareness tools for helping in building advocate for a better relationship. As well as creating a better understanding among ourselves and with one another.

Keywords:

Dyslexia, Dyslexic, Disability, Reading Disability, Visual Tools, Visual Communication, Raising Awareness

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Table of Contents

Acknowledgements	ii
1 Introduction	1
1.1 Designing for Extreme	1
Extreme Visual Recognition	1
1.2 Dyslexia	2
1.3 Creating Awareness	3
Empathy	4
2 Literature Review	5
2.1 Specific Reading Disability	5
2.2 Typoglycemia	6
2.3 Empathy Development	8
Better Awareness	9
2.4 Related Works	10
Open Dyslexic font	10
Through Your Childs Eyes	11
Gift of Dyslexic	12
Dyslexia Typography	14
3 CYSLFKIA	15
3.1 Concept	15
Design Experiment	16
Concept Design	19
Augment Reality	20
3.2 Prototype	23
Building Application	23
Text Input	24

TABLE OF CONTENTS

4	Proof of Concept	30
4.1	Testing	30
	Individual feedback	32
4.2	Overall Feedback	35
4.3	Utilizing the Application	39
4.4	Limitation	39
5	Conclusion	41
5.1	Overview	41
5.2	Future Plan	41
	Reverse Engineering	42
	References	44
	Appendix	46
A	Survey	46

List of Figures

1.1	Dyslexic Example of the Word "Teapot", Dr Vincent Goetry and Dyslexia International. http://www.dyslexia-international.org/Campus/ONL/EN/Course/S2-3-2.htm	2
2.1	Example of Typoglycemia Texts, Matt Davis, MRC Cognition and Brain Sciences, "Reading jumbled texts". https://www.mrc-cbu.cam.ac.uk/people/matt.davis/cmabridge/	6
2.2	Example of Open Dyslexic Font, Open Dyslexic. https://the-digital-reader.com/2015/04/07/overdrive-app-for-android-ios-now-includes-a-dyslexic-font/	10
2.3	Font Comparison, Open Dyslexic. https://opendyslexic.org/about-2/	11
2.4	'b d p q' Example of Open Dyslexic Font, Open Dyslexic. https://opendyslexic.org/about-2/	11
2.5	One of the Question within the Website Interaction for Parents with Dyslexic Children, Understood.org. https://www.understood.org/en/tools/through-your-childs-eyes/personalize	12
2.6	Book Design for Encouraging Dyslexic Children, Dustin Dahlman. https://www.dustindahlman.com/gift-of-dyslexia/	13
2.7	Dyslexia Typography, Daniel Britton. https://www.designboom.com/design/daniel-britton-dyslexia-typeface-06-04-2015/	14
3.1	Project Name Conceptual	15
3.2	Logo	16
3.3	Campaign Concept	17
3.4	Questionnaire with Dyslexia font	18
3.5	Dyslexia Demonstration Moving Gif in 3 Frames	19
3.6	CYSLFKIA Font Order and 'Quick brown fox jumps over the lazy dog' Sample	21

LIST OF FIGURES

3.7	Idea of 'Dyslexic Translation'	22
3.8	Concept Application Interface	23
3.9	Flow Model of the Application Logic	25
3.10	Left: Google OCR Tutorial Final Outcome, https://codelabs.developers.google.com/codelabs/mobile-vision-ocr/#6 Right: Edited Version, Changed Positioning, Background and Text Colour.	26
3.11	Left: Without Graphic input. Right: With Graphic Input	27
3.12	Input Text Setting	29
4.1	The Show Setup	31
4.2	Survey's Result	36
4.3	Survey's Result	36
4.4	Survey's Result	37
4.5	Survey's Result	37
4.6	Survey's Result	38
A.1	Survey	46
A.2	Survey	47
A.3	Survey	48
A.4	Survey	48
A.5	Survey	49
A.6	Survey's Result	49
A.7	Survey's Result	50
A.8	Survey's Result	50

List of Tables

3.1	Alphabets Characterize	20
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Chapter 1

Introduction

1.1 Designing for Extreme

The idea of designing something for the extreme users are a fairly new concept. When you are designing something for the extreme spectrum, the result is not only useful toward the extreme users, the average users could also as well get the benefits of the design solutions. When designing for extreme we allows greater problems, limitation and condition into the significant criteria, which is the keys into pushing towards a great design. Extreme solutions always able to be dilute and used in a totally different set up, while in the other way around, the solution would never had work.

Extreme users are a good source of new perspectives and creative innovation, as they are someone who neither or either, below or above average in physical strength or/and intelligence. Extreme users also could be someone who lacks or excess in an average human capabilities, such as abilities to see, hear, talk, walk and so on. Not only it helps in pushing for great design, but designing for extreme also create a conversation around a topic matters that most individual may not have knowledge beforehand about the said topics.

Extreme Visual Recognition

A case of the extreme user that I have taking a huge interested in are those with extreme vision. The particular reason for that is because for the longest time, I have always had trouble with my own eyesight. On top of it all, due to my own utmost ignorance, I have become quite short-sighted. For the past ten years, I have always had a hard time in reading signs and texts from a distant, describing landscape, recognize people faces and as well as problem while driving. Luckily my own problems are a easy fixes. Although it left me puzzled, why it took me so long to realize that the issue I was having was a problem that I needed to fixed.

I have adapted to my own struggles for so long, that I have created a unhealthy way to deal with them.

Vision are one way of receiving information. When trying to communicating or conveying other people, if the other individual are not receive the same information as you, it would be extremely hard to connect and to communication with one another, thus this work the same with visual recognition of symbol or languages. This aspect of the extreme visual impairment have fascinated me with the probability of creating the different kind of communication keys and visual tools.



Figure 1.1: Dyslexic Example of the Word "Teapot", Dr Vincent Goetry and Dyslexia International. http://www.dyslexia-international.org/e_Campus/ONL/EN/Course/S2-3-2.htm

1.2 Dyslexia

Dyslexia is probably is one of the interesting extreme user case in the visual capability category. Dyslexia is a specific language-base learning difficulty due to a defect in the brain's processing of the graphic symbols.(Understood 2018) In another words, dyslexic individuals are someone who having a hard time recognize

individual alphabets and letters, therefore it extremely difficult for them to read. Research showed that 20% of the world populations are currently struggling with this hidden disability according to Yale center for Dyslexia, and many have and will remain undiagnosed and untreated, considering that this disability recognition level of dyslexia are different throughout the world, and are especially quite low in Asia.

Characteristics of dyslexia often include,

- Difficulty associating sounds with letters and letters with sounds
- Find it hard to concentrate
- Mispronounce when reading aloud, struggle to use the proper tone, grouping words and phrases together
- Difficulty sounding out unfamiliar words
- Trouble writing or copying letters, numbers and symbols in the correct order
- Trouble with rhyming

Personally I didn't know what Dyslexia was. I have no awareness of it whatsoever. This particular issue was something that I have never discuss among friends, classroom or anywhere else. Therefore, how do we get people to starting talking about this disability if there were not many knew about it. How can we create questions and conversation, so we can understand and raising the awareness that it needed. Because of this, I have taking a huge interests in this particular topic.

1.3 Creating Awareness

As the result of in-dept research, there are many organization and research facility dedicated themselves in improving the life of Dyslexic individual, and there are many tools and technology in the past decades have been studied and developed in order to help them erase the burden of reading difficulty. I have noticed that a lots of dyslexia tools and guide are only helping with the disability, but not on the social scope of the issue. Dyslexic individual are sometime bullies in school, because their peer do not understand and does not empathy's due to the fact that

most of dyslexic children look like an average person. The lack of reading ability create an illusion of not capable of being smart, which is a false.

Best way in creating an awareness and understanding of this situation is to visualize it, to show what does it really look like to be a dyslexic individual. How hard is it for them to focus and how hard is it for them to read each sentences, because what they saw is something that not an average individual saw, but something totally different.

Empathy

Empathy are needed to be create in order to understanding the other persons emotions, needs and concerns. Using empathy is very important in creating the right awareness. Not only it sure to create a positive human interaction, but also people who tends to have empathy have more percentage in reaching out to help. Empathy also create better moral, better judgment and kindness toward other. Raising awareness with empathy do create a better memory flashback, therefore the awareness last longer, and the more the awareness last there are the higher chance for individual to be selflessness.

Using empathy in creating dyslexic awareness's are possibly the best solution. By using visual graphic, We can creating an visual imitating of what would extreme cases of dyslexic people see and use them as a visual tools.

Chapter 2

Literature Review

2.1 Specific Reading Disability

Dyslexia is characterized by the unexpected of difficulty in reading as well as in children and working adults, who otherwise seem to have the intelligence and motivation considered necessary for ability to read normally. More formally, Dyslexia is a specific learning disability that is caused by our neurobiological. It is characterized by having difficulties with accurate and/or fluent word recognition and by poor spelling and decoding abilities. These difficulties typically result from a deficit in the phonological component of language that is often unexpected in relation to other cognitive abilities and the provision of effective classroom instruction (Lyon 2003). Our brief understanding of the neural systems for reading had its roots as early as 1891 (Geschwind 1974) when Dejerine suggested that a portion of the posterior brain region is critical damaged, therefore reading becoming very difficult.

