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DESIGNING FOR DYSLEXIC STUDENTS IN HIGHER EDUCATION

by

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Abstract:

The definition of dyslexia is variable, from traditional and mainstream view of it is a specific learning disability to the more liberal modern view of dyslexia as unique brain functionality. It can be overwhelming for dyslexic students making the transition from high school to university, which requires more independent learning, assistance and tools. These range from bespoke specialist typefaces to note taking technologies that can record spoken word. The variable definitions of dyslexia cause no standardisation of tools, which causes the market to be limited, causing a majority of tools are often unsuitable for a mature student in higher education, leaving a gap where there is a demand.

I have used practice-based research through the design process to develop an understanding of what is best suited for dyslexic's students. This included background research that utilised traditional research methods including semi-structured interviews with professionals and analysis of literature. As a result of this, I have created a design solution that exampled the knowledge gained in the background research. This was designed and underwent through a process of testing and developing on used in the design processes on the demographic to gain further insight into what they desired from these tools, where previous research methods did not provide knowledge on.

This paper questions the success of the government funded Dyslexia Funding Allowance (DSA) assistance and offers a solution that is beneficial, cheaper and more suitable to the demographic. Further insight is discussed and demonstrated what suitable for those who wish to design a tool for dyslexics. The results provide information of the best ways to design for dyslexic and why it is necessary for suitable design to assist in making a dyslexic work with their strengths and develop their weaknesses.

Table of Contents

1 – Introduction

This thesis uses practice-based research to develop a tool that assists and allows dyslexic students in higher education to reach their potential. Practice-based research included traditional research methods to develop an understanding of dyslexia and what kind of assistance is truly beneficial for them. The aim of the research is to determine the current level of assistance provided by a range of tools, and to provide an intervention to fill any gaps. I will articulate the design techniques that are most suited to communicating assistance to, and addressing the needs of, a dyslexic student demographic.

There are conflicting views of dyslexia; government definitions differ to those discussed in current and recent academic literature such as *The Dyslexic Advantage: Unlocking the hidden potential of the dyslexic brain* (Eide and Eide, 2011) and *The Gift of Dyslexia* (Davis and Braun, 1994). University policy is dictated by government definitions. This lack of agreement, along with current financial changes in the disabilities provision to be university responsibility has resulted in a lack of clarity. Consequently, causing variation in quality and no minimum standard of assistance for dyslexic students.

The key challenge in this project was to take the positive qualities from existing assistance and enhance and develop them into an original tool to assist the dyslexic student demographic. The research goal was to develop clear and informative communication techniques to assist dyslexics, without a condescending tone in the design and without financial restrictions. If successful, this research has value to its target audience as the outcome can continue to assist dyslexics no matter independently of the economy's effect on government policies and on changes in funding for dyslexic students. To approach this challenge, core research questions were developed to cover some key areas, including questions such as "what is the definition of dyslexia", "what are some suitable ways to assist dyslexics?", and "what universities were doing to facilitate this demographic?"

2.1 – Methodology and approach

The main methodology of this thesis is practice-based research through design:

> Practice-based research is an original investigation undertake in order to gain new knowledge partly by means of practise and the outcomes of that practice. Claim of originality and contribution to knowledge may be demonstrated through creative outcomes which may include artefacts such as images, music, designs, models, digital media or other outcomes such as performances or exhibitions. (Candy, 2006, p.2).

As a practising designer I believe that a practice-based approach will produce an outcome of far greater value to dyslexic students, as opposed to a written thesis. This is because this methodology allows for interactions with potential end-users of the research, through the testing and developing stages in which the tool will be tested by its target demographic, who then provide feedback to future versions of the design. This iterative approach reveals new information about dyslexic students relationships with existing assistance that may not be discovered by testing existing tools and traditional research methods alone.

The "design process", is a way in which designers break down and approach into stages. This technique is used throughout the project, from its research to the final design. This process is a mixture of traditional research, critical thinking, testing and developing prototypes to produce the most suitable end product for the user. It consists of four fundamental steps; "discover, define, develop and deliver" (Design Council, 2007, p.6). Below is a brief explanation of these four steps with examples of the methodologies used throughout them.

- Discover: This is the background research where traditional research methods are used, which is necessary for any successful design. This includes the sections of this paper named '*Dyslexia*' and '*Dyslexia assistance at university*'. The '*Dyslexia*' section focuses on the origin of dyslexia and understanding between the different

schools of thought by reviewing the current literature. In addition to this, I also conducted a semi-structured interview with dyslexia tutor and professional *Dyslexia expert one*. I knew *dyslexia expert one* as he used to tutor me, and some of my peers during high school and sixth-form. The questions I asked him were designed to understand more about the dyslexic working style and the best way to assist them. An example of questions asked include: *'How do Dyslexics creative thinking process?'* and *'How does this ability to 'recognise/adapt/consolidate' benefit a dyslexic?'*. The *'Dyslexia assistance at university'* focused on the universities, the assistance and information they provide for dyslexic students. To do this, I chose thirty universities, divided into three equal categories; non-Russel group, Russel group and art based university's, and send them three question in regards to what they provide for dyslexic students and additional information about the facilities they have. However, due to a lack of responses I changed my approach, instead analysed the chosen thirty universities websites pages where they discuss what they provide for prospectus students. I used two specific examples and measure their success as informative pieces of design. This section is also used to understand the student demographic, including their study lives and study patterns, using dichotomous questions, on social media platforms so I could contact fifty students across the country, giving me quantitative results.

- Define: In this thesis, defining was used in two key areas. Firstly, in the part of *'Dyslexia assistance at university',* I use two examples of design and critique their success and failures. To do this, I defined what makes good design, again this used traditional means of to define this using literature, especially the works of Don Norman (2003) and of Paul Rand (2007). This is important, as I would be using these same principles when designing my own tool in development. The second area of defining was in *'design solution'*. All my research across dyslexia and the tools, showed me many areas dyslexics struggle, excel and ways to assist and develop their

skills. This is where I define nine key areas of dyslexia that my design tool will be assisting.

- Development: Where a visual concept is generated and applying my findings research into a testable prototype. This process is a cycle, where a design is repeatedly tested and developed using three dyslexic students. These students where recruited by talking to dyslexics I knew at university, who put me in touch with others interested in the project. The chosen three students all went to different universities, studied different things with varying skill sets.

   Student 1: Male, engineering student, Non-Russell group university. He was diagnosed with dyslexia in early education. Struggles with writing and communicating ideas vocally.
   Student 2: Female, chemistry, Russell group university. Diagnosed with dyslexia just prior to university, main issue is with reading and comprehension.
   Student 3: Male, animation, art-based university. Been diagnosed with dyslexia since an early age and has had constant assistance since. Main areas are reading, writing, comprehending spoken and written word.

   The three participants are provided with the prototype that they then test and after a few days, I asked a four open questions designed to get feedback to get an insight into the success of the tools function, its communicative ability and its visual form. Using the feedback I would then develop the design, this process would keep on going until the feedback provided reaches a level where it fulfils the criteria of good design.

- Deliver: The final stage of the process, where the final input from the students has been considered and implemented into the design. It is then made available for the public to use. I will also evaluate and analyse whether the tool is successful, where

could it be improved and what possible changes if I were to to do something differently.

2.2 – Approach of the writer

I have been aware of my dyslexia from an early age and I appreciate that dyslexia has it's positive and negative aspects, but I do not agree that it is such a burdensome disability as some claim. Nor do I believe that it is entirely a 'gift' as some literature suggests, but I do recognise some of the strengths that both myself and other dyslexics possess. I have experienced what it is like to go through the education system as a dyslexic who has also received assistance through various stages of my education, from secondary school funded assistance, to after-school private tutoring. Four years ago I experienced and negotiated the transformation from school to university, and from the outset I was aware that there were large gaps in the provision of support for dyslexic students, especially in the style and tone of communication, which were aimed towards a younger target audience. The support and materials came across as ill-informed and patronising. As a graphic designer and a mature student, I feel there is not enough assistance for dyslexic students that communicate appropriately. From both my own experiences, and the experiences of dyslexics around me, I felt the urge to design a more effective, enjoyable and ultimately beneficial tool for dyslexic students in higher education.

3 - Key Terms:

Dyslexia terms:

- Dyslexia Student Allowance (DSA): Government funding for students who have long-term health conditions, mental health conditions and specific learning disabilities including dyslexia.

- British Dyslexia Association: A worldwide-recognised organisation that provides information for dyslexics of all ages. Their overall objective is to create a 'dyslexic friendly society'.

Design Terms:

- Typography: The aesthetics, organisation and settings of the way type appears on a page.
- Kerning: The space between each character. (Design insights, 2017).

The quick

- Leading: The space between the baseline of two successive lines. (Design insights, 2017)

The quick brown fox jumps over the lazy dog

- White Space: White space is the area on a page/screen where there is an absence of images/type
- GIF: A format for image files that can be animated or motionless.
- Copy: Content in the form of words.
- User-friendly: easy to use and understand
- User-experience: The overall emotional experience of person using a design such as how easy or pleasurable is a design.

4.1 – Understanding Dyslexia

The understanding of dyslexia has vastly changed over recent decades, due to the development in areas of science and psychology. This developing understanding has led to a decrease in negative public perception and stigma. According to the British Dyslexia Association, dyslexia affects around fifteen percent of people to a lesser or greater extent (BDA, 2016). There are conflicting definitions of dyslexia, sharing similar ideas on the origin and weaknesses of it, but different in terms of other attributes it has.

