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Dyslexic Notation: Combining Aesthetics and Scientific Notation to Combat Dyslexia

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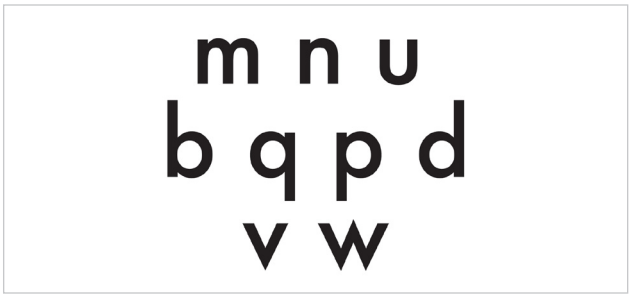
ABSTRACT Dyslexia is a learning disability that plagues five to ten percent of the world's population, this translates into approximately 684,050,700 diagnosed cases.[1] Dyslexia cannot be alleviated through a simple treatment, instead it requires years of educational support to help a child overcome their disability. What is most unfortunate is the fact that over sixty-three percent of dyslexic patients appear to have a higher than average IQ, yet they are held back from achieving full potential by this curious malady.[2]

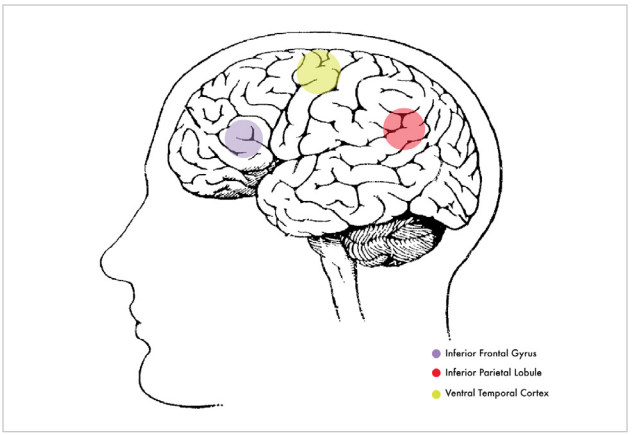
Through the exploration of written symbols, particularly in the formal area of typography, we have pursued a solution that would be readily accessible and implementable as we addressed the two major types of dyslexia. Our goal was to investigate and generate something effectively informative—in the sense that it would be able to help a great number of people—however, we were also looking to leverage the artistic side of experimental typography toward that aim.

INTRODUCTION

Dyslexia, also denoted to as Developmental Reading Disorder,[3] refers to a broadly defined learning disorder whereby the patient has impaired ability in reading and writing. The term encompasses subject areas including phonological and orthographic coding and recognition, as well as a poor auditory short-term memory.[4] Dyslexia is a much larger and loosely defined condition than the common perception of "merely reversing letters." Dyslexic patients typically have difficulty with rhyming, rapid naming, and other sound recognition tasks as well as the well-known symptoms of letter reversal and word-shape recognition difficulties.[5] The IQ of a patient has no correlation to dyslexia, in fact, quite often patients have average to above average IQ's. Accomplished adult dyslexics are able to overcome the disorder, however, it's found that their abilities come less quickly than those without the disorder.

The most accepted classification of Dyslexia is that it





encompasses three subtypes: Dyphonetic and Dyseidetic. Dyphonetic refers to a type of dyslexia where the patient has difficulty connecting sounds to symbols whereas Dyseidetic refers to a subtype of people who have a grasp of the phonetics but have difficulty with spelling and letter recognition. Currently there's a large amount of research being carried out with the findings culminating in description or casual theories. According to the National Institute of Neurological Disorders and Stroke dyslexia is defined thusly:

> *"Dyslexia is a brain-based type of learning disability that specifically impairs a person's ability to read. These individuals typically read at levels significantly lower than expected despite having normal intelligence. Although the disorder varies from person to person, common characteristics among people with dyslexia are difficulty with spelling, phonological processing (the manipulation of sounds), and/or rapid visual-verbal responding. In adults, dyslexia usually occurs after a brain injury or in the context of dementia. It can also be inherited in some families and so on, and recent studies have identified a number of genes that may predispose an individual to developing dyslexia."*[6]

Typically, dyslexia is diagnosed early in childhood. Tests for dyslexia consist of questionnaires, psychological observations, academic tests, and neurological tests. There is no definitive way to identify dyslexia. Physicians typically screen the patient for other visual or hearing impairments beforehand in order to rule out a misdiagnosis. There is strong evidence to show that dyslexia is a genetic disorder passed down irregardless of the child's gender.