To a large degree these advances in understanding the cognitive basis of dyslexia have informed and facilitated studies examining the neurobiological underpinnings of reading and dyslexia. Using MRI scan measuring the size of brain regions using static morphometric while the brain function during performance of a cognitive task. show use that there not enough in metabolic activity and blood flow in specific brain regions while subjects are engaged in cognitive tasks. The term functional imaging has also been applied to the technology of magnetic source imaging using magnetoencephalography, an electrophysiologic method with strengths in resolving the chronometric properties of cognitive processes.

Additionally, Dyslexia also runs in genetic. One-fourth to one-half of all children who have a parent with dyslexia will also have the disorder (Scarborough 1990), and if dyslexia affects one child in the family, it is likely to affect half of his or her siblings. Recent studies have identified a number of genes involved in dyslexia (Fisher, DeFries 2002). Dyslexia affects boys and girls equally (Flynn,

Rahbar 1994) There a belief that only boys suffer from dyslexia, result from gender-bias school-identified samples. Most boy more likely to act out and cause disruptive behavior results in their being referred for testing more often, whereas girls who struggle to read are more likely to sit quietly in their seats. Dyslexia is a persistent, chronic condition rather than a transient "developmental lag." Children do not outgrow reading difficulties. The evidence-based interventions now available, however, can result in improved reading in virtually all of the children.

Reading ability assumes adequate language comprehension and fluent word identification. Written words are encoded representations of the spoken words, and spoken words are encoded representations within the environment. Thus, the ability to learn to read also depends on the variety of different types of knowledge and skills, which, themselves, depend on individual development of reading-related linguistic and non-linguistic cognitive abilities, Which most dyslexic children lacks in. The linguistic processes and knowledge that allow one to acquire a spoken word vocabulary and language skills in general, as well as visual and linguistic knowledge does not allows them too acquire knowledge and skills determinants to the ability of learning to read. The lack of visual coding processes, refer to sensory and visualization processes make graphic symbols challenging to be used as represent written words.

Aoccdrnig to a rscheearch at Cmabrigde Uinervtisy, it deosn't mtttaer in waht oredr the ltteers in a wrod are, the olny iprmoetnt tihng is taht the frist and lsat ltteer be at the rghit pclae. The rset can be a toatl mse and you can sitll raed it wouthit porbelm. Tihs is bcuseae the huamn mnid deos not raed ervey lteter by istlef, but the wrod as a wlohe.

Figure 2.1: Example of Typoglycemia Texts, Matt Davis, MRC Cognition and Brain Sciences, "Reading jumbled texts". <https://www.mrc-cbu.cam.ac.uk/people/matt.davis/cmabridge/>

2.2 Typoglycemia

Typoglycemia is the cognitive abilities that the human brain have possess. Typoglycemia enables us to recognize words by matching inner letter content guided by a few clues, which are mostly still a correct letters for making up that word

and as long as the exterior letters of the words remain the same, typoglycemia then can comprehend the correct words.

Also chunking is closely related to typoglycemia, is actually a cognitive shortcut that our brain have uses to divide random information into more meaningful one so that the information can be recalled more effectively. Chunking is a type of meomory device. For example, if you were to speed read a page, you might utilize chunking by breaking down the page into individual paragraphs, then reading each paragraph by comprehending it as a single unit rather than a string of sentences.(Nadkarni 2016) Similarly, in typoglycemia, we read and comprehend individual words as a whole rather then individual spelling. Typoglycemia and chunking are examples of the information utilize by the brain and the ability to adapt individual situation, in this case words into the correct one. Skimming or fast reading are using the same cognitive process in order to grab on important words to create a understandable content rather than reading and interpret each individual words.

Our vision perceived by the senses and then simultaneously constructed by the brain to make sensebased on pattern recognition, prior knowledge and experience.(Bor 2012) This is one the explaining why dyslexic individual have problem reading and recognition of word because the brain have no prior knowledge of the correct form as It always received them in the in-corrected form. Therefore its explains how average person can look at a string of scrambled letters and still be able to see the dominant patterns in them, for example, in most cases when the first and final letters is remain the same, ours brains are able to fill in the blanks. (the de-arranged letters) An editing process that now makes the words fit our expectations and projections. Another interesting aspect that we can also making a word from a telephone number for better memory storage such as 12251950 apart as 12-25-1950 to yield Christmas Day 1950.

Furthermore, chunking helps people make decisions by allows us grouping a meaningful information into clusters so that this information does not use up as many mental resources.(Wu 2016) For example, you can buy food for lunch, even if you dont know exactly what you want to eat, because you have knowledge about a category of food. In one extreme form, chunking can lead to creating stereotypes, where you end up grouping people of a particular type together and attribute the same information to all of them, even if it is not true.

The brain have a great power to fill the necessary blanks information in order to make senses of what in front of them, these mechanism like process are developed

with us, as we growth. In dyslexic individual cognitive ability are not quite there, which make it hard for them to makes sense of the jumble information as they do not process the ability to group them back together like we are able to, due to the fact that they never quite actually receive the right kind of information and therefore could not use Typoglycemia and chunking to get the right information.

2.3 Empathy Development

Empathy is a compassion and comprehension emotional, most of us have possess as an ability to unconditionally give out this emotion for one another. Empathy are a great healthy way to relates and build relationship with your family, friends, even a stranger. Everyone are highly capable of using and possessing empathy as well as we are all capable of having morality.

There are many other definitions of empathy, but mostly empathy are implies to at least three of this different processes: feeling what another person is feeling, knowing what another person is feeling, and having the intention to respond compassionately to another persons distress. But regardless of the particular terminology that is used, there is broad agreement on three primary components of (a) an affective response to another person, which often, but not always, entails sharing that persons emotional state; (b) a cognitive capacity to take the perspective of the other person; and (c) some regulatory mechanisms that keep track of the origins of self and other feelings (Decety, Jackson 2004).

Thus, empathy requires both the ability to share the emotional experience of the other person (affecting component) and an understanding of the other persons experience (cognitive component). This are the keys to a better understanding and better relating to other individual. Empathy are not taught-able but suggest-able as much as bring out the internal instinct.

As a humans develop and maintain our self-concept through the process of taking action and then reflecting on what they have done that is, the sensory consequences of their actions (Gopnik 1993), argued that the understanding of the other person emerges in part from being like them in action, through imitation, and that this provides the basic mechanism for empathy. However, the recognition of self-other equivalences would be the starting point for social cognition, not its culmination (Goswami, Meltzoff 2007). Social psychologists have shown humans mimic unintentionally and unconsciously a wide range of behaviors, such as accents, tone of voice, rate of speech, posture and mannerisms, as well as moods

(Bargh 2001). One of the adaptive advantages of such behaviors is that they bind people together and foster empathy. Demonstrated that participants who had been mimicked by the experimenter were more helpful and generous toward other people than non mimicked participants. They also found that these beneficial consequences of mimicry were not restricted to behavior directed toward the mimicker but included behavior directed toward people not directly involved in the mimicry situation. Therefore setting the right example to showcase can sure to determine a good outcome.

Better Awareness

It is generally accepted that to raise public awareness of a topic or issue is to attempt to inform a community's attitudes, behaviours and beliefs of the said issue. Furthermore, it is our intention through information to influence these other attitudes, behaviours and beliefs positively in the achievement of a defined purpose or goal. (Sayers 2006) In this case it the dyslexia and its reading disability.

The theory and practice of public awareness-raising has always drawn heavily on the literature of mass communication and social or "social change" marketing. Social change marketing refers to the practice of communicating or selling a 'good idea' with the stated object of changing community attitudes and actions. Seeking and using information is one such good idea, but other examples include messages about public health and education and social inclusion of the individual.

Personal communication helps to make the audience feel more connected with the message of the campaign and understand the significance of that message in relation to their everyday life and work.

Examples of personal communication might include,

- Community and stakeholder meetings.
- Public forums, presentations and workshops.
- Word of mouth - person to person.
- Social events - a festival or a event organized for individual.
- In societies and cultures where oral traditions dominate, role plays, performances of specially composed stories, songs, dances, plays and poems.

2.4 Related Works

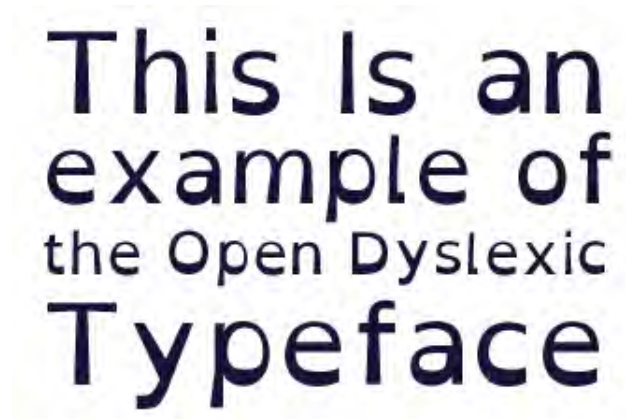


Figure 2.2: Example of Open Dyslexic Font, Open Dyslexic. <https://the-digital-reader.com/2015/04/07/overdrive-app-for-android-ios-now-includes-a-dyslexic-font/>

Open Dyslexic font

Open Dyslexic is one of the open-source font that created for the sole purpose of increasing in the readability in dyslexic individual, the font doesn't 100% guarantee its readability, but it better than many other different fonts. Open Dyslexic are always updated with the help of input from dyslexic users, making this font one of the best available. As you can see in figure 2.3 the uniqueness of the font help identify and distinguishes each individual alphabet's, which increase the readability and create a much smoother reading for dyslexic.