It is commonly accepted that dyslexia is neurological in origin, meaning it is located within the brain and caused before birth:

> The brains of dyslexics are wired differently to those of non-dyslexics and appear less ordered. Compared to the average person, information processing is organised differently in dyslexic individuals, and brain scans have shown us that different areas of brain are active" (Gyarmathy, 2015, p.2).

This means dyslexia can affect anyone, regardless of education and upbringing. 'Acquired dyslexia' is a completely separate condition and is very rare. but can be caused by illnesses and traumas to the brain, such as a stroke or injuries to the head interfering with the brain's hardwiring (Nordqvist, 2016).

In 2009, educationalist Jim Rose released an independent report on identifying and teaching young people who suffer from dyslexia. He defines it as, "A specific learning disability" (2009, p. 31). Institutions including the government and the NHS share this view. Moreover, he claims it's, "a learning disability that mainly affects skills involving reading a spelling" (2009, p. 31). Putting together a list of observable attributes of dyslexic's characteristics developed this definition. The list includes; phonological awareness that affects reading and

writing, short-term memory issues and processing speeds. When looking at these attributes, it is evident that a person with dyslexia would struggle with traditional methods of communication necessary in education and so I suggest that deeming it a 'learning disability' is only justified when considering just these specific attributes.

A separate view of dyslexia, defines it as a different way of understanding, interpreting and communicating. Rose raises the point that "dyslexia is thought of as a continuum, not a distinct category with no clear cut of points" (2009, p. 30) However, he fails to develop on this as he only applies it to negative attributes and how they can be different from one person to another.

There are conflicting views to those of Sir Jim Rose. Hammond and Hercules acknowledge there are key points from Rose's report in terms of a dyslexic's intelligence:

> It may seem obvious to say this, but dyslexia has nothing to do with intelligence. Nor is being dyslexic simply about spelling difficulties, or being able to read and write fluently (Hammond and Hercules, 2015, p.13).

Furthermore, Hammond and Hercules do not believe dyslexia is an issue solely to do with literacy skills. Dr. Brock L. Eide and Dr. Fernntte F. Eide, explain dyslexia as the following:

> It's also a reflection of an entirely different pattern of brain organization and information processing - one that predisposes a person to important abilities along with well-known challenges. This dual nature is what's so amazing - and confusing - about dyslexia. (2011, p.4)

This explains why individuals with dyslexia can be seen as many different ways depending on how they are viewed. Its 'dual nature' shows that dyslexics are limited in some areas, the

most mainstream and associated issues are reading and writing, but it also suggests that dyslexics possess a more positive skill set that non-dyslexics may not possess.

4.2 - The secondary view of Dyslexia

Ronald D. Davis and Eldon M. Braun describe dyslexia as a gift and argue that their many attributes that define dyslexia as a positive. Creativity is a concept that is often associated with dyslexia, but they argue that creativity stems from curiosity. "Curiosity is the dynamic force behind creativity" (p.106, 1994). This suggests that dyslexics are more curious from a young age, which is evident in young dyslexic behaviour. Dyslexics question and want to understand more about their own surroundings, and utilise a visual way of thinking which includes; "material reasoning, narrative reasoning" (Eide and Eide, 2011) and "multidimensional thought" (Davis and Braun, 1994, pp.100-110). This can be understood as possessing a heightened ability to think in a visual way and manipulate spatial perspectives more so than non-dyslexics. This is not to suggest non-dyslexics are incapable of this, however dyslexics find it easier to construct scenarios and think visually as it helps them comprehend the information around them, as they naturally struggle with spoken and written word. According to Dr. Maryann Wolf, a reading and language specialist at Boston University, Leonardo Da Vinci was dyslexic, and there is evidence for this in the way he writes in his many sketchbooks. Leonardo da Vinci's sketchbooks show evidence of mirror writing, a trait associated with dyslexia. Wolf tests this and finds that dyslexics write quicker in mirror writing, suggesting this was a method of communicating Leonardo da Vinci found more natural. However, his revolutionary ideas and drawings demonstrated a creative mind not bound by a particular issue of dyslexia he struggled with (Wolf cited by Eide, 2015). His ideas and concepts were a product of what many theorists believe to be Leonardo da Vinci's ability to think uniquely in three-dimensional and multidimensional ways, ways in which he was able to generate, design and test his ideas. This ability to create and come up with these ideas is what we would define as 'creative' by definition as it stems from original thinking. It is clear that these skills, directly applied, can be very useful in problem solving. Leonardo Da

Vinci demonstrated problems with writing, evident in his mirror writing, but his creative ability is in no doubt.

However, there is a disagreement within the field of thought over where creativity comes from. Davis and Braun (1994) believe it to be more innate, whilst Madeline Martine who wrote the article Creativity and Dyslexia (2011), takes a more sceptical approach, by explaining the creativity is not an innate skill, but one that is developed in spite of their dyslexia:

> Simply matter of fact that since dyslexics have learned to think creatively in order to overcome their challenges with read and writing in school, they often have great strength in problem solving and the ability to preserver through their lives (2011, p.5).

Dyslexics creative skills are developed by them persevering through the issues that their dyslexia causes, by finding creative and what is described as 'out-the-box' solutions that suit them. This suggests that a dyslexic need to have negative experiences and, over time, understood it for them to have developed creative ability in spite of their dyslexia.

Although there are disagreements over the cause of creativity, this secondary view of dyslexia acknowledges that dyslexics are more curious and creative, due to a different brain organisation. This causes many dyslexics to possess heightened functions, often allowing them to recognise "analogies, metaphors, paradoxes, similarities, differences, implications, gaps and imbalances" (Eide and Eide, 2011, p.5)**.** These heightened brain functions are desirable attributes to have when problem-solving. The ability to find solutions that are not obvious is useful in the majority of industries and can be an explanation to why dyslexics fall into creative professions that require problem solving such as "medicine, law, business, psychology, education, and the arts and science." (Fink, 2002, p.1).

4.3 - Examples of dyslexic experiences

Dyslexia has such a wide spectrum of characteristics, I have put together some examples of what dyslexics experience in the university environment:

Phonetic spelling:

> Inadequate phonological processing ability, which affects the acquisition of phonic skills in reading and spelling that unfamiliar words are recently misread in turn affect comprehension. (Lucid Research, 2006, p.2,).

The English language has many rules that are constantly broken in vernacular speech. The way in which adults talk, the way words sound and the way we spell are all completely different. Dyslexics tend to write and spell how the spoken word is vocalised. (Moats and Dakin, 2008). When writing notes, converting spoken word to written word is difficult, causing some spellings to be completely wrong and using the wrong words.

Homophones:

Homophones are words that have the same sound as each other, but do not carry the same semantic meanings or have the same spelling. This is an issue many non-dyslexic people struggle with, but is far more server for dyslexics. For example, saw, soar and sore all sound the same but have totally different meanings. If a student is writing an essay and they write the wrong word, spell check will not pick it up. It has the potential to completely change the context of a sentence. This also becomes applicable to note taking.

Letter rotation:

Christian Boer (designer of dyslexic specialist typeface) discusses how the language and visual parts of the brain do not collaborate together and causes letters to move and increases reading errors causing movement and rotation within the type (C. Boer, 2011). When reading

it is not uncommon for dyslexics to get these mixed and muddled when reading especially under-pressure in exam situations.

Verbal Communication:

Speaking and communicating verbally is also due to phonemic awareness problems. This is due to the visual way in which dyslexics, creating difficulty articulating something, although they fully understand it. They also get 'tongue tided' often causing dyslexics to "mix up sounds in multi-syllabic words such as "pasghettit" for spaghetti, "aminal" for "animal" (Dyslexia Victoria, 2016).

Organisation and stress:

> Adults with dyslexia sometimes also struggle with time management and organisation at work. Planning and organising sat out time tables, distinguishing between important and the urgent, remembering appointments, passing on telephone message from memory and meeting deadline can be exceptionally difficult for many people with dyslexia. Some people may get bogged down, overwhelmed by the workload and stressed. (Dyslexia Association of Ireland, 2016).

For many students university is their first taste of living and working independently. It is a challenge for many students, especially dyslexics to manage the balance between many things including paid work, university studies, social lives and others. For a dyslexic student doing all of these things for the first time, organisation can become a huge factor in their studies, success and overall happiness.

4.4 - How can Dyslexia be assisted?

> People are trying to work out how do we educate our children to their place in the economics of the twenty-first century? How do we do that given we can't anticipate

what the economy will look like at the end of next week, as the recent turmoil is demonstrated (Robinson, 2008, p.2).

Sir Ken Robinson highlighted that the educational system has lost it way in terms of providing quality education due to financial restrictions. This standardisation of teaching does not suit dyslexics and often causes them to fall behind as they struggle with the current teaching methods. Furthermore, dyslexia is extremely variable to each person who has it, making it difficult to teach in a classroom with many non-dyslexics.

As dyslexia is so variable it makes sense for students to be broken up into groups who share similar abilities and areas to improve, a concept that is agreed with by many professionals including specialist dyslexia expert one. Specialist dyslexia expert is a specialist in dyslexia with over twenty-five years of experience, who works in schools across East Anglia and also provides home one-to-one tutorials with dyslexic students. He tutors students from their early teens, up to students in their twenties. I asked various questions about the most suitable way to teach and assist dyslexics. Dyslexia expert one explained how he believes that dyslexics skill sets are "less innate than taught" (appendix 1, Q.1), as also indicated by Madelin (2011, p.4-6). Dyslexia expert one continued to highlight how "they each recognise, adapt and consolidate their learning styles to reflect approaches that 'work' for them" (appendix 1, Q.1) and in doing this over time dyslexics grow a confidence and consistent way of working' (appendix 1, Q1). This means that when a dyslexic understands their own disability they can recognise how to work within their own ability and with methods that feels most comfortable to a dyslexic. Dyslexia expert one also explains how dyslexics develop a "power and an enthusiasm to preserve and develop a motivation to succeed" (appendix 1, Q2). Although he is not teaching anything different to a student than any other teacher would do in a classroom, he is providing a place where a student can feel comfortable, without pressure, focus on what he can assist them with the specific areas a dyslexics student may find challenging**.**

He further explains how he works with dyslexics and 'chips away' at an issue the student struggles with, such as reading comprehension, doing this over a period of time. This includes practice, reading out loud, having discussions about a book they are reading and suggesting other sources to understand more about the book**.** This method of working would suggest that assisting and changing dyslexic negative habits and issues are a long process, and not a simple change, due to the fact that dyslexia is hardwired into their brains from pre-birth as defined by Gyarmathy (2015) and Nordqvist (2016) previously.