In distinguishing Dyphonetic Dyslexics the phonologic piece of the persons brain has malfunctioned.[7] Dr. Sally Shaywitz, in her book *Overcoming Dyslexia*, states that, "Before a word can be identified, understood, stored in memory, or retrieved from it, it must first be broken down into phonemes [individual sounds] by the neural circuitry of the [phonologic module] (2003, pgs. 41-42)." [8] Research has not definitively found this module in the brain, which is why treatment is typically therapy based and supplemental to already existing education methods.

Dyseidetic dyslexia is characterized by the inability to visualize the whole word or specific letter. This problem arises when there is a failure in the back left side of the brain where linguistic code is stored. People facing this disorder don't have as much trouble with phonetics therefore they are able to sound words out and commit their meaning and spellings phonetically to the mind. When it comes to words that aren't spelled phonetically, such as *want*, *what*, *the*, *does*, or *was*. These words, typically referred to as *sight words*, don't allow the person to apply sound-symbol strategies to sound them out as well as their general shapes are similar making it difficult to remember. The idea remains true for mixing up letterforms as well. Forms that are similar in shape often are misinterpreted for their counterparts, such as *b* and *q* or *u*, *n* and *m*.

A common misconception when looking for signs and symptoms of dyslexia is that all dyslexics write their words in backward fashion. This, however, is found in only a small population of dyslexics, for the majority of others when this symptom is manifested it occurs only in select occasions.

Typically, in early ages, dyslexia may easily be mistaken for A.D.D. or even low intellect.[9] Early symptoms that correlate to diagnoses of the disorder are: delays in speech, letter reversal or mirror writing, and easily being distracted or frequent headaches when trying to accomplish tasks relating to literacy. As they get older, dyslexic patents, have trouble rhyming or separating words out into syllables, as well as combing sounds to create words both in speech and writing. What is common is a poor grasp of spelling, yet this must be looked at in conjunction to the other symptoms. A dyslexic will quite often omit or add letters when writing. It is during speech that the rotation of characters becomes a problem.

NOTES ON RESEARCH AND TREATMENT RESPECTING DYSLEXIA

It is noted that theories surrounding the cause of dyslexia must be taken in stride, such theory serves as a set of perspectives when trying to discuss common symptoms. Dyslexia has never had a true cause cited. With each generation of researchers information concerning the cause of dyslexia builds upon itself and theories are evolved, fade in acceptance, or are newly proposed.

Genetic research into dyslexia has its roots in autopsies of the brains of people with dyslexia.[10] When observing the anatomical differences between a dyslexic patient and a patent with good reading skills it was noted that there were like malformations in the language center of the brain. What was found were ectopias and, not as often, vascular micro-malformations.[11] In some patents micro-gyrus malformations were found which is an area of the cerebral cortex that includes only four cortical layers rather than six. This is believed to be, in part, due to a lack of prenatal development.[12] It must be stated that this was found in only a few of the patents. However, that being said patents who were found to have reading difficulties manifested a clear structural difference in their brain when using modern MRI scanning. The deficit is found to have origins in the left hemisphere of the brain specifically in the inferior frontal gyrus, inferior parietal lobule, and middle and ventral temporal cortex.[13]

Current treatment for dyslexia involves the management for the problem. There is no cure for dyslexia, but dyslexic individuals can learn to compensate with the appropriate educational support.[14] What's found most successful are programs that are tailored specifically to the patient. A simultaneous multisensory approach is necessary due to the fact that the problem is tied to phoneme recognition. Overall there is little empirical or quantitative researching supporting the use of any particular problem. Most all dyslexic persons grow to overcome the disability.