The visual confusion between p and b or p and d is an inversion and indicates a more severe level of difficulty. Normally our brain naturally reverses and inverts the same object, otherwise we could not recognize a chair as a chair when it fell over. (Sandman-Hurley 2013) Therefore letters b d p and q that are all the same shape can easily replace each other.

Open Dyslexic font make sure that the letter have a heavy weight bottom to add gravity to each letter as in figure 2.4 Therefore you will be able to figure it out very quickly which part of the letter is suppose to go down. This is the aid to help the brain recognize the letter faster and the unique shape also help prevent confusion through flipping and swapping.

Gill Sans	rn m	MW	dpqb	l lijJ
Verdana	rn m	MW	dpqb	l1IijJ
OpenDyslexic	rn m	MW	dpqb	l1IijJ
Times	rn m	MW	dpqb	l1IijJ
Helvetica	rn m	MW	dpqb	l1IijJ

Figure 2.3: Font Comparison, Open Dyslexic. <https://opendyslexic.org/about-2/>

Open Dyslexic is great, however it hard to related to it usability and to understand the font functionality as someone with no dyslexic disorder.



Figure 2.4: 'b d p q' Example of Open Dyslexic Font, Open Dyslexic. <https://opendyslexic.org/about-2/>

Through Your Childs Eyes

Through Your Childs Eyes is one of the section withing the website call 'understood.org,' an American organization in helping bridge the gaps between parents and child of dyslexia. The quiz simulation can be adjust by choosing the child ages and what he/she particularly most struggle with reading, writing etc. for it in order to create the appropriate simulation to test out. There are hints in the quiz to helps with understanding what get change, and there are also timer to simulated the stress level that every dyslexic child is going through.

This is one of the great simulation on the internet, but it was very hard to understand the process, when choosing for the child ages for simulation it was

very confusing, considering that I have no child of my own to base the simulation on. Also there are overwhelming choices, which make me feeling very hesitant in continuing the experiences.

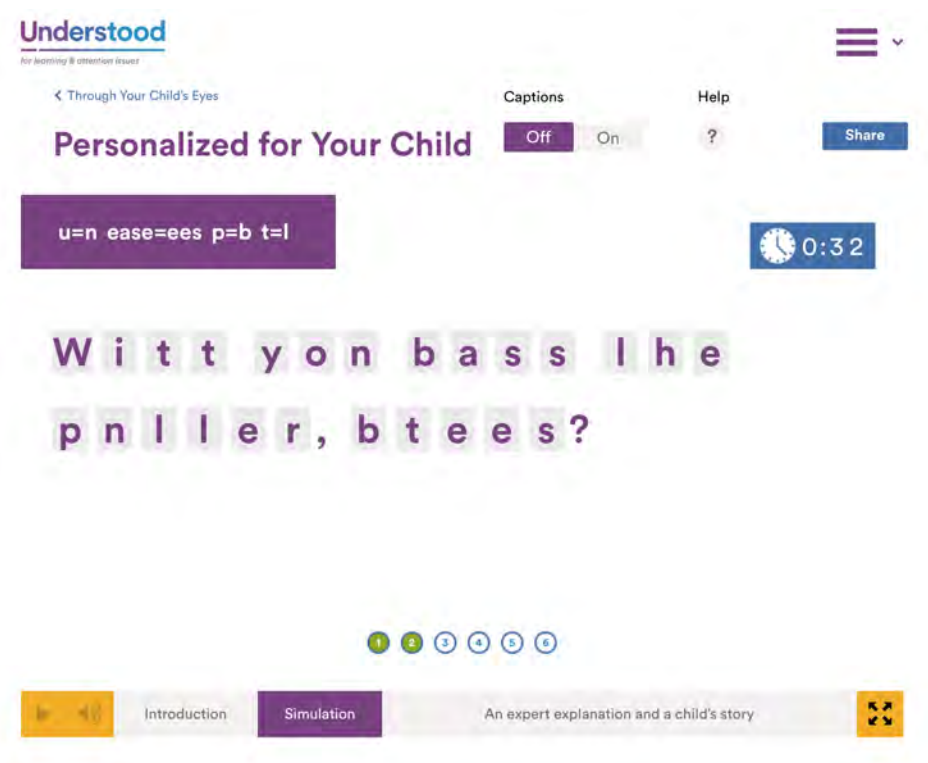


Figure 2.5: One of the Question within the Website Interaction for Parents with Dyslexic Children, Understood.org. <https://www.understood.org/en/tools/through-your-childs-eyes/personalize>

Gift of Dyslexic

A gift box for dyslexic children to celebrates the unspoken gifts of dyslexia. A box full of booklet and wonderful gratification for celebrating being yourself and understand your own challenge and encourage to overcome by its.

The book contents are very kind and encouraging. This is a nice positive approach, the contents are very interesting, it fills with kind and encouraging work. On another point the impactful of this book are still lacking in some senses, especially if you are someone who doesn't know what dyslexia is, nonetheless it does carry a nice messages.



Figure 2.6: Book Design for Encouraging Dyslexic Children, Dustin Dahlman. <https://www.dustindahlman.com/gift-of-dyslexia/>

Dyslexia Typography

Design graduated Britton create a typeface, figure 2.7, that would demonstrate the effects of the dyslexia disorder, Britton himself is dyslexic and due to his own struggle he have created this typeface. Using his observation of what is missing, by quickly glance through a paragraph. He describe it as partial structure of the alphabet is missing. Making it impossible to read as they all becoming a familiar shaped to each other. His purpose was to showcase the struggle of his everyday life by that he hope to create understanding and empathy.

This is the works that have hits all the potential criteria that I have look for and wanting to achieve, but his method are still lacking in physical characteristic and the direct interaction that I would like to create.



Figure 2.7: Dyslexia Typography, Daniel Britton. <https://www.designboom.com/design/daniel-britton-dyslexia-typeface-06-04-2015/>

Chapter 3

CYSLFKIA

3.1 Concept

Creating awareness toward dyslexic individual are something that haven't been done enough, as I discover through my research. The opportunities in working within this range of topic are still broads and as someone who haven't heard of dyslexic before this past year, this topic have pushed me in wanting to create a better awareness.

Therefore I would like to present my idea of using Augment Reality as a visual tool for mimicking the physical and the visual characteristic of dyslexia. In order to create a strong awareness for one another, a strong visualization as well as a unique approach are needed. For someone who may not heard about dyslexic symptom before hand, delivering simple messages is a must. The main goal would be creating a visual simulation for everybody else without dyslexia for raising a better awareness.

Using a visual that cop-orated empathy, as empathy create a vivid understanding, which would help strengthen the relationship of non dyslexic person to dyslexic individual. Therefore it would raises a memorable awareness for those who never realized what this disable means, as well as those who may have never been diagnose.



Figure 3.1: Project Name Conceptual

Design Experiment

Early Approach

The very first approach in designing for dyslexia were all about trying to understand what is a reading disability and what is a dyslexia. The figure 3.2 were the result of discovering the confusing between b,d,p and q as the alphabet itself are identical to one another. The logo were inspire and design to represent the said alphabet and it ability to rotate, mirror or flip stilling looking like a same logo. So a dyslexic person will have no problem misread or unrecognized the logo.

The logo were treated as a mean in spreading awareness, and to get people into a conversation of what and who is dyslexic. The campaign mock-up were aim to show a logo being use and integrated into a everyday life. The logo was a great start, but it obviously lacking in an instant interaction and as well as the mean to educated other.

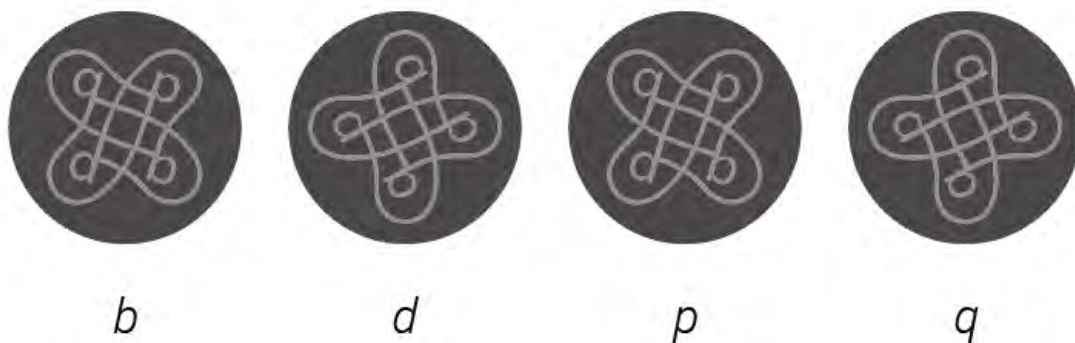


Figure 3.2: Logo

From the logo approach, comes the different ideas, challenging to show the frustration of reading and writing in dyslexic person. Figure 3.4 a Questionnaires Simulator were design in order to create a more hand on experiences and as well as in order to conducted to see if the frustration helps with creating an impactful awareness or not. The feedback for the questionnaire were quite mix, as well as no one actually manage to finish the quiz as it was too difficult and too confusing, as it was taking longer than they expected it to be.