Not all one-to-one assistance is entirely beneficial for dyslexics; I believe that there is a fine line between assisting and educating a dyslexic to develop their skills and 'doing' the work for them. This method of assistance can be provided by some universities, and includes scribes and note takers. A scribe is someone who writes for the student. On the surface a scribe appears useful; dyslexics struggle with comprehension and communication and so a scribe can help them by assisting them articulate their thoughts, coherently written and allowing them to be away from a blank screen, reducing stress and anxiety. In situations such as a lecture, where a dyslexic student is hearing and learning new and complex concepts, for the first time, they have to convert writing and visual information into to notes and in a coherent way that they can reference later on. To have a scribe do that for the student would take the element of confusion out of the equation means that they can fully focus what is being taught. Additionally, scribes can be useful during, in which stress can render a dyslexic's handwriting incomprehensible. According to Dr. Schultz, who is part of the International Dyslexia Association, dyslexia relate older experiences with one at hand:

> If on the other hand, someone has met with repeated failure when attempting this or a similar talk in the past, his or her body and brain may be working together sending out chemical warnings system that translated as 'This is going to be way to difficult for you!' (2013, p.1)

16

He also suggests that "perception is everything" (Schulz, p.1), meaning that if you are given the opportunity to relax and test out concepts without fear of judgment, it can reduce stress interference with dyslexia.

However, these skills are important to acquire and develop of them is necessary for any career path. Scribes can also give a bad impression to other students and could be the cause of some of the existing stigma against dyslexics; perceptions of a student being lazy, but possibly even an element of jealousy among other students and even embarrassment. Graduates in employment will not have the luxury of a scribe, employers, by law, will recognise and respect that their employee has dyslexia, but this does not mean they will facilitate them in the same way the educational system would. This is partly because it is not financially feasible and also because if a potential employee does not have this skill, they will simply employ another candidate that will:

> And whilst it's rare that anyone will lose a job for not taking notes on something, the small, on going effect of bad notes (or skipping notes completely) can really hurt your career. (Stull, 2015).

Dyslexics commonly have short-term memory and organisation problems and therefore, note taking is not an important skill for dyslexics to improve on issues they naturally struggle with. Having a scribe to take notes for a student means they will never develop this skill. Referring back to Martin's paper, *Creativity and dyslexia* a dyslexic student's ability to approach concepts from creative and unique angles is in fact a product of their experiences with dyslexia. If someone has no negative experiences and has constant assistance, they will never to continue developing methods and creative skill sets (2011, p.4-6). This means that they may have never developed any positive skills. It would be cheaper to educate dyslexics on how to note take, and show how it can be easily tailored to the way they work. Note taking and planning can be taught to dyslexics through the one-to-one tutorials, teaching them that

they can approach it in their own way. If they are artistic or creative they can visualise through drawings or use abbreviations to stop them having trouble with spelling.

It could be argued that universities are more focused on improving and upholding their academic credentials by getting students to get the best grades improving their university ranking, which alongside student satisfaction are the two key factors that dictate overall university quality, therefore having the best calibre of students applying and receiving more funding. This also fulfil other criteria including degree completion, good honours and result in greater facilities and academic expenditure, which are part of the criteria students have when applying for university. If the universities are only focusing on their ranking, it may mean that they don't entirely have the student's education for the future as their primary interest. This disadvantages students, as they have not been taught key skills, as they have had constant assistance such as that provided by scribes.

5.1 - What is provided for dyslexic students at university?

Dyslexia was recognised as a disability under the Equality Act 2010, meaning dyslexic people are entitled to Disability Student Allowance (Department for Benefits, 2016). DSA is a grant relative to a student's dyslexia, receiving on average one thousand seven hundred and forty-one pounds; this contributes to assisting the students in various forms. These include:

- Specialist equipment;
- Non-medical helpers, in the form of tutors and specialists;
- Other disability-related costs of studying. This can include extra printing credits and longer library loans.

These benefits are only available to those who are diagnosed with dyslexia, and who can provide evidence to their university. If a student believes they are dyslexic they can go

through a dyslexia screening process that is undertaken by a HCPC registered Psychologist or a specialist dyslexia teacher with a current practice certificate for assessing students at higher education, depending on the university (BDA, 2016).

Although all universities provide the assistance listed in the Disability Student Allowance, the reality is that some universities only provide the minimum and some go beyond the requirements. For example:

- Providing their own funding for dyslexics who have not been professionally diagnosed as some students cannot afford the cost of the dyslexia diagnoses. It also acknowledging that diagnoses are not always 100% accurate, a view shared with British Dyslexia Association, 2016.
- Dyslexia is very personal to each whom has it. There are specialist one-to-one sessions where students are tested and then told their strengths and weaknesses. Where a professional can direct them to a tool which is best suited for them.
- One-to-one sessions are part of the mandatory criteria. However, some universities have variations of this such as specific skill sessions, group sessions and subject related assistance.

5.2 - Quality of the design and information

The tools and assistance available for dyslexic students raise two main issues; the first is the quality of content, the second is how suitable is the method of visual communication is to the user. Design refers to the aesthetics and function of an object, image or building. Creating a balance of duty and a visually appropriate style, a good design should work in harmony. It is important to understand whether this harmony exists in the tools and assistance available for dyslexic students, as understanding success and failure of this will be fundamentally important when crafting a new tool.

My original methodology to understand the quality of information provided by universities was to contact thirty universities dyslexia/disability departments, equally divided into Art specific, Russell group and non-Russell Group universities, and ask questions about what they provide, how many students use the assistance available and the extent students know what's available to them. However, only three of the universities thirty contacted replied, leaving me with little substance for the foundation for a design project. Instead, I carried out desk research by visiting and analysing the original thirty universities websites, and downloaded any other supporting documents they provide about assistance and tools for students at university. I wanted to find out about the variety and accessibility of the assistance available, and analyse the success of the way the information is communication, as well as the quality of its content. In conjunction with the three responses from university departments I did receive, I found some key correlations and differences with university dyslexia assistance and have chosen two highlight the two most important findings.

> Finally, students from within the UK are eligible for funding – Disabled Students' Allowance (DSA) – which can cover the cost of 1:1 support, such as proofreading, SpLD tuition or equipment, that students may need to reduce the impact of their condition on their studies. (Appendix 2, University B).

The response from University B (a non-Russel group university) was responding to the question of what their university provides for dyslexic students. It was unsurprisingly, consistent with the majority of universities websites, in the fact they highlight the providing particular assistance available through the DSA. This is understandable, as this is a legal requirement for all universities to provide this (Department for Benefits, 2016). The websites, much like the email response, discuss support for dyslexics, often highlighting the importance of dyslexia diagnoses, as it is necessary to be diagnosed to receive any assistance through DSA. Although this is understandable in making sure only dyslexics receive funding, I am

critical of putting more emphasis on diagnoses rather than going into valuable detail on the support a student can receive. There was variety in terms of more specific assistance to each university, for example some discussed scribes whilst other discussed note takers for class, however there was no correlations or patterns in the data. However, the art based universities do not follow this pattern and also provide insight into their overall attitude towards dyslexia.

> As we have a high percentage of dyslexics in our student population, we offer assistance outside of the DSA in the form of free drop in sessions and study groups to help address and develop particular skill sets. (Appendix 2, University C)

Notably, the language is very different from University A; "develop particular skill sets". This language is what is more associated to with the secondary view of dyslexia. University C, also explains how they offer assistance outside of DSA. This is uncommon among the thirty shortlisted universities, but slightly more present among art-based universities. Facilitating dyslexics in a manner such as this, allowing access to assistance which helps them develop their skills sets regardless whether they have been screened for dyslexia. This data suggests that the positive attributes in art-based universities is why we see dyslexics in what is considered creative and problem solving fields where dyslexics tend to flourish, fitting with various theorists who view dyslexics more than a disability.

> Next time you run across an unusually good designer, landscaper, mechanic, electrician, carpenter, plumber, radiologist, surgeon, orthodontist, small business owner, computer software or graphics designer, computer networker, photographer, artists, boat captain, airplane pilot or skilled member of any of the dozens of "dyslexia-rich" fields we'll discuss in this book, ask if that person or anyone in their immediate family is dyslexic or had troubles learning to read or write. We'll bet you dollars for films that person says yes. (Eide and Eide, p.5).

The main correlation between the universities is that art based universities, have a different attitude towards of dyslexia, in turn meaning more available and beneficial assistance. Perhaps this is a consequence of having more dyslexic students like University C, leading to a better understanding of how to work with dyslexic students. Although there were not many differences over the type of assistance universities provide there were very different ways of communicating it, and the quality of it does not rest on the type of university.

I have chosen two examples of how universities provide information on their sites, to analyse the 'form' of their content. I have chosen two documents that both provide good content, but both have very different methods of communicating it. The first focus is a document for prospectus students (Fig. 2)

What is Dyslexia?