THE ALPHABET AND DYSLEXIA

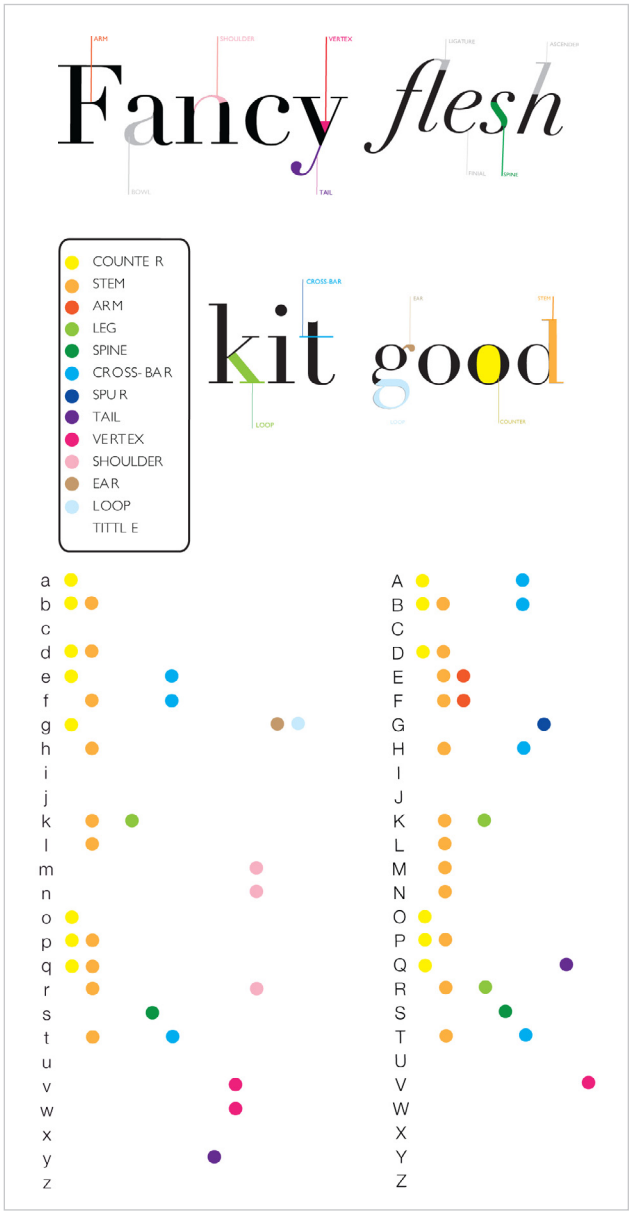
In 1950 Bradbury Thompson proposed a simplified plan for representing then Latin alphabet. He was inspired to do so after watching his son experience difficulty between recognizing similar words. He called the simplified