Using Typoglycemia information, combined with dyslexia characteristic, Gif were design, figure 3.5. This Gif were design by using 3 photo, simultaneously flicker in 5FPS (Frame per second) setting. The Gif was aim to be a visual



Figure 3.3: Campaign Concept

Hcllo.

Mcleomc to Dyslexia simulation! (Double click at the box to type)

1. Can gou tcII mc your name?

Grcat. It jz such a lovely hamc.

2. What jz gour native language?

3. Mnat jz gour second lahyuayc? (ahb third, fourtn, and so oh jf gou have morc)?
Please ahzvcr starting vjtn tnc mozt fluent one fjzrt.

4. Mnat jz gour education/earccr backgrouhb?

Figure 3.4: Questionnaire with Dyslexia font

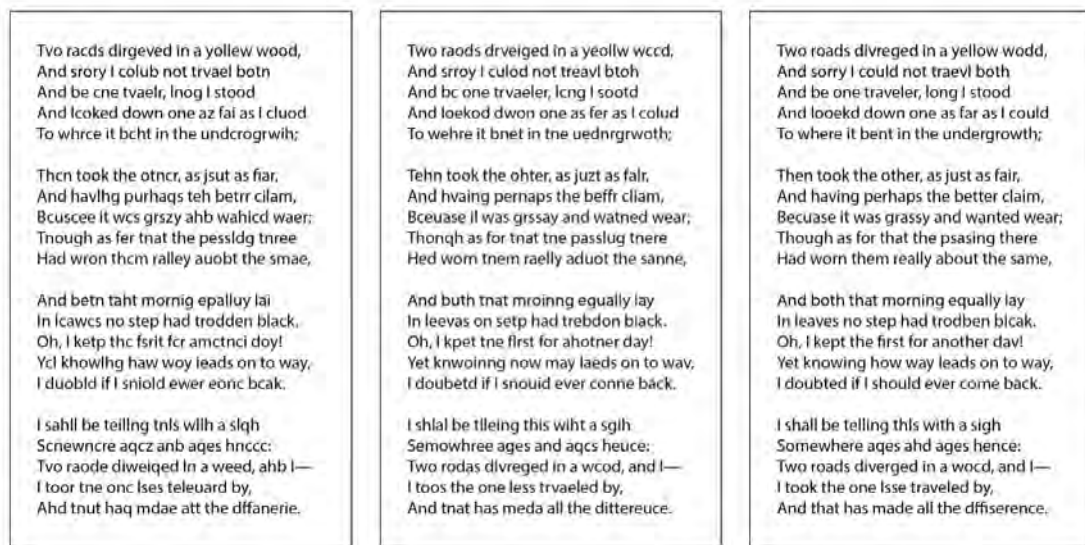


Figure 3.5: Dyslexia Demonstration Moving Gif in 3 Frames

tools in portraying dyslexic symptom. The user test were conducted by asking a participant to read out loud, as the words were flickering. Later question were ask if he/she knew what what the poem were about. As this is mimicking one of the many struggle that dyslexic individual have to go through in daily basis. Half of the user did having a hard time recognizing to poem, but another half were able to figure it out. The Gif create a good interaction case-scenario, but because the poem doesn't change, the participant are quickly loses interests in the visual tool. Therefore an upgrade is required.

Concept Design

CYSLFKIA (Pronounce, dyslexia) is the visual tool as simulator in a application design on andriod platform. 'CYSLFKIA' is the play on dyslexic symptom of mis-recognition in each individual alphabet. The mobile application that are aim to creating will be using a 'image to text recognition' function, as well as a translating system, but instead of translating to another language, it translate to dyslexic symptom. This will create a direct and hand on interaction.

There are many categories and variation of dyslexic symptom and due to the huge variable, it have to be limited down to a small sample, for the simpler version

of dyslexia. Even though there a need narrowing down to a small example, the small example should still create a disrupting and confusion, enough that it seem readable but not actually is. In order to creating a systematic gibberish, these dyslexic characteristic were chosen:

Three Characteristic symptom

- Sometime the letters unconsciously rotate.
- Sometime the letters unconsciously mirror.
- Sometime the letters are incomplete.

Then we categories the English alphabet into different characteristic, as you can see on the table 3.1, also in figure 3.6 for the full set of substitute the letter that would be appropriated to swap with each other. Not only using the symptom's logic to categories but also consider which typeface to use as well. The different typeface will determined the different outcome because of design and its similarity, and the different typefaces will convey a different meaning. I have decided to chosen 'Myriad Pro typeface' as it a defaulted font to many of a modern program. As it was design to be a clean open shapes. Myriad Pro has a warmth and readability that result from the humanistic treatment of letter proportions and design detail. Using this typeface as we aim to create familiarity for the user and as well as create a commonality of a normalize daily basis routine.

Table 3.1: Alphabets Characterize

Characteristic symptoms	Capital	Lowercase
Rotate	M, W	b, d
Mirror	J, L	d, p, s
Missing	P, Q	e, g, h, j, w
Mixes	D, K,	k

Augment Reality

Augment Reality is the enhanced version of reality, direct or indirect views of physical real-world environments being shape by computer-generated images over

A	B	C	D	E	F	G	H	I	J	K	L	M
A	B	D	C	E	P	G	H	I	L	X	J	W
N	O	P	Q	R	S	T	U	V	W	X	Y	Z
N	O	F	O	R	S	T	U	V	M	K	Y	Z

Oujek grovh fox iumdz owcr tnc lasg boy

a	b	c	d	e	f	g	h	i	j	k	l	m
a	q	e	b	c	f	y	n	j	i	k	l	m
n	o	p	q	r	s	t	u	v	w	x	y	z
h	o	d	p	r	z	t	u	w	v	x	g	s

Figure 3.6: CYSLFKIA Font Order and 'Quick brown fox jumps over the lazy dog' Sample

a user's view of the real-world. Thus enhancing ones current perception of reality. The origin of the word augmented is augment, which means to add something. In the case of augmented reality (also called AR), graphics, sounds, and touch feedback are added. Unlike virtual reality, which requires you to inhabit an entirely virtual environment, augmented reality uses your existing natural environment and simply overlays virtual information on top of it. Users of augmented reality will experience a new virtual of information in this case, a graphic overload from dyslexic symptoms.

Applications of augmented reality can be as simple as a text-notification or as complicated as an instruction on how to perform a life-threatening surgical procedure. I think it a perfect platform for display the dyslexic characteristics. They ability in highlighting certain features, enhance understandings, and provide accessible and timely data.

Real time Augment reality will be able to paint even more realistic pictures, representing the struggle of each individual dyslexic person have, when they do the simple task of reading. Seeing is believing and seeing have no boundary. By experiencing the visual without much knowledge of English language you would still be able to gasp the basic concept. One of the most important point is in showcasing the dyslexic symptom to be able to recreate a best imitating example

that will create the most impact to the user. Ideally the user will consequently and subconsciously create the empathy towards the dyslexic individual, which leads to a better and long lasting awareness.

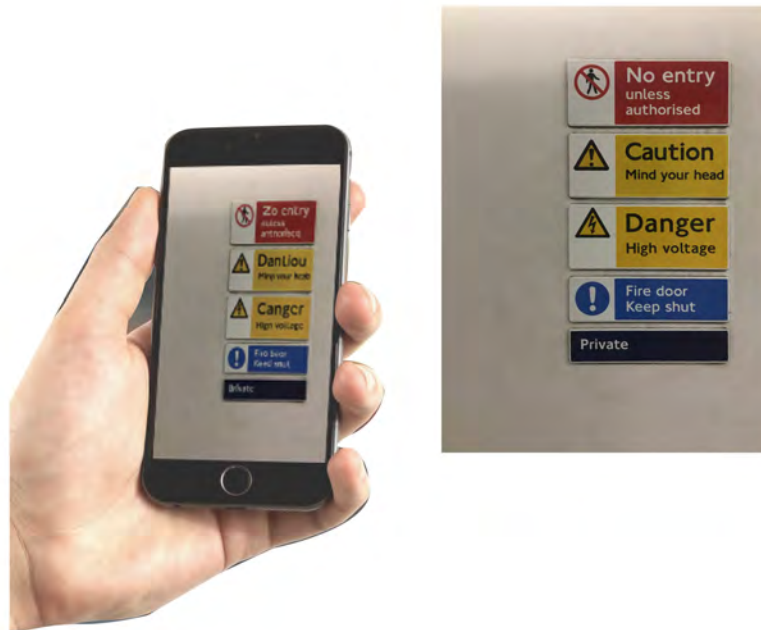


Figure 3.7: Idea of 'Dyslexic Translation'

- **Accessibility** Using application as a tool, it easily accessible and it can be carries to anywhere.
- **Commonality** Because it can be use wherever, this create the sense of normality and everyday life aspect.
- **Visibility** Instantly see the actual texts change, create a meaningful impact.