★ Lexis refers to language – dyslexia means problem with language. This can refer to reading, writing, spelling, and phonological problems which result in difficulties acquiring new language.

★ Another typical feature of dyslexia is a marked discrepancy between intelligence and specific skills such as literacy, organisation, short term memory and certain information-processing abilities. Often verbal expression is favoured over written.

★ Possibly 10% of people are dyslexic, of these 6% are mildly or moderately affected, 4% severely so.

What is Dyspraxia?

★ *Praxis* comes from the Greek word meaning *to do*. Three abilities are required for effective praxis: these are the abilities to conceptualise, organize and execute sequences of unfamiliar actions. If one or more of these is impaired then dyspraxia may result.

★ Dyspraxia is also known as *Developmental Co-ordination Disorder* (DCD)

★ Dyspraxia manifests itself in problems in adequately registering, interpreting, organizing and integrating sensory information to produce an efficient response, and it affect many of the skills required in HE.

★ As children dyspraxics are often referred to as having "clumsy child syndrome" because of their tendency to bump into things and they frequently have trouble with sports, e.g. catching balls.

★ Between 5% and 10% of the population are affected.

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The Dyslexic and Dyspraxic Learning Style

N. B. Please refer to the pages on 'The Different Functions of the Two Brain Halves' and 'Dyslexia and Dyspraxia - Typical Strengths and Abilities'

Dyslexia and dyspraxia can be seen as a differing cognitive style. Dyslexic and dyspraxic people have (as do others) strengths and weaknesses in how they process and organise information. Understanding these strengths and weaknesses can help you and your tutors find more effective approaches to organising learning and work.

Teaching methods tend to rely largely on language and the consequent need to process a great deal of verbal information in one form or another. Such an approach favours students who have no difficulties with processing language efficiently or using a sequential approach to learning.

Whereas, dyslexic and dyspraxic learners often have inadequately developed language specialisations in the left hemisphere, they often rely more on right hemisphere functioning. They therefore develop a preferred learning style which reflects this processing bias, favouring a holistic and visual-spatial approach rather than one which is sequential, temporal and language based.

Dyslexic and dyspraxic people typically might have a weakness in respect of their working memory - holding, storing, retrieving and manipulating linguistic information. As a result, they must make meaningful, often highly personal connections in order to learn and remember. The advantage of this is they often have excellent long-term memories. It can also make them good communicators and educators as they can often make information highly personal for other people too.

Not all dyslexic and dyspraxic people will exhibit this cognitive style and not all will have strong visual-spatial skills. However, 'right brain' approaches to learning are usually more effective for two reasons.

1. because the dyslexic and/or dyspraxic learner is definitely disadvantaged in some aspects of left hemispheric linguistic processing

2. because right hemispheric approaches are powerful tools to learning generally as they emphasize emotion, humour and imagery.

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Fig. 2 Dyslexia advice from The University of Hull (2016, p.1 and 12)

Although the aesthetic element of design is somewhat subjective, it is still possible to determine the aesthetic aspect of a designs success. Paul Rand, distinguishes the difference between art and design, emphasising that the visual part of design should serve a purpose and not to design without meaning.

> Design clichés, meaningless patterns stylish illustrations, and predetermined solutions are a sign of weakness'. He continues to define what makes a good designer; 'able to distinguish between trendiness and innovation, between obscurity and originality. He uses freedom of expression not as a license for abstract ideas, and tendency not as bullheadness but as evidence of his own convictions. (Paul Rand, 2007).

Paul discusses the distinguishing of trendiness; visual form, with innovation; its purpose. A good design fulfils its function, but also has a form that is suitable to its user, providing the best possible user-experience. Don Norman uses the example of a cutting knife to demonstrate this balance.

It's a Global cutting knife made in japan. First of all, look at the shape –it's

wonderful to looks at. Second of all it's really beautifully balances: it holds well, it

feels well. And thirdly, it's share, it cuts. (Don Norman, 1:25, 2003).

Furthermore, Norman also makes the distinction describing why something beautiful doesn't

necessarily reflect good design and, similarly to Paul Rand's argument, becomes more

considered art, as its aesthetics do not serve a function purpose only emotional.

This is a Philippe Starck juicer, produced by Alessi, it's just neat; it's fun. It's so

much fun I have it in my house—but it in the entryway, I don't use it to make juice.

In, fact I brought the gold plated special edition and it comes with a little slip of paper

that says, "don't use this juicer to make juice. The acids will ruin the gold plating.

(Don Norman, 0:51, 2003).

It is clear that design is a balancing act of function, does it fulfil its purpose and form, does

the visual aesthetic add a positive experience to the user and/or is it visually appropriate.

Importantly, form is not to be confused with whether one's opinion suggests, as this is

subjective. Good form in design defines it as it being suitable and beneficial to the user.

Considering the design of Fig. 2, it is clear to see the use of clip-art illustrations and fonts that

appear juvenile, unsuited to a mature audience. This is a poor design consideration as its form

does not assist in the communication of its content in a visually appropriate way, instead it

feels condescending and childish, making the users experience a negative one. Form is not

only the relevant to the suitability and enjoyment of the user, it also effects the users

experience in a functional way. Fig. 2, shows a very type heavy document with long line

lengths that make harder to read, and unsuitable for a dyslexic, as a common trait of dyslexics

is to struggle with comprehending written word. It will only add to their frustrations with

reading. Overall, this is clearly an example of bad design which feels condescending and also has inappropriate formatting for dyslexic readers.

Fig. 3 uses a much more user-friendly format for dyslexics in the form of a video, discussing facilities and includes student experiences, and despite its bas design, again includes very useful information for prospective and current students.

Fig.3 Brunel University Disability and Dyslexia Service (2009)

This video is more dyslexia friendly and it minimises text-based information, favouring audio and visual as communication methods. However, it also has issues with is visual language. The design of the video feels out-dated, due to the standardised font with a heavy drop shadow that feels artificial and has nothing visual that captures the eye. The elevator-style music also adds to this, making it feel very sterile, as if in a waiting room. When talking about dyslexia and other disabilities, this feels insensitive and unsuitable. Overall, the video is again full of quality content, but is not captivating nor engaging.

Although these sources and are not necessarily tools themselves, they share the same issue in that they are not suitable for a dyslexic student. The condescending tone of these websites and documents would not make a student especially interested in seeking any assistance associated with the same tone as the video and documents. I believe that these attributes are not only an issue in the universities, but also consistent in some of the tools themselves.

Example of a Tool – Design of Bespoke Typefaces – Dyslexie

Background and concept:

Letters in a typeface share characters that are similar to each other. For example, this paper uses Times New Roman, a common and standardised typeface used in books. Observe how similar in structure and shape the b, d, p and q, and common across many typefaces. They are all essentially the same letter rotated, although they represent completely different sounds. If a reader mixes these up, it can have significant changes to a word that affects reading speed.

Dyslexie is a bespoke sans-serif typeface designed in 2009 by Christian Boer to help dyslexics read more fluently. As a dyslexic himself, he based the design on eliminating his own experiences of word movement when reading. Recent media attention hailed it as one of the leading typefaces solutions for dyslexics alongside Open-Dyslexia.

Dyslexie (Fig. 4) aims to tackle this issue, making each character individually unique, making no two characters the same. Additionally, adding bigger spaces between each letter and larger spaces, with capital letters being much bolder, anchoring the letters in place. (Dyslexie Font, 2016, the Dyslexie font section). The typeface is available for web plug-ins, on mobile phones, computers and also downloaded as for use on screen in applications such as word and even design software. It is free for personal use, but costs for teachers and lecturers to use it. According to the website the typeface has thousands of downloads and active users including Nintendo and Google (Dyslexie Font, 2016).

ABCDEFGHIJKLM
NOPQRSTUVWXYZ
abcdefghijklm
nopqrstuvwxyz
0123456789!?#

Fig. 4 Dyslexie Typeface (Boer, 2009)

ABCDEFGHIJKLMNO
PQRSTUVWXYZÀÅÉ
abcdefghijklmnopqr
stuvwxyzàåéîõøü&12
34567890($£€.,!?)

Fig. 5 Comic Sans Typeface

Dyslexie (Fig. 4) is a typeface specifically for dyslexics, and free for dyslexic students to use.

Although this is a subjective opinion, it does not balance form and function, looking similar

to Fig 5, a Comic-Sans a typefaces designed to be fun. I wanted to investigate if others were

affected by its aesthetics, and if the font balances form and function. To do this, I provided

the typeface to a lecturer at a non-Russell Group to use in one of his seminars. The lecturer

27

used the font in a lecture on students who all had varying ability, with knowledge that there was a minimum of four dyslexics in the group. After the seminars, he asked the students for their feedback: "The feedback was generally negative due to the way it looked. In fact, some students actually said it was more of a distraction" (Appendix 3). What this shows that there is not only an imbalance of form and function, but that the form of the typeface is distracting from the functional properties. As the concept of the form was purely for functional purpose, it shows that the typeface is successful in its intention. Bad aesthetics in design is potentially damaging for dyslexics:

> And when you're happy - what we call positive valence - you squirt dopamine into the prefrontal lobes, which makes you a breath-first problem solver: you're more susceptible to interruption you do out-the-box thinking (Norman, 2003, 00:05:52).

Norman explains how when we enjoy something, such as design, we become happy and work better. He uses the works 'out-the-box' thinking, which has already been linked with one of dyslexics more positive attributes. Therefore, giving dyslexics ugly, unsuitable and condescending design and language could make them unhappy, and may in fact affect their out-the-box and unique approach to critical thinking. Consequently, showing that there is a need for design that can communicate assistance to dyslexics in mature, intuitive and enjoyable way, to best benefit their learning and understanding of their own dyslexia.