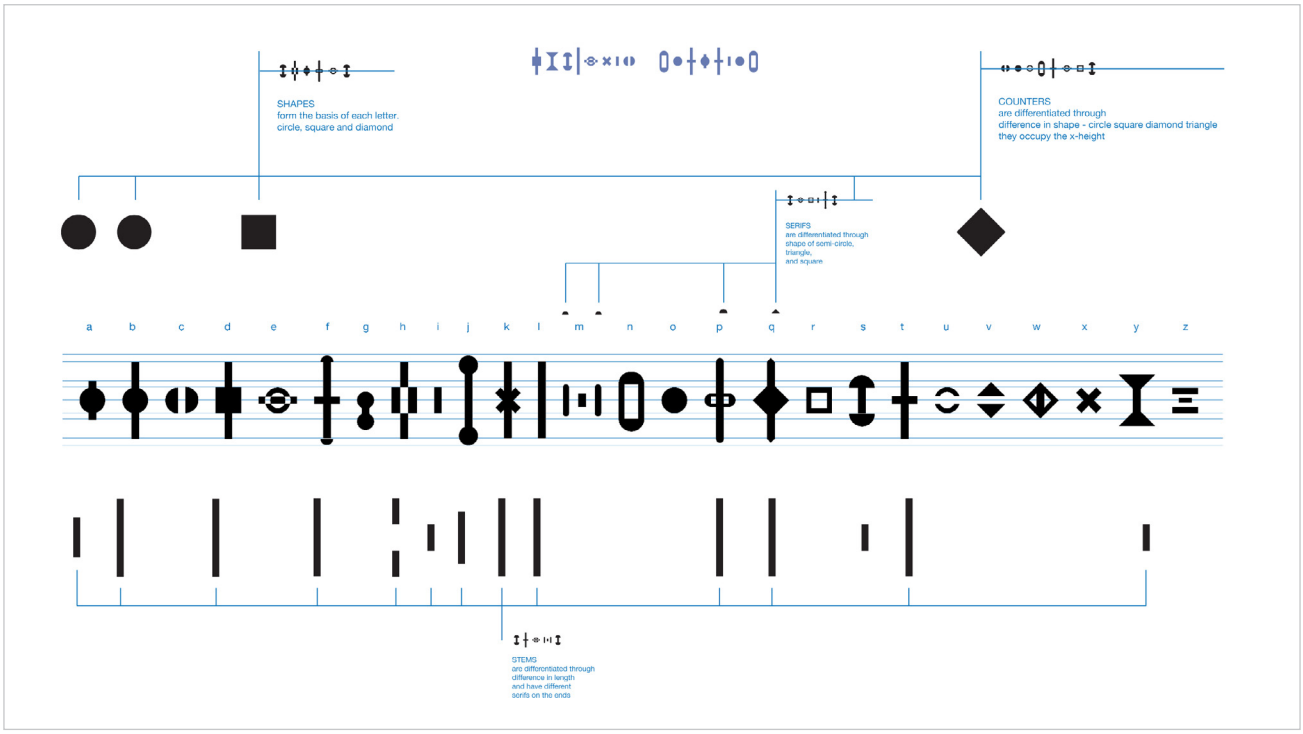
every uppercase and lowercase option into a single element representing each letter. Alphabet 26 does not, in itself, address dyslexia, however, a simplified alphabet helps to get rid of any discrepancies between matching phoneme's with their corresponding letter. Noting that our current alphabet contains nineteen discrepancies between upper and lowercase letters, As noted, Thompson designed Alphabet 26 around the idea that there would be one letter shape for each corresponding sound. Based upon his own theory that a graphic symbol must be consistent to be efficient, Thompson designed Alphabet 26—a font system made up of only 26 upper and lowercase characters typeset in Baskerville. He kept the lowercase version (and discarded the uppercase version) of the seven characters of the alphabet that are the same across cases—**C**c-**O**o-**S**s-**V**v-**W**w-**X**x-**Z**z. Of the remaining 19 dissimilar characters of our alphabet, he kept the uppercase version of them—**B**b-**D**d-**F**f-**G**g-**H**h-**I**i-**J**j-**K**k-**L**l-**P**p-**Q**q-**R**r-**T**t-**U**u-**Y**y—and the lowercase version of four—**A**a-**E**e-**M**m-**N**n. This system helps to simplify the task for early learners and aids dyslexics in the sense that it makes memorizing phoneme to the corresponding shape easier. It doesn't solve the problem entirely for dyslexics when it comes to differentiating the shape itself.[15]

DEVELOPING THE SYMBOL SET

Our objective was to solve a problem focused on informativeness yet underpinned by aesthetic directives. The authors constructed a typeface to combat the problems of dyslexia. The result, though driven by an informative objective, admittedly was highly expressive as rendered.

The basis for our creative effort was the metaphor that dyslexics view characters as three-dimensional shapes. This way our characters seem to have an organic stature to them. The English language is almost fifty percent redundant with the typeface we carried that redundancy over to the letter itself so that even if confusion does occur that characters are still easily distinguished.





We began by looking at current letter's aesthetics, ears, counters, loops, spines, and so on and so forth; essentially, we wanted to consider the smallest features that composed each letter. Through this process we distinguished which letters had which "architectural" aesthetic. We determined how frequently each component piece occurred in the language. With this information we were able to simplify the most frequently occurring aesthetic elements.

The resultant system, i.e., the structure which we used to display the composite components, is a tri-partitioned horizontal column. (akin to simplified version of what is used for musical composition). Each of the three horizontal columns has a slight gutter between each column, or segment. The center segment being the x-height with a sixth of the x-height's space as a gutter for "serifs" some letters contain for further discrimination. The next two are on the top and bottom and are the same size as the x-height with the same allocation of gutter space. This allows for the core of the letter to be symmetric and having the embellishments, such as ascender, descender, and serifs, to flow from top to bottom in whatever manner the perceived gravity is flowing.