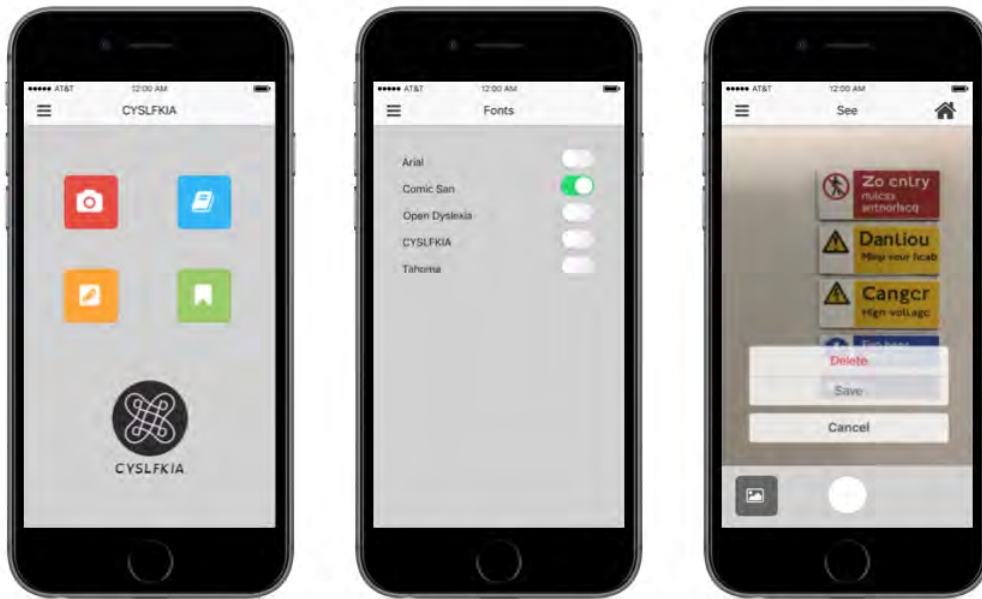


Figure 3.8: Concept Application Interface

3.2 Prototype

Building Application

In order to execute the mobile application correctly, I have to try create and as well design the main function as close as the concept design as possible. Researching languages translation and text recognition on online platform, which led to a Google's cloud translation API(Application Programming Interface) service, which provides a simple programmatic interface for translating an arbitrary string into any supported language. As I want to translated a each individual alphabet, and dyslexic were not officially a supported languages, Translation API were not the right tools. The Google's Translation API require a language system as it work for words rather than decipher an individual letters.

Prior to a deeper and more in-dept search, a easiler solution in using Google's Optical Character Recognition or OCR were found. Google's OCR, gives computer the ability to read text that appears in an image, signs, articles, flyers, pages of text, menus, or any other place that text appears as part of an image. Also the

Mobile Vision Text API can also be integrate with an Android system, creating a powerful and reliable OCR capability that works. On top of that Google's Code lab developers allows open source use on the OCR as well as a online guide on Google Cloud Platform, with step by step in setting up the system.

The step are included:

- Googles Optical Character Recognition or OCR, Which gives computer the ability to read text that text appears as part of an image.
- The Mobile Vision Text API then use with Android system, creating a powerful and reliable OCR capability that works.
- Initializing the Mobile Vision Text Recognizer.
- Setting up a Processor to receive frames from a camera as they come in and look for text.
- Rendering out that text to the screen at its location.

The Google Open source tool are also included a sample codes that can be easily adjust to the design for the application, see figure 3.10 (left), as the original coding outcome and see figure 3.10 (right), as the final result of the coding adjustment, carried out to match the desired design and a better suitability and the readability for the project.

Flow model

Using the provided codes as we apply in for the CYSLFKIA application, make sure that it works as much as similarly as designed. The flow model are a simple guideline of what is happening within our application. As figure 3.9, 'Draw graphic to the screen' and 'image input' are on loop. The reason in designing it is that way, is in order to create a jumpy and shifting movement on the screen, as to closely mimicking the dyslexic symptoms as close as able to. As well allowed to be able to choose to freeze the image for a better looks.

Text Input

Figure 3.11 are when the graphic input is draw to the screen, and as you could see on the bottom of the application, I have reintegrate the previous design logo

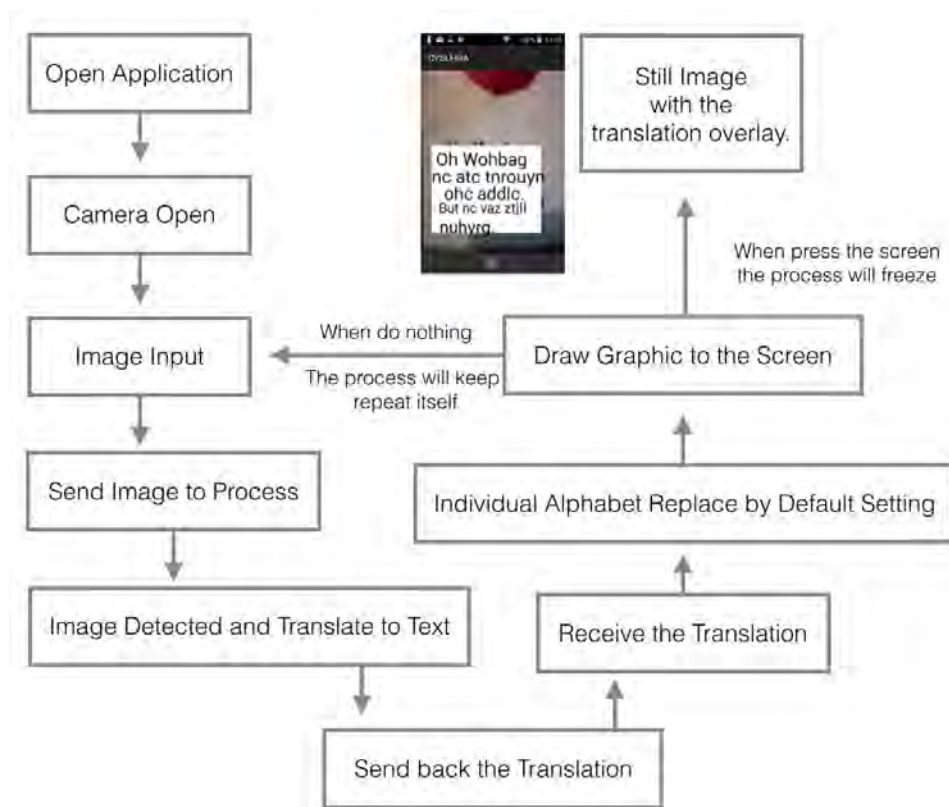


Figure 3.9: Flow Model of the Application Logic

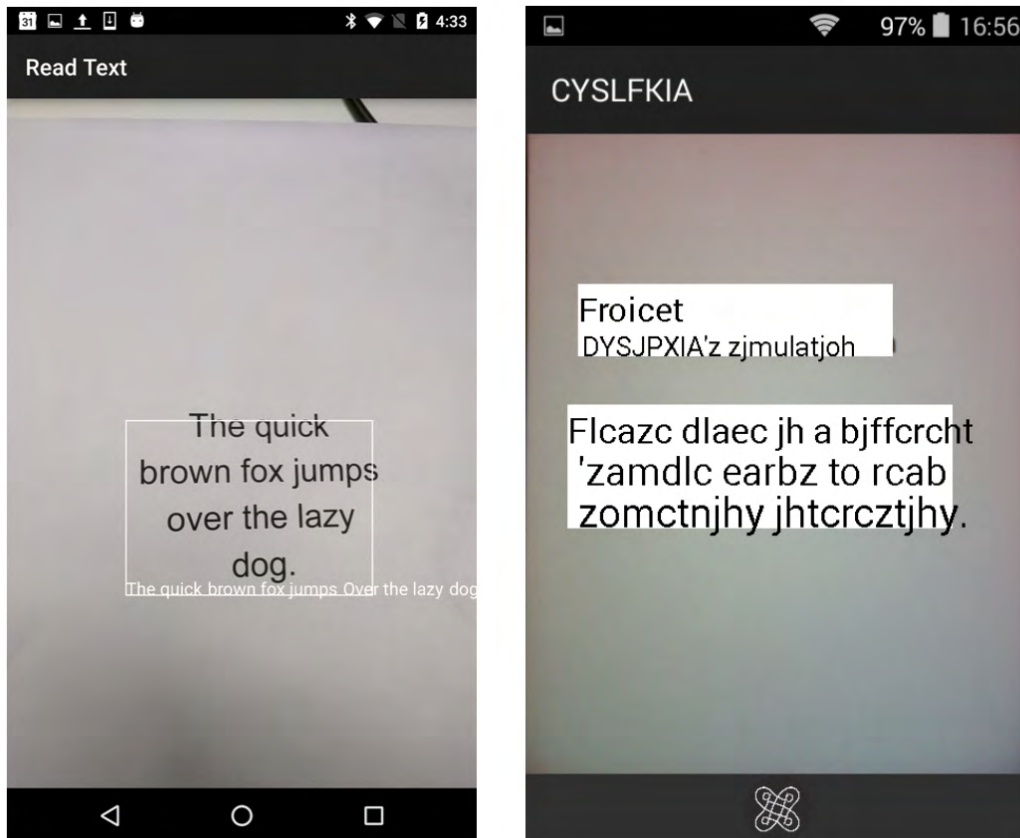


Figure 3.10: Left: Google OCR Tutorial Final Outcome, <https://codelabs.developers.google.com/codelabs/mobile-vision-ocr/#6> Right: Edited Version, Changed Positioning, Background and Text Colour.