6 – Design Solutions

In the research stage of this thesis, I have gained a detailed understanding in regard to the positive and negative effects of dyslexia. This has helped me formulate nine skills and areas dyslexics at university may face and suitable solutions to them. Below are the nine areas my tool will address, with brief explanations of how I arrived at these nine areas of assistance.

(1) Understanding your Dyslexia: The first piece of assistance is to define dyslexia, as it is important not to address dyslexia a disability, but as a different way of understanding and working. Showing an attitude to dyslexia similar to art universities.

(2) Moving Words: As the Dyslexie typeface identifies (Boer, 2009), the movement of words caused by typography dyslexics to struggle when reading. Explaining the cause of this will help dyslexics understand why this happens, offering simple, financial feasible solutions. Such as, a ruler or colour filter can be the solution to this.

(3) Talking to Understand: Dyslexia expert one talks the importance on one to one tutorials, with specific targets over a period of time. (appendix 1, Q1). Conversation about literature for example can increase comprehension and that is what makes one-to-one sessions so successful, doing this with other students, is just as and also offers familiarities discussing with peers (similarly to the concept in your space). It must be noted that I am not discouraging dyslexic from reading just to use other methods to reinforce understanding and learning.

(4) Visual Note Taking: Madeline Martin (2011), and the interview with Dyslexia expert one (appendix 1, Q1) said that dyslexics often learn to work in their own ways through adaption and developing. I am encouraging dyslexics to work in their own way, including note taking. Encouraging them that notes do not have to be traditionally paragraphed, but recorded in a way that they understand.

(5) Your Space: Dr Schulz (p.1), discusses the importance of being comfortable and relaxing to without fear of judgment and to encourage their own working style.

(6) Abbreviations in Notes: Same principle here with visual note taking, professional degrees used complex academic language hard to grasp even when not dyslexic, abbreviations can help quick notes.

(7) Tailored Comprehension: Same principle as 'talking to understand', but acknowledging that students are not always able to attend campus to study. However,

the internet alone offers endless resources to assist reading such as videos, over views, podcast and more.

(8) Organisation and Planning: Sir Jim Rose tells us that dyslexic struggle with short-term memory and planning (2009, p. 31). This level of organisation, planning and independence is new to many students. I advise having a visual calendar in a way for dyslexics to clearly and coherently plan their time accordingly, something that will see daily to help them remember.

(9) Captivating Curiosity: Ronald D. Davis and Eldon M. Braun discuss curiosity as a dynamic force behind creativity (p.106, 1994). I think this is important to include in the tool, encouraging dyslexics to utilise and not be afraid of their curiosity as it leads to creative thinking (Eide and Eide, 2011, p.5)**.**

6.1 - Concept and Metaphor:

A concept describes the starting points that will guide the way into making design decisions and trying to solve the problems in the brief or in the research questions, with an underlying logic which becomes the bases for visual choices and determines the aesthetics. A good concept ties all design information together:

> Essentially, concepts set themselves up to say things like: 'this is a books jacket design. It references and interprets the material you'll read inside' or, 'this is a logo whose face symbolises the spirit of the company or service' etc. (Santoro and Santoro, 2015, p.5).

The generation of a concept comes after the initial research stage in a project, as it is vital to know the target audience, the project's aims and what already exists in terms of competition and related solutions to the same problem.

Many of the existing tools available for dyslexics appear to be base upon the primary view of dyslexia, approaching it as a disability. This focuses on single dyslexic issues and offers a solution to 'fix' it, without communicating and educating a dyslexic on how to develop their skill sets and understanding of their more positive attributes. An example of this is evident in a tool named 'Dragon 13 home'. Although I acknowledge that this tool is beneficial in recording ideas, it has the same issues as a scribe as there is no skills being learned on behalf of a dyslexic student. These skills include; note taking, planning and improving academic writing.

The concept dictates the style, to what the designer considers as user-friendly and suitable as possible. For example, the typeface Dyslexie style is dictated by the concept, to counteract type on the page rotating and moving. However, I believe in approaching dyslexia in the secondary view, not considering it as a disability. This is because the secondary view of dyslexia aims to help dyslexics develop their skills as well as understand the issues they have. I aimed to describe dyslexia as less of a disability, wanting to show a dyslexic's potential, and to not simply 'fix' an issue that they faced. Instead of talking about limitations, I used the idea of potential and possibility of success. One extremely successful dyslexic is Albert Einstein, who stated that:

> The words of the language, as they are written or spoken, do not seem to play any role in my mechanism of thought. The psychical entities which seem to serve as elements in thought are certain things and more less clear images which can be voluntarily reproduced and combined. (Eide and Eide, 2011, p. 58 - 59).

This quote demonstrates that Albert Einstein was aware of what worked best for him whilst acknowledging his limitations. I feel that he is a perfect example of all the positive attributes that was discussed in the literature. His ideas were unique and revolutionary in his era and demonstrate how dyslexia is not a limitation; all it takes is a good understanding to unlock his

potential. This is the core purpose of my tool, to communicate methods of assistance to dyslexics that can develop their skills and reach their potential that is unknown and unlimited through their own unique style and understanding. This theme of potential and science inspired me to think of a way which could translate into a visual language. I took the link between 'science' and 'space', and this into a metaphor.

I came up with the concept that space is a metaphor for an individual's dyslexia as it represents how gravity can cause you to be stuck in one way of working. However, once a student begins to understand how to work with their own unique way, it allows them to break away from gravity and explored the unknown by utilising their curiosity and creativity, just as Einstein did.

As with all design projects, the tool needed and identity, name and style. The name I chose was *Interspellar*, based on the word interstellar which means 'the space between stars'. This suggests traveling and exploring the unknown, which fits well into the concept of space as a metaphor for dyslexia. The second part of the name *Spellar*, is an example of a dyslexic issue which is the phonetic spelling or words. The reason I chose to do this as it directly links with dyslexia, meaning when people hear the name they can instantly make the association from spelling to dyslexia. However, the main reason I decided to do this is because some literature almost takes dyslexia too seriously. I am attempting to communicate a less clinical and negative perception of dyslexia, in a more enjoyable tone.

6.2 - Typography

Typography is the style, arrangement, formatting of written words and characters. It fulfils a particular purpose in design, as it establishes hierarchy of information, communicates feelings and emotions, and communicates traditional written word. Its purpose dictates its style, for example a typeface for road signs need to be visible for drivers to see without distracting them from the road. Therefore, the typeface needs to be bold and clear to provide clarity for

road users, most likely a Sans Serif typeface. A san-serif typeface does not have serifs, which are decorative flicks and tails on the end of the strokes.

When designing a tool for dyslexics, it is important to make it as user-friendly as possible to make it as intuitive and enjoyable to use as possible. When considering written word and dyslexic users there is a fine line between what can be beneficial and what could pose as a distraction or disengaging. Fig. 3 demonstrates of bad design choices in terms of typography as is hard to read due to the quantity or words and length of the lines. Therefore, there must considerations into what is the most suited typeface for dyslexics, minimising any possible issues. I do not believe in making the tool entirely reading free, this is because for dyslexics to develop their reading they must practice even though they may not like it. This concept was discussed in what is truly beneficial for dyslexics.

Layout and typography can be used to break down information for dyslexics, into bite-size chunks, in a format that reduces stress elements such as word and letter vibration, which are both visual attributes that some dyslexics experience. To do this, I will make the copy is limited and to the point, making the length of the lines no longer than twelve words. I will not be using a bespoke dyslexia typeface as a simple google search and reviews can show this distaste for its aesthetic style; with quotes from various sources saying:

> My god its ugly! I understand aesthetics come secondary to functionality when it comes to designing typefaces for dyslexic people but I think there are some design choice s that make no sense. (Martin Silvertant, 207)

This in conjunction with the test carried out by Lecture A (Appendix 3) serves as direct evidence that the typeface is inconsistent and is also aesthetically unpleasing. Furthermore, typography experts such as Bigelow and Holmes suggest that changing aspects of a typeface is beneficial to a reader more so, than changing to a specialist typeface:

For typography – the sizing, spacing and arrangement of type, but not typeface design – few scientific papers found that certain variations in typography offer statistically significant benefits to dyslexic readers (Bigelow and Holmes, 2014).

With this considered, I decided to use a typeface named 'Din', it has varying weights which means it comes in bold italics and more which allowed me to make a clear hierarchy. I chose it as it suited the mature audience and worked with the other elements of design in the project. Din in its nature is a bold typeface, but I also changed the format in terms of giving it spacing double spacing in the titles, increasing the tracking and leading and increasing its size to keep it clear and easy to read. Reducing the chances of dyslexics missing words, lines and type movement.

A further issue for dyslexics when reading is the contrast of colours of the background and the typeface. The contrast of colours can be a factor in causing the characters to vibrate and move around. One tool that is designed to counter this is a colour filter as it as it provides the page with a more constant tone, reducing contrast. Although the colour filters are physical or available as online plug-ins, the idea of using less contrasting colours to reduce this issue is one that can be easily applied into the design.

6.3 - Illustration and Animation

Illustration is a very broad term, but in graphic design it is the method of communication that is a visual explanation or interpretation. Illustration can be used as a stand-alone form of communication and work with other visual and writen information. Depending on the concept and its purpose it can be variable in its styles. Varying from technical illustrations to more abstract and artistic. Animation is the simulation of movement, putting together various shapes to form the illusion of continuous motion.