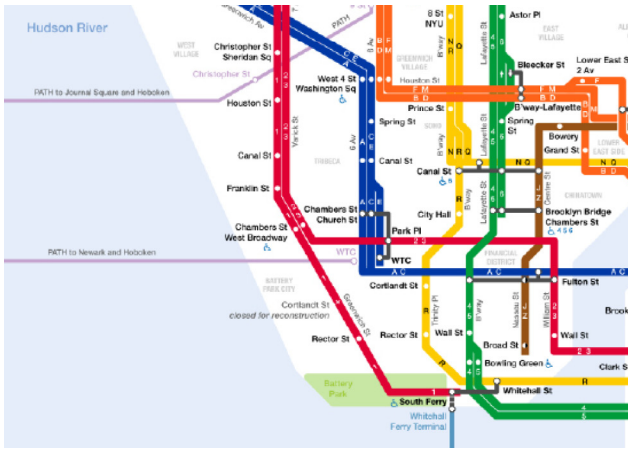
Each letter is built primarily out of a simple shape, circles, squares, or diamonds. With this method the alphabet becomes highly graphic and illustrative allowing for easy recognition in childhood and a simplified, cohesive beauty over all. The basic shape allows the letter's core to be symmetric from all sides as well. If a dyslexic individual shifts the character in any direction the core will be recognizable from all sides. Compensation was made for the fact that a square may be perceived as a diamond when rotated. This was addressed in the use of counter-space and serifs.

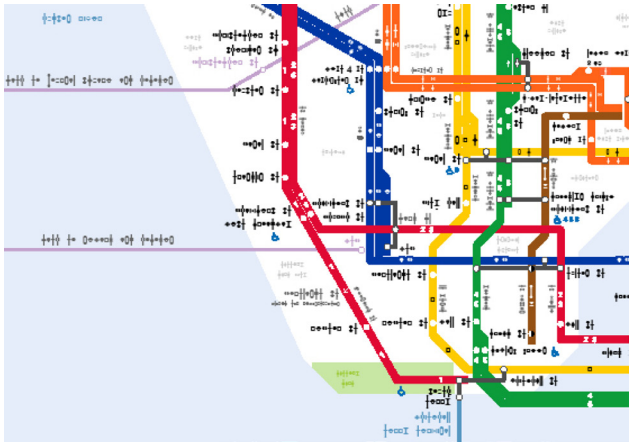
The second simplification developed is the use of top, bottom symmetric ascenders, and descenders. The stems act as both ascenders and descenders stretching through all three sections of spacing. This one directionality acts as a method to prevent the dyslexic person from viewing a square as a diamond. All shapes that would be easily confused with another shape are built with a stem.

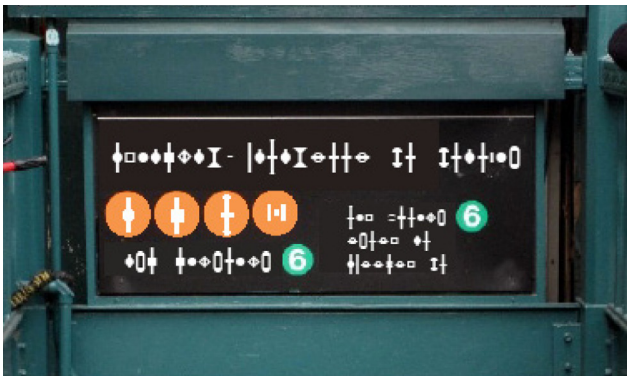
For the more complex letterforms our counters were creative to be extremely graphic. Counters, just as stems, are viewable only from one direction. When the letterform is shifted the counter prevents confusion between simple shapes and mimics the 'flow of gravity'.

At first glance the unfamiliarity of the typeface overpowers its ability to communicate. Particularly for those already accustomed to the Latin characters. To combat this each character is built to mimic the letter that it represents in the English language. Since the face is derived from an already existing language it was redundant to invent new phonemes rather it was constructed with the existing form in mind. The alphabet allows for a large amount of space between characters while still remaining cohesive as a word, which lends itself greatly to teaching to children.

This typeface may not be the final solution for dyslexia but it can be a very helpful learning tool when beginning to develop language skills. Each letter takes only one form lending itself to easy memorization of different sounds to letters. The characters are redundant within themselves preventing any discrepancies in mixing up letterforms. The highly graphic typeface address the two majors forms dyslexia can take and comes up with a solution that maintains a sense of artistic integrity along the way.







NOTES

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