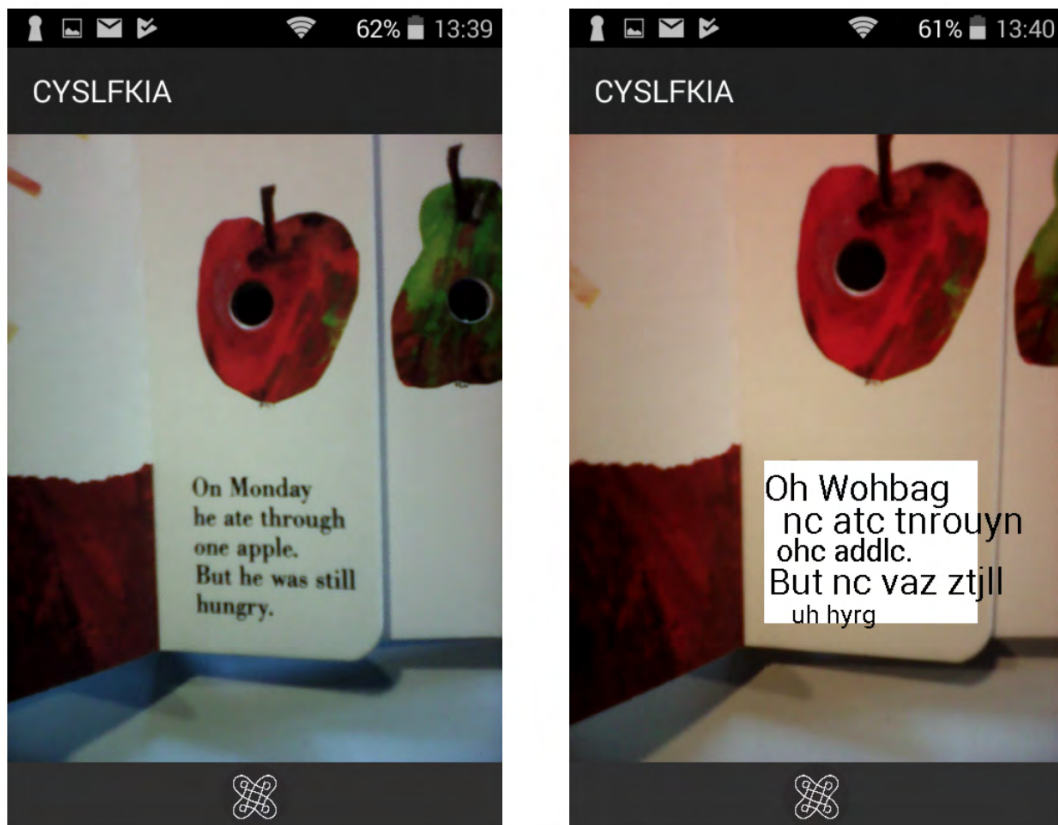


Figure 3.11: Left: Without Graphic input. Right: With Graphic Input

to become a part of the brand. As we are adjusting to the open source code, not only background colour, text colour and text display positioning were change. The main mandatory change is for the application to display a different individual letters than the detection. According back to our font chart, figure 3.6. each letters are giving commands to change for a default set up, figure 3.12.

Creating and fixing this as a default setting, insure to always mimicking the visual characteristic of dyslexic reading disability.

```
public String transformSt(String input){
    String output = "";
    for(int i = 0; i < input.length(); i++)
    {
        switch(input.charAt(i)) {
            case 'C':
                output = output + 'D';
                break;
            case 'D':
                output = output + 'C';
                break;
            case 'F':
                output = output + 'P';
                break;
            case 'J':
                output = output + 'L';
                break;
            case 'K':
                output = output + 'X';
                break;
            case 'L':
                output = output + 'J';
                break;
            case 'M':
                output = output + 'W';
                break;
            case 'P':
                output = output + 'F';
                break;
            case 'Q':
                output = output + 'O';
                break;
            case 'W':
                output = output + 'M';
                break;
            case 'X':
                output = output + 'K';
                break;
            case 'b':
                output = output + 'q';
                break;
            case 'c':
                output = output + 'e';
                break;
            case 'c':
                output = output + 'e';
                break;
            case 'd':
                output = output + 'b';
                break;
            case 'e':
                output = output + 'c';
                break;
            case 'g':
                output = output + 'y';
                break;
            case 'h':
                output = output + 'n';
                break;
            case 'i':
                output = output + 'j';
                break;
            case 'j':
                output = output + 'i';
                break;
            case 'n':
                output = output + 'h';
                break;
            case 'p':
                output = output + 'd';
                break;
            case 'q':
                output = output + 'p';
                break;
            case 's':
                output = output + 'z';
                break;
            case 'v':
                output = output + 'w';
                break;
            case 'w':
                output = output + 'v';
                break;
            case 'y':
                output = output + 'g';
                break;
            case 'z':
                output = output + 's';
                break;
        }
    }
}
```

Figure 3.12: Input Text Setting

Chapter 4

Proof of Concept

4.1 Testing

In order to proof the designed concept, the visual simulator tests were conducted by using the designed visual tools to test how people would reacted. In order to see if the awareness of dyslexia could be raises or further improves. After testing, there are a follow up questionnaire, and a brief discussion are also conducted on the participant. Especially about participant prior knowledge of dyslexia and as well as how participant currently feels after the test were carried out.

Testing tools are includes, a working prototype of simulator application in the form of Android device, a different postcard card with paragraph of text that are interchangeable. The each individual postcard are different as for it to simulated different sentences and different phase for participants to try and see. Also the application have a ability to read a handwriting, therefore the user were as well encourage to write something to try to use with application. The reason is for the application to be able to showcase a realistic picture of what their handwriting look like to someone else with dyslexic disorder.

Global Grad Show

Fortunately, within the process of working on CYSLFKIA project, the work were recognize by Global Graduate Show, and it got pick up to becoming a part of a exhibition in Dubai Design Week. The exhibition are showcasing 200 different graduation project, from around the world from 92 different university. As a result of this I had decided to use this opportunity to test the simulator at the exhibition.

CYSLFKIA Simulator at the Global Grad show set up included:

- Android Phone (with the application)

- Poster
- 1 min Video
- QR code link to the survey.
- Text Postcards
- Postcard Holder
- Phone Holder
- Android's Charger



Figure 4.1: The Show Setup

The Setup interaction are also includes:

- The application recognize the text on postcard through camera, then it put up a graphic replace the said text.
- The postcard can be change with different sentences.
- Blank postcard can be written up, as it work on hand writing too.
- The camera will freeze, when tapped.

Individual feedback

The set up that was use to conducted a user test with the other exhibitors are included,

- 1 Question them If they know what dyslexic was.
- 2 Show simulation.
- 3 Explain how it works.
- 4 Ask for feedback.
- 5 Further discussion.
- 6 Follow up with survey.

User Test Case 1 Eugene, 26, New Zealander, Architecture.

Have you heard about Dyslexia? Yes.

How much do you know about Dyslexia? About average.

Reaction/Engagement: He understand the use of the application right away, and immediately ask how it works, but he doesn't show much of enthusiasm.

What did you find most intriguing about this experience? The experience of a simulation, where you may feel how it would be to be dyslexic.

Overall how do you feel about this experience? Im a little bit curious, I think I'll probably read into it when I have time.

Additional comment? Maybe a quick introduction to what I am about to watch and what the intent of it is. If it is meant to simulate having dyslexia, then maybe saying so might be useful to understand what we are partaking in. However, it is still quite obvious, just a thought.

I was really intrigue to see someone who actually gives no minds to it at all, his criticism are very structure. He does show sign of interested within the mechanism, not so much on the awareness messages.

User Test Case 2 Michele, 24, Hongkonger, Student.

Have you heard about Dyslexia? Yes.

How much do you know about Dyslexia? I know it a reading disability.

Reaction/Engagement: Right away she start to play around with text post-card and write up sentences to put in.

What did you find most intriguing about this experience? The Real time and the hands on simulation are very good, I like it.

Overall how do you feel about this experience? It shows you what dyslexic people see, but I wished there would be more to evoke the feelings of anxiety and stress for even more empathy.

It was interesting to see that some of the users wanting the application to push a bit further than it was. They want something a bit harsher, and even more extreme, as they feel like the exsiting visual tools are not yet enough. Most people, within the testing already find its confusing. This is one of surprise results that I didn't predicted to be receiving.

User Test Case 3 Vanna, 29, Thai, Designer.

Have you heard about Dyslexia? Not sure.

How much do you know about Dyslexia? Very little.

Reaction/Engagement: Ask questions right away and as well show a lot of interests and curiosity.