Dyslexics struggle with short-term memory and comprehension when reading. Unable to visualise what the words they are hearing or reading mean. Through illustrations and animation, it is possible to visualise what the information is telling them without the need for a dyslexic to be faced the challenge of decoding what is being said:

> It can be particularly useful as a tool to encourage the creativity of students who find spelling and grammar a challenge, because it liberates them from the anxiety of always worrying about technical and enables them just to concentrate on the story instead (Bates, 2016).

Using illustration and animation to form a narrative reduces the risk of misinterpretation, but allows dyslexic students to fully engage and learn what the animation is actually teaching. Illustration and animation can be used as communication tool, and can be used to assist dyslexics and develop their skill set. Take the example of word and letter vibration; animations can demonstrate an issue a dyslexic is facing in their work. The animation can visualise what they are experiencing, which a dyslexic can instantly relate to. The animation would show a colour filter or ruler being used to stabilise the text, thus providing a solution to dyslexia related issue, showing the symptoms and solution in an animation that can be demonstrated quickly and coherently much more effectively than written word.

Sir Ken Robinson highlights that the current style of education being taught is not engaging and therefore not suited to children at school:

> They're being besieged with information and calls for their attention from every platform – computers, from iPhones, from advertising hoarding, from hundreds of television channels and we're penalising them now for getting distracted. From what? Boring stuff at school for the most part (Robinson, 2008, p.2).

Regardless of dyslexia and the age demographic, I believe this to be true to the majority of students and especially relevant to bad design. If a design is disengaging and aesthetically unpleasing, then a user is not going to fully absorb everything the design is communicating to them. Animation and illustration can communicate assistance in an engaging way.

6.4 - Platform

Platform refers to the format that the design elements are going to brought together and how it will be functional for students. Although the platform of the tool has been dictated by other design factors such as the use of animation for example, this means that it will not be a print design tool, as it does not facilitate this. However, there must be considerations into what is the most suitable, accesable and considerate of financial factors. These are important issues to understand so that my tool will not have the same issues as the existing tools and the ways in which universities currently provide their assistance.

The idea of accessibility concerns two main issues, the first is the process of gaining access to the assistance and funding that universities and the government provide. For the majority of universities, it is only possible for a student to gain funding and assistance when a professional has diagnoses a student as dyslexic. Only then will they be allowed access to the Disability Student Allowance. Only a minority of university are offering assistance and funding outside of the DSA, but these are few and far between. Diagnoses for universities is important is to ensure the correct people receive the assistance, but the main issue is that screening tests can cost a lot of money, becoming a financial barrier. A common way of diagnosing is through screening which are in the form of a paper/computer based series of tests, identifying characteristics that is common within dyslexics, but according to the British Dyslexia Association it is not 100% accurate (The British Dyslexia Association, 2016). This leaves potential for errors and missed opportunities to correctly diagnose a potential dyslexic. However, the main issue lies within the actual concept of a definitive test and does not fit

with the nature of dyslexia. Relating back to Sir Jim Roses paper, "Dyslexia is best thought of as a continuum, not a distinct category, and there are no clear cut of points" (page 33, 2009). Dyslexia is hugely ambiguous, complex and individual to each person, and does not lend itself to a yes/no answer.

Some universities provide screenings free of cost, meaning anyone could take it and possibly exaggerate attributes associated with dyslexia. In the initial research stage of this project, I was talking to dyslexic students at university, and meeting many students who had no previously had issues with traditional characteristics of dyslexia, nor do they necessarily feel they need the assistance when going through the screening process to gain free assistance and equipment. I present them with the question: "why have you decided to go through the dyslexia diagnosis/screening process when don't associate or identity yourself with any dyslexia traits?" The answer was consistent throughout, so they could reap the assistance and the DSA funding for tools, which they can spend how they see fit.

> What motivated me was after talking to them and hearing that the test was free I thought I would have nothing to lose other than time to go and see if I was and what I should change to assist me with my work. (Appendix 4, Student B).

Although it is easy to criticize these students for exaggerating their possible traits, nut the reality is that they are just taking a free test for the possibility of some sort of financial gain through free equipment, especially at the cost of university and equipment for particular subjects.

This leads onto the second issue of financial difficulties students face at university. Many articles and league tables show that 76% of all universities charge the maximum fee of nine thousand pounds a year (Brooks-Pollock, 2014). The students regard this as a potential lifelong debt whilst they also struggle with the cost of living as well as the need to buy

equipment for their courses. It may be argued that the reasons a non-dyslexic may try to get funding through the DSA is because university is so expensive now, students will take this test as they have nothing to loose with a possible financial gain.

Although diagnoses are necessarily to ensure the correct people receive DSA funding, it is evident that this method of diagnoses is not the most suitable for the dyslexia spectrum, and also relatively easy to exploit. The tool I have designed will not be limited to only those who have been professionally diagnosed. The assistance I will provide will be available for anyone to use and also beneficial for those who are not dyslexic, but in a format that is suitable for dyslexics and non dyslexics.

University B have ten-thousand students with approximately four hundred and fifty neuro-diverse students who are registered at the university. When asked about the usage of the facilities they responded, "It is certain not all the students registered with us" (Appendix 2, University B). This demonstrates that the facilities and assistance are not being fully used by those entitle to them. The underuse of these facilities is partially due to the cost of university, with students often needing to work jobs to cover rent, living costs and equipment, causing them to miss tutorials. A *Daily Telegraph* article, which covered the true cost of university, interviewed Sarah Thake, she says that in York the student loan does not cover the average rent, and is hard to survive without a part-time job or parents to financially assist (Ellis, 2012).

Therefore, students have to study and work at different hours of the day, which often conflicts with university staff and faculties working and opening hours. I asked fifty students in person and through social media, from all different universities around the country about their studying habits. Asking the closed question, when is the majority of their studying takes place, during university hours or outside them? Twenty-three of them said that they study at night/after hours. (Appendix, 5). Many universities are aware of the need for late night study

areas as they facilitate twenty-four hours a day study areas, libraries and learning resource centres, supporting a student's lifestyles. However, apply this situation to a dyslexic student who is entitled to one-to-one specialist tutorials and study groups, they will miss out as these are only in workday hours.

This could be the reason why funding for tools such as Dyslexie, Dragonfly and the colour filters is in place, to support students when they cannot get the human assistance. However, this leads onto another issue of the student's ability to identify which tool is correct for their specific issue. There is no clear pattern among universities assisting to identify their weaknesses and suggest suitable tools, it maybe included in the one-to-one sessions, however this is not clearly stated. This is why students tend to just get new computers rather than these more tailored tools to assist them, as they do not know what is the most suitable for them. Furthermore, in terms of budget, the cost of Dragonfly tool is expensive, although its functionality and form is suitable for dyslexic students the price is out of their budget. Although a computer costs more, it would be seen as better value for money and also more versatile in what it can be used for.

The current state of accessibility and funding for tools means that I had to consider my design to be:
- Financially feasible and considerate of a student budget.
- A service that is available twenty-four hours a day seven days a week.
- Does not draw attention to itself, a student can feel happy to use it wherever without feeling embarrassed by it.

My solution was to use a website as it allows me to include all the design elements I have discussed. Although I was considering a mobile app, a website is more diverse, as it is available on any device that has Internet. An app will limit it to mobile use, limiting screen size, and this may be problematic for some dyslexics. Furthermore, any students without a

smart phone or Internet access at home can use the university's facilities to access the site when they are working at their university campus.

The benefit of a website is that it has the option to combine all the forms of media I have discussed. It can also be as close to a one-to-one tutorial as possible without a human as I decided to include an interactive element, where there will be a series of filters relating to specific dyslexia issues and areas of university. The reason I decided to have both of these is that a student may be struggling with writing a project, but might not necessarily know what dyslexia issue is holding them back. They can click the relative option and that will filter some beneficial assistance to them. Allowing a dyslexic to tailor the needs at a given time, an attribute that makes one-to-one tutorials so successful.

I also want to make it Instead of having a contact page; there will be an option to 'share my story'. Acting in the same way as a contact page, but where a dyslexic can share a skill or method they have developed or something they feel has assisted them, which then can be looked at and potentially added to the site. The site will also share the other tools I have looked at throughout my research, to provide as much information to a dyslexic student as possible.

Lastly, the website will be free to use and cheap to maintain. If it were a physical tool it would be expensive to manufacture, hard to maintain and update. Furthermore, dyslexics struggle with short-term memory and producing a physical tool leaves the potential for them to lose it or it gets damaged. These are issues that are not a factor when it comes to a web site.