What did you find most intriguing about this experience? How it works with handwriting is really amazed me.

Overall how do you feel about this experience? Now I could imagine how people who have Dyslexia feels and see text or paragraph in daily life. Really interesting idea to show how Dyslexia people's difficulties.

Additional comment? At first glance, I thought it was a tool for translate English to some other language like Google Translate. But I eventually understand the concept of the product and I think it is very interesting.

The mention of Google translated proved to be both good and bad as it is indeed a translation but the purpose is different. Breaking the already strong recognition design will be something that needed to be work on.

User Test Case 4 Shan, 30, Taiwanese, Engineer.

Have you heard about Dyslexia? No.

How much do you know about Dyslexia? Wait, lets me Google this.

Reaction/Engagement: She was confuse, and It took her a few minutes or so to realize what was happening.

What did you find most intriguing about this experience? The constantly shifting nature of the text was so interesting.

Overall how do you feel about this experience? It was interesting, could be fun to experience in VR, or how dyslexic people experience other things as well.

It was expected of someone who has little knowledge of dyslexia, especially as she was from East-Asia country. Also it was interesting to see how fast it is for her to wrap the concept around her head. Even though before she didn't know what dyslexia was. This is one of the engaging interview and I'm glad to see the huge interesting for wanting to jumping into it as she mention VR headset.

4.2 Overall Feedback

The overall feedback after the participant were shown the simulator are mostly positive, which 1 out 5 individual do ask more question, which leads to many interesting discussion. As well as a handful amount of people are surprise in their own ignorance of not knowing what dyslexic was. Nonetheless everyone was willing heard what it is about and also was willing to discuss about it. This show that participant in the test application, already create engagement in the topic.

After discussion I have followed up most people with additional surveys, which also conclude in a slightly different results than the in person interaction.

Awareness Result

A set of questions are asking about the knowledge and all rounded awareness of dyslexia. The result was slightly unexpected as I didn't receive the same information when I was conducting a short interview or user test. On figure 4.2, it was expected that most people will find dyslexia irrelevant to themselves, however on figure 4.3, I was expecting a cluster and the most right, but that didn't happen. The graph do show a increase in the relevance but it still distributed quite evenly around 1-4. On both figure 4.4 and 4.5, 1 meaning not at all, while 5 is meaning very aware. I was good to see the huge decrease in number 1 and an increase in 3 and 4. There are many comments stated that there are not enough introduction, that it make them unsure. Some said that The visual tools needed to be in a bigger platform and some even suggest a video introducing to the application might help them to understand it better.

Is 'Dyslexia' relevant to you?

43 responses

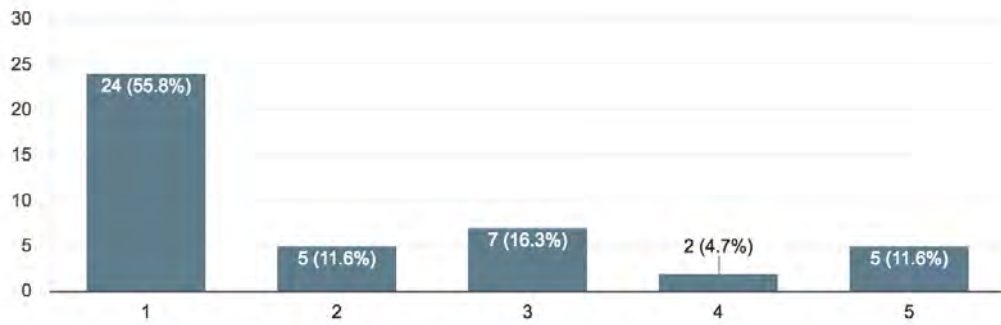


Figure 4.2: Survey's Result

Is 'Dyslexia' more relevant to you now after the experience?

43 responses

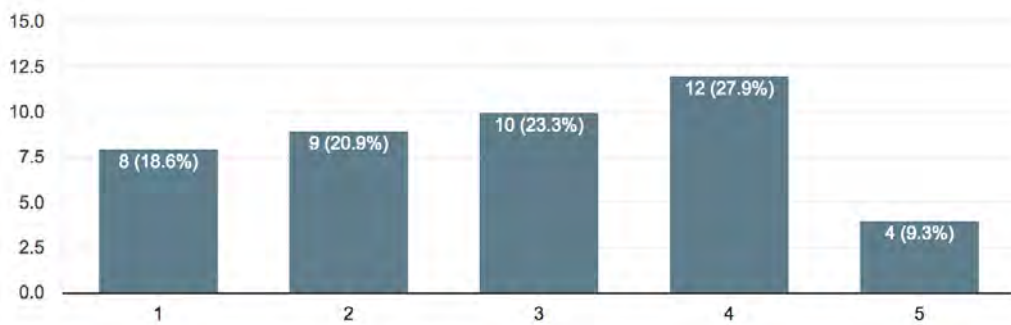


Figure 4.3: Survey's Result

How much did you know about Dyslexia before seeing this demo?

43 responses

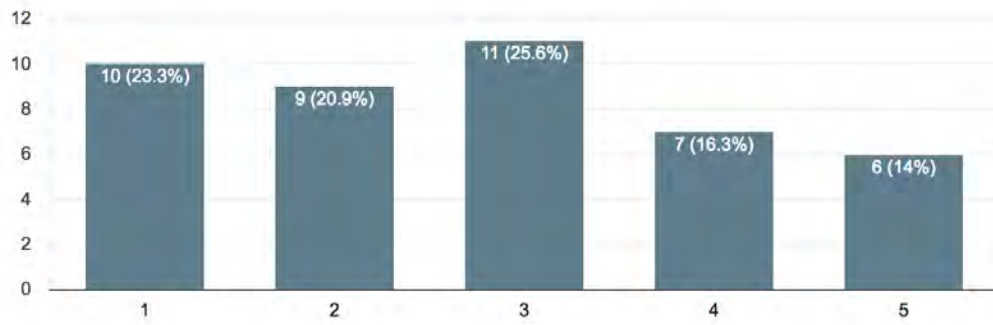


Figure 4.4: Survey's Result

How much more aware have you become after this experience?

43 responses

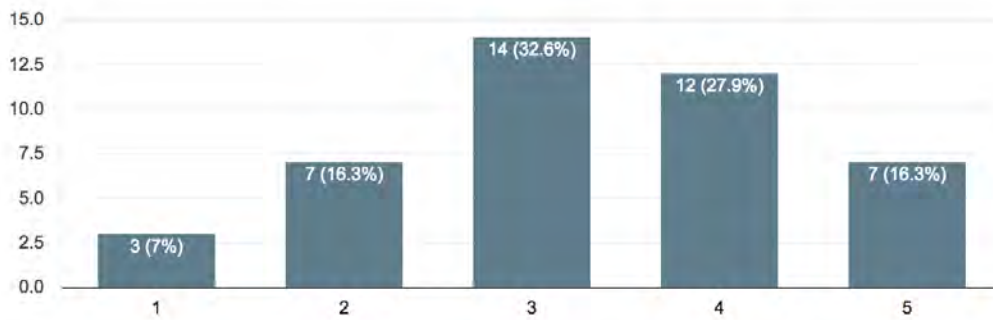


Figure 4.5: Survey's Result

Empathetic Result

Empathy measuring are base on self-awareness and self-evaluation. This may not be accurate, because everyone average points are different. However it was interesting to see if they could estimate their own self of values and empathizes. Many who partake in the interview agreed that this project are somewhat a being in a sense of morality and empathy. After the experience a good amount of people describing themselves being able to easily offering a compassion from now on, not only for dyslexic individual but as well as toward an another following human.

Do you feel like you have gain empathy through this experience?

43 responses

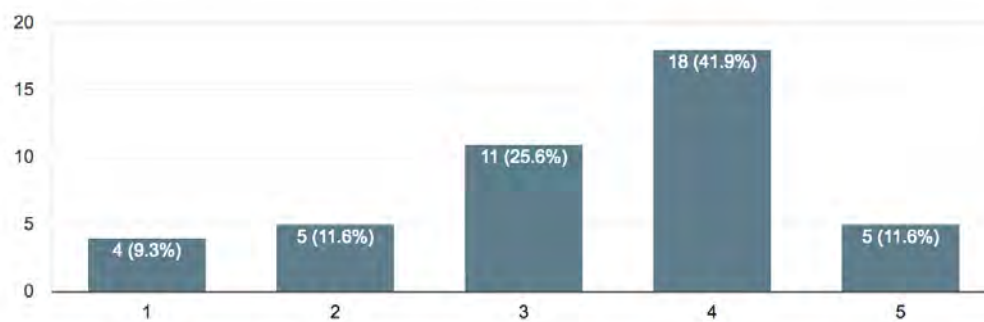


Figure 4.6: Survey's Result

Personal comments

There are many additional comments from the participants, which are a good keys toward what is needed to be improves and what feature is already validated. Such as the shifting nature or the pause lapses are the one feature that a lot of people talked about.

Also there are an agreement that the visual tool can breed understanding of the condition more quickly than other methods to people, and that it was a great empathy tools. Also it helps relating to people with Dyslexia. The attempt to start making dyslexia becoming better understood by those who the reality of dyslexia are apparently very different. One interviewee said, 'I really like the idea

of giving people a direct, interactive experience with dyslexia since most people don't really understand how it works/what it's like.'