6.5 - Example of the design process (letter and word vibration)

The design process if ideation, designing, testing and developing in a loop until the designer sees fit can vary from each design and project. This process used the feedback from dyslexic

students to develop the tool and understand more about dyslexic students needs. The gif

demonstrates the issue and shows how to resolve it using colour filter and a ruler.
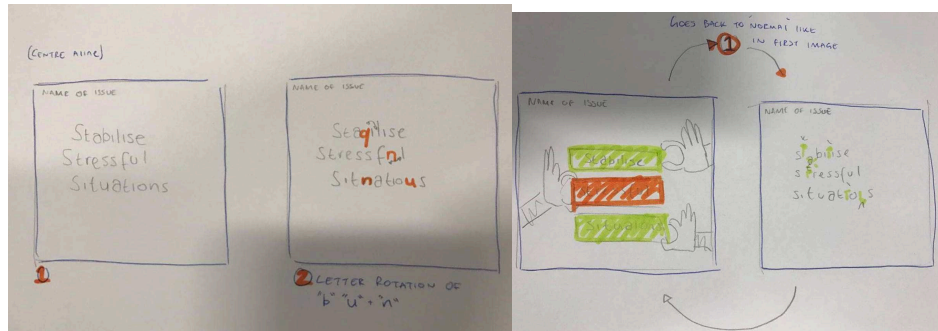

Fig. 6 and 7 Story Board

Fig. 8 Version One

Key feedback:

> Student 1 "It's clear to see what's happening, and recognise this to my own experience to
>
> some extent, but the way the letters move in just one area is untrue to my own
>
> experience" (Student 1, Q1, Appendix 6.1)

> "Feels cold and dull, I think this is mainly due to the colour pallet. The dark colours are
>
> boring and the movement doesn't engage me, although I recognise it as my own

experience it doesn't have any visual appeal to me what's so ever." (Student 3, Appendix, Q2, 6.1)

Positives:

The animation made clear the issue of character movement and how to assist it. (Fig. 8)

Negatives:

The bold style was to praise, however students felt it was over simplified and flat. However, the most concerning criticism was that they felt the dyslexia experience was not necessarily true to their own. Particularly how word vibration would not only happen to one line, letter rotation and word vibration are usually separate rather than all at the same time. (Fig. 8)

Fig. 9 and 10 Version Two

Changes:

The style was developed, adding detail with a expanded colour pallet. The gif was split into two parts, the first would show letter rotation where rulers would fix the issue, the second would show letters jumping around where colour filters would assist the issue. I 'left aliened' the words, as it is closer to the reality of what would be in a textbook closer to the student experience. I also introduced 'easy-ease' a tool used to make the animation run smoother.

Key feedback:

 "I notice you have added a lot of little gimmicks and things, and not necessarily fit with this space theme. But all of these components and the playful movement of the letters seems a little childish and something I would see on Cbeebies. Which is a shame, because the hands style looks so much better than the first time you showed me. Again this reiterates my point this is too much style and not enough consideration" (Student 3, Q2 Appendix 6.2)

Positives:

The style was much more enjoyed; the lighter background allows for more clarity whilst the bold colours are engaging but work well together.

Negatives:

The second half of the animation demonstrated word vibration, but in this version they bounced around interacted with each other in a much more fun way. However, the students felt it was slightly childish as it seemed the letters were 'playing around', but they also said it was again not entirely true to their experiences. It was more of a smoother transition and loss of line clarity.
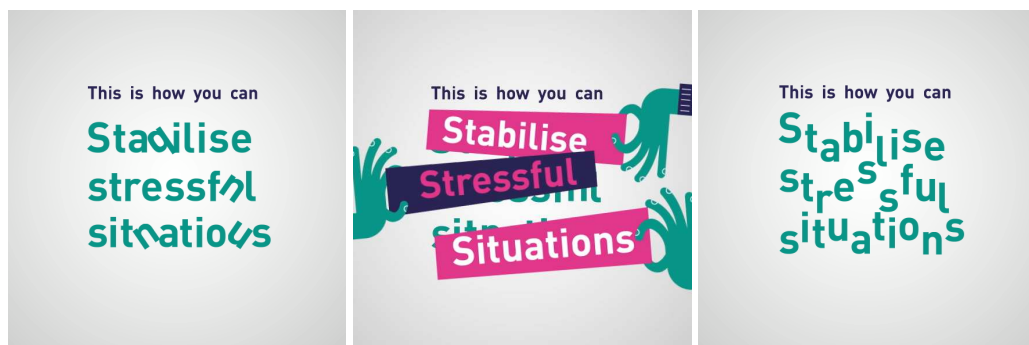

Fig. 11, 12 and 13 Final Version

Changes: The word vibration is as close as I could get it to the descriptions the provided in the feedback (Fig. 13). Additionally, I removed capital letters from each line making it as close to reality as possible (Fig. 11 and 13). Lastly, I have given a slight grey gradient, to give the letters less of a contrast like the colour filters to make readability as user-friendly as possible.

Final Review:

> "I know I have been very critical of the word vibration, but this is spot on. The time between transitions in this visual really help me understand this issue, what's happening and how to fix it." (Student 3, Q1, Appendix 6.3)

> "Clear and more precise. I looked into this myself and the way it can move can be different from person to person. However, the example in this latest gif I think if the smoothest and coherent one." (Student 1, Q1, Appendix 6.3)

I believe the biggest success of this gif was the fact it was instantly recognisable of a dyslexic issue the students could relate, without the need of large amounts of text. Although I feel the gif is limited in terms of working with the metaphor of space used throughout the design, but it is consistent with the rest of the style. I feel it does reach the primary objective of communicating assistance, and from the students feedback, it does this is an enjoyable and suitable way.

Link to final Design:

www.interspellar.com

7 - Conclusion

This thesis used practice-based research to develop a tool that assists and allows dyslexics students to reach their potential. The research stage in the design process allowed me to

answer key research questions about the various definition of dyslexia, understanding the multiple views of dyslexia, revealing that there is a conflict of views even within the trains of thought. Research on the university revealed more answers about the provision by universities, but also insight into the issue's students face gaining access and obtaining assistance in the form of human and tools. Showing that universities are dictated by government sanctions, both identifying dyslexia as a 'specific learning disability', causes majority of the assistance unsuitable for dyslexic. Theory and questions answered by dyslexia specialist one, shows that one-to-one tailored assistance is key for dyslexics development, deeming this attribute necessary in any form of design for dyslexics. Understanding these success and failures of the tools and assistance allowed me to understand what is suitable for the demographic in terms of practicality. Furthermore, utilising the successes of these tools and assistance and including them in my own design.

One discovery my research has revealed is that bad design can be not only frustrating to use, but actually limit a dyslexic in developing and utilising their positive attributes. Referencing to Don Norman explanation of how beautiful design allowed for an enjoyable user experience, this allows heightened ability to 'think outside-the-box' and tackle problems. Creative and out-the-box thinking are what the secondary view of dyslexia theorists explain is an attribute possessed by dyslexics and used to overcome and work around their dyslexia. This insight shows that it is not only important for the design of a suitable tool to be enjoyable aesthetically, but is vital for a dyslexic user as it encourages dyslexia positive attributes. Once this new idea was applied into my own design it demonstrated that using the secondary view of dyslexia (as a different way of thinking) then the designer is not trying to 'fix' an issue, but utilise a dyslexics quality.

Whilst the first key finding highlights how to benefit dyslexics in a unique way the second key finding was a negative representing the misunderstanding universities have of students and dyslexia. Revealing the frustrations of accessibility to receive assistance because of

unsuitable and costly diagnoses test, the inability to attend one-to-one tutorial because of other commitments and the out pricing and lack of understanding of what tool is for them. These really benefited the development of my tool as it revealed key elements that my tool needed to be, and led me towards a self-tailored website which is accessible at all times. The design outcome in this project was designed in a way that is fully accessible for dyslexic students whenever they are studying and whenever they need assistance, which is not like many existing tools. As mentioned previously it does not try to fix problems, but address possible solutions, one which are suited to a dyslexics abilities and encourages their positive attributes of creative, curiosity and out the box problem solving.

The greatest limitation of the research is that the original universities contacted did not answer any of my questions, which meant I had to rely on student experiences and other literature to understand the assistance at university as well as the tools. Not giving me as many quantitative figures to help back up my research. Although I believe the alternative route I took in this research is sufficient and has still provided some valuable information in how to design for dyslexics and also revealing dyslexic.

Overall, the tool I developed utilises the best design practise is when designing for dyslexics. It is evident what definition the designer/university uses to define dyslexia shapes the whole design/style of assistance. However, if the secondary view is used, it is more likely to function as assistance in development rather than quick fixes that do not necessarily develop the dyslexics skill set. I argue the government spend too much money on funding assistance for dyslexics when one-to-one are the most beneficial. I believe more funding should be put into developing properly designed tools, as it will help dyslexic's careers and future. Having fifteen percent of the population dyslexic, but understanding their dyslexia and knowing how to utilise the positives could mean for some creative solutions in the future, including in their profession.

8.1 - Appendix:

1. Responses from semi-structured questions with Dyslexia expert one:

Question 1: How do Dyslexics creative thinking process?

"Sometimes I wonder if the different 'thinking process' is less innate than taught. In working with many children who do not show dyslexic traits alongside those whom do they both seem to make progress. They each recognise/adapt/consolidate their learning styles to reflect approaches that 'work' for them. Often the approaches followed are normally considered those to be used with dyslexic students. Hence the mixed group suddenly begin to make progress in reading, spelling and subsequently writing. (Probably the same is for maths issues - not my strength as a practitioner!) With that comes a growing confidence and an ability to adapt and develop around issues. Making appropriate life choices as regards education and then 'the sky is the limit'!"

Question 2: How does this ability to 'recognise/adapt/consolidate' benefit a dyslexic?

"I believe they have a 'power' - an enthusiasm to persevere: a motivation to succeed. This in my experience of 25 years working with dyslexic pupils in particular (work with Suffolk and Norfolk Children's Service and or course, privately), is often the case. I suppose you would be a case in point - as, quite differently, one student I have who now finds a niche in practical industrial work. So, whether at interview or in the workplace already, an employer may seek out and recognise that steely determinism we often find with academically successful (minimum 5 GCSE at 'c' grade) dyslexics."

Question 3: What is the best way to assist dyslexics?

"It may be worth you spending a hour or so pondering just how we organise education today. Paving aside curriculum, it is still in classes/groups in institutions we call 'schools'. What is the definition of school? We have one or more adults in control of this group of learners - teaching all at the same time with, today, more differentiation than previously and with more awareness of the learners. But, it is basically the same approach we used two hundred years

ago! Was this always the case, is teaching a group the best? There is some evidence from art to suggest that seven hundred years ago, teachers took a different route - one that was more individual. Think for a moment of how we worked together - 1:1 with specific targets over a period of time. I am curious by this general acceptance of the 'school' as an unquestioned institution. Does this 'organisation' work to the best interests of our children and in particular those with specific learning difficulties. It is out of this accepted organisation that we find our 'designers' doctors scientists and teachers?"

2. Responses from the universities in regards to (1) What assistance, facilities and tools are provided for the dyslexic students? (2) Does the assistance you provide all come under the Student Disability Allowance? (3) Are all the facilities/assistance available for dyslexics well utilised?

University A:

"For the majority of students, their dyslexia support at *University A* is dictated by their Disabled Students' Allowance and the recommendations made in their Assessment of Need. This commonly includes one-to-one study skills tuition with a dyslexia specialist, the provision of assistive technology and training in its use, and sometimes allowances for printing or books, or the provision of a note-taker. However, the support offered through DSA is currently under government review, as I'm sure you are aware. At this institution we provide study skills tuition through an in house team and students can book as many sessions as they need, up to the level specified in their DSA. Some dyslexic students attend a weekly appointment (usually an hour) but the majority access these sessions on a more ad hoc basis. Some students don't use the service at all; it varies enormously. In addition, we offer appointments via Skype or telephone, we have a study area that students can use in our centre, we arrange exams access arrangements, provide cover sheets for coursework (to let markers know that a student is dyslexic), make special library arrangements for students and liaise

with academic departments about reasonable adjustments. Some students access note-taking or mentoring services, the latter usually only if they have additional disabilities."

University B:

"Thanks for your recent enquiry regarding the support provided to students with dyslexia at the *'University B'*. We have ten thousand students with approximately four hundred and fifty neurodiverse students who registered as such on starting their education. The majority of students here use what is available, but It is certain not all the students registered with us. We offer a wide variety of support to students with this specific learning difficulty, and the assistance and supports put in place will vary depending on the individual student's needs. However, these measures can include the following 1:1 assistance: Provision of proofreading support, regular sessions (usually up to 10 hours) with a Specific Learning Difficulties Tutor, who can help the student to develop skills, strategies and techniques to minimise the impact of their difficulty on their academic studies. In addition, students typically receive support from the University in the form of adjustments, which can include the following: This student has specific learning difficulties. He/she should incur no penalties for poor spelling, grammar, punctuation and structure in examination scripts, unless these are being directly assessed and are core to an understanding of the course. This adjustment should also apply to take home exams. Extra time in exams (usually 25%, though occasionally 33%) Student requires prior sight (15 minutes) of the paper for the purposes of reading and highlighting. Provision of a standard pc in all examinations. Tasks to be broken down into smaller chunks. Provide double loan time on short loan and reserve books. There are numerous other adjustments that could also be recommended, depending on the individual student's needs and course of study. Finally, students from within the UK are eligible for funding – Disabled Students' Allowance (DSA) – which can cover the cost of 1:1 support, such as proofreading, SpLD tuition or equipment, that students may need to reduce the impact of their condition on their studies. This equipment may include the provision of digital audio recorder, relevant software (such as text to speech or voice recognition) or a range of other

assistive technologies. Non UK students, who are ineligible for DSA, receive equivalent support either via loans of equipment or by the University covering the cost of their 1:1 support. The Student Disability Service at the *'name of university'* is a validated assessment centre and so can assist students to apply for this funding. However, no support (reasonable adjustments, 1:1 support or DSA funding) can be recommended without relevant evidence.

University C:

"As we have a high percentage of dyslexics in our student population, we offer assistance outside of the DSA in the form of free drop in sessions and study groups to help address and develop particular skill sets The university offers a range of help for dyslexic students, including scribes, one-to-one sessions with on campus experts and a range of group sessions. The DSA entitles students to a budget to funding towards technology to aid them independently, and one to one tutorials with specialists, in which encourages tailored learning."

3: Dyslexie font test:

Lecture A: "The feedback was generally negative due to the way it looked. In fact, some students actually said it was more of a distraction. There was a lot of dislike for the inconstancy for its strange shape. One student even questioned why the font was being used before I asked for feedback."

4. "Why have you decided to go through the dyslexia diagnosis/screening process when don't associate or identity yourself with any dyslexia traits?"

Student A: "It started off as a rumour in the first couple of months of uni that you can do a test and get a free mac. After a couple of my classmates did the test and got a lot of free and very useful things like a macbook, printer, book credits etc, I decided to give it a go. Sent a

form to the dyslexia department and they sent me a questionnaire back on which it was blatant that they have no way of knowing your condition. Therefore, your answers could be very exaggerated in favour of the Mac. I sent it back and got a response which said that it is very likely that I have a case of dyslexia and I should take a real test for which I'll have to pay. However, at that moment I have already received my desired laptop from my parents and lost interest and pursuing the one from uni."

Student B:

"Well actually even though I hadn't been diagnosed I had spoken to other people with dyslexia and realised I had a few similarities to them. What motivated me was after talking to them and hearing that the test was free I thought I would have nothing to lose other than time to go and see if I was and what I should change to assist me with my work. The support equipment was very inviting and is how I obtained my IMAC, an essential piece of equipment to my course."

5. Do you use the university study facilities such as study areas, libraries, Learning resource centres, in the hours of 9am to 5pm?
Results: Yes 23 / no 27

6.1 First round of feedback on development of design tool:
Question 1: From looking at this visual, does this help you understand/ assist your dyslexia?

Student 1 "It's clear to see what's happening, and recognise this to my own experience to some extent, but the way the letters move in just one area is untrue to my own experience"

Student 2: "Yes, it's quite self explanatory, but is there any other solutions though other than a ruler?

Student 3 "I can identity the moving words to my own experience, although it is not exact, I can defiantly relate it to my own experience."

Question 2: At what point do you feel board looking at the design?

Student 1: "I like the visual of space, I think that's a good idea for the style, just seems a bit robust and lacking something though. Perhaps its just the style and movement of the animations. If the theme is space, don't make it still make it a more sci-fi view of space."

Student 2: "I like the animation, but I would like to see it more than once. Instead of keeping on clicking on it to play again."

Student 3: "Feels cold and dull, I think this is mainly due to the colour pallet. The dark colours are boring and the movement doesn't engage me, although I recognise it as my own experience it doesn't have any visual appeal to me what's so ever."

Question 3: What would you change?

Student 1: "Make the word vibrating more accurate to a dyslexic's experience, so I can know I'm looking at the right assistance strait away.:

Student 2: "I'd like the video to be longer so I can engage with it for a longer period of time without having to click play again."

Student 3: "For me, just make it more interesting. It does its job, although the moving letters and words aren't exact, but my biggest issue is with its so slow and almost lifeless all-round style."

4.2: Second round of feedback on development

Question 1: From looking at this visual, does this help you understand/ assist your dyslexia?

Student 1: "Again, this is probably further from my own experience as it's not really showing what happens for me. Although they move, it's not in this manner."

Student 2: "I'm happy you listened to my feedback in other ways besides the ruler. The colour filter now makes sense to me why I see it on dyslexia websites! The solutions in this are great, and the copy you have added just comments that."

Student 3: "No, this is not how it looks for me when words move on a page. The solutions are clear, but the example is more visual than factual."

Question 2: At what point do you feel board looking at the design?

Student 1 "There is a lot of movement, the little circles and stars that are moving around the words slightly distracts me from the vibrating words and solution with ruler. Although their quite enjoyable to watch!"

Student 2: "The loop of the gif is much better, I can keep watching it and if I don't necessarily get it, I can just watch it a few more times before my brain makes the connections. Having said that I think this is really clear and I know exactly what to do if I see letters rotating."

Student 3 "I notice you have added a lot of little gimmicks and things, and not necessarily fit with this space theme. But all of these components and the playful movement of the letters seems a little childish and something I would see on Cbeebies. Which is a shame,

because the hands style looks so much better than the first time you showed me. Again this reiterates my point this is too much style and not enough consideration"

Question 3: What would you change?

Student 1 "Slightly diel back that extra moving elements, I enjoy them, but the current quantity of them is distracting. I think the style is better, but it needs focus on the letter and word vibration and movement."

Student 2 "I don't really know, I really like it and think it's a much better way of figuring out a problem and then having a solution right after."

Student 3: "The word vibration needs to be accurate. I think the style of it has improved, nevertheless I still think there is an imbalance of style and substance."

4.3: Third round of feedback on development of design tool:

Question 1: From looking at this visual, does this help you understand/ assist your dyslexia?

Student 1: "Clear and more precise. I looked into this myself and the way it can move can be different from person to person. However, the example in this latest gif I think if the smoothest and coherent one."

Student 2: "The way of assisting the word vibrating is powerful and the examples of letter rotation are good, although in my experience never had an issue with letter rotation."

Student 3: "I know I have been very critical of the word vibration, but this is spot on. The time between transitions in this visual really help me understand this issue, what's happening and how to fix it, well done!"

Question 2: At what point do you feel board looking at the design?

Student 1: "After it has looped about three or four times. Its very much enjoyable to look at, much more than any other assistance for this that I have come across before."

Student 2: "This is great, the loop almost grasps my attention longer than it should! The colours also are well defined, and clear. Looking forward to seeing the rest of these!"

Student 3: "It's not a boring design if that what you mean, there is good balance here though. I don't feel overwhelmed with moving parts, instead tis clearly visualised for me in an almost cute way."

Question 3: What would you change?

Student 1: "Maybe the fingers could move, like, let go of the colour filers and move away?

Student 2: "Not a change, but I would like to see how it fits along side the other visuals and how it works as an overall tool, instead one part of the whole thing. But I understand this is what you're working towards!

Student 3: "Maybe remove the grey background and just have it white? Its no real concern though and is not off putting if left with grey. No other changes you have addressed the main concerns I had."

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