Another interviewee also said, 'I think it is helpful for awareness but it leaves me wanting more. Like what can I do to help? How can average people help?', which this statement have proves that the work have a capabilities of people to wanting to start a 'Call for Action' and that is a important step for the visual tools in raising awareness.

With all the positive comment there are likewise a confused participants who didn't understand the concept as it was 'very abstract', 'strange', 'weird' and therefore 'having a hard time to understand everything.' There were many who additionally asked in providing a little bit more information. This a very great finding for the projects as I learned that the visual tools may not be as effective for someone.

4.3 Utilizing the Application

The main purpose for this project is to be able to create application to use for the purpose of improved a way in raise awareness about dyslexia. By creating empathy as method to reaching out to other. We all know that empathy can be utilizing in different way, and always create a positive outcome. While I was user testing, I have notice that not only the issues of dyslexic were raise as a question but as well as many discussion about people related to them either about family members, close friends or teacher and classmate. These people are already possess some sense of empathy, however participating in the simulation allows them to be even more empathetic, and are more capable of expressing sincerity and compassionate attitude.

This sparks my interests of expanding the applications purpose: the possibility of using them in classroom or private home, as the connection bridge to one another. Using in classroom can create a better environment and teach children a better understanding of dyslexia. With such application, it might help reduce bullying in the school environment.

4.4 Limitation

Although the research has reach it potential, there were some unavoidable limitation, Firstly because of the time limit. Within the frames of the times limits,

this is the most capable that I was able to. Participating size were also one of the limitation that I have faced. I could not gather a more specific study group and as well this research was conducted in small size of the population who were particularly participating in global grad show. Therefore if the I could collected more surveys, I would have created a better and more accurate results. Another limitation is specific group of people were not carry out, the sample group that I have interviewed and test have a mix knowledge of dyslexia and therefore survey results are not as reliable as it should be.

Finally due to the nature of where I live, it harder to reach out to the dyslexic communities for a closer study of the relationship between dyslexic and non-dyslexic individual. Consequently the limitations may affect the overall final result.

Chapter 5

Conclusion

5.1 Overview

The objective of this particular research is to come up with new approach toward a special issues and as well in designing a visual tools for using in spreading awareness, in my case it was all for a reading disability, dyslexia. Unlike other advocated group that dedicates only for dyslexic individual, This work is aimed for people with no knowledge of dyslexic instead. For the purpose of education not only about other but might as well could also be about your own self.

The use in Augmented reality simulator or a visual tools, is in hoping to provoke a empathy, and its somewhat effective. The result of the overall evaluation are quite optimistic, and also there a good sign of user's being able to understand the purpose of the simulation clearly. Which have prove that the design is applicable. The are many responses interesting in the visual standpoint of the application, and on the system the are capable in mimic the visual and physical attributed of dyslexics symptoms. Most of the users are often surprise by the ability of Augment reality and as well as surprised by the simulating of dyslexic vision. Which was the most ideal situation, I could have asked for. So far the work have proved to work as a small starting point in create an attention. Awareness toward dyslexic might not have much impact now but I believe it a good starting point.

5.2 Future Plan

In the future being able to integrated the CYSLFKIA simulator with some of the existing dyslexic design, would tremendously help improve this project. Also possibly, this could helps broaden more awareness of the reading disability in general. Some future insights also include more explained details of what the

simulation is about. On top of that dyslexic characteristic symptom that I have selected are narrow down to the small group of sample. For future versions of simulators with the variation of symptoms, we would be able to continue spreading awareness in an even better way.

Also an improvement to the application would also be needed, such as:

- Further development for more integrated graphic overlay to showcase the dyslexic symptom more realistically.
- Create a friendly user interface that has no language boundaries.
- Have the ability to have different settings within the range of extreme spectrum.
- Seamlessly works on both Android and iPhone.

Reverse Engineering

Another different approach for improving this project is to explore the reverse direction. As it could be by using the visual simulator to work for of dyslexic individual, and becoming a new tool to be use in helping with their studies. As a tool that works for educating to both dyslexics and non-dyslexics individual. By creating a common tools, not only creating an awareness in one another but also might be able to create relationship between dyslexic and non-dyslexic individual.

This future works would also involve

- Further development for graphic fonts for improving the ability to read in dyslexic individual
- Researching different tools and way non only in visual but using other sensed to excited the idea.
- Have the ability to have different settings to suited with your disabilities
- Seamlessly works for all users.

Even more further advance research and developments could also happen by evolve the current version of the visual tools not only in portraying dyslexia, but a different reading disability such as Dyscalculia, difficulty in making arithmetical calculations, Dysgraphia, inability to write coherently, and Hyperlexia, difficulty in understanding and using verbal language.

In all, it is believed that there is a huge potential in further development of CYSLFKIA project and the potential itself stands for the extension in creating even more awareness.

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Appendix

A Survey

How much did you know about Dyslexia before seeing this demo? *

	1	2	3	4	5	
Never heard of it	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	I knew much about it

Is 'Dyslexia' relevant to you? *

	1	2	3	4	5	
Not at all	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Very much

Is 'Dyslexia' more relevant to you now after the experience? *

	1	2	3	4	5	
Not at all	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Very much

Figure A.1: Survey

Have you ever met or known someone with dyslexia? *

Yes

No

If yes, how was your relationship?

Family member

Close friend

Classmate

Workmate

Acquaintance

People within your community (such as neighbour, church and local store)

Other...

Figure A.2: Survey

Did you find this demo to be? *

	Not really	Somewhat	Very much
Difficult to understand	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Difficult to concentrate	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Difficult to focus	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Difficult to make sense	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

⋮

What did you find most intriguing about this experience?

Long-answer text

Figure A.3: Survey

How much more aware have you become after this experience? *

	1	2	3	4	5	
Not at all	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Very aware

Do you feel like you have gain empathy through this experience? *

	1	2	3	4	5	
Not at all	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Very much

Figure A.4: Survey

Overall how do you feel about this experience? *

Long-answer text

Name (optional)

Short-answer text

Nationality

Short-answer text

Any additional comments is always welcome :)

Long-answer text

Figure A.5: Survey

Have you ever met or known someone with dyslexia?

43 responses

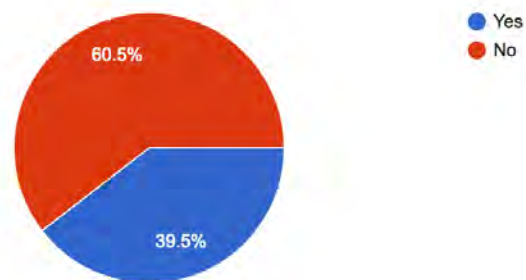


Figure A.6: Survey's Result

If yes, how was your relationship?

18 responses

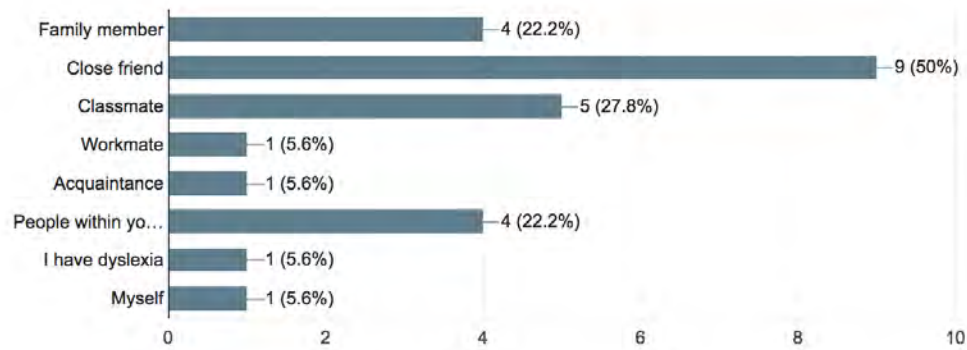


Figure A.7: Survey's Result

Did you find this demo to be?

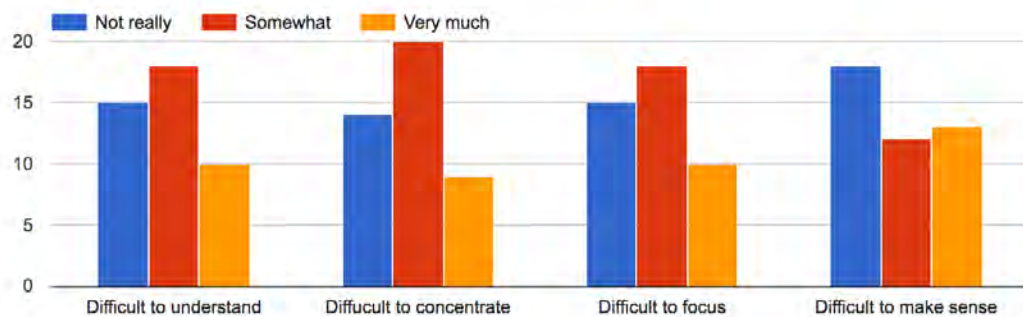


Figure A.8: Survey's Result