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SANTA CRUZ

Neither Contradictory Nor Coincidental
Finding Strength in Cognitive Abnormalities

A thesis paper submitted in partial satisfaction
of the requirements for the degree of

Masters of Fine Arts

in

Digital Arts and New Media

by

Laura Stevenson

June 2019

This Thesis of Laura Stevenson is
approved by:

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Lori Kletzer
Vice Provost and Dean of Graduate Studies

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2019

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ABSTRACT

NEITHER CONTRADICTORY NOR COINCIDENTAL

BY LAURA STEVENSON

The *Diagnostic and Statistical Manual of Mental Disorders,* Fifth Edition defines dyslexia as "a pattern of learning difficulties characterized by problems with accurate or fluent word recognition, poor decoding, and poor spelling abilities" (67). Few, however, understand the complexities of its neurologic make up or recognize the key strengths with which dyslexia is associated. Because of this, the current education system tends to cater to non-dyslexic students and often prevents dyslexic individuals from reaching their full potential. The purpose of this paper is to describe the cognitive benefits of the dyslexic processing style and reveal the ways in which the public school system fails dyslexic students. Toward this purpose, this paper examines responses to qualitative interviews collected from various sources and discusses recent findings in neuroscience and educational psychology. *Neither Contradictory Nor Coincidental* is an interactive video installation aimed to raise awareness around this issue. The piece includes audio from interviews with twenty dyslexic individuals and a transcription of each. By placing text in a three-dimensional environment the piece highlights the dyslexic mind's strength in processing three-dimensional material. While navigating the piece the viewer is able to experience how challenging it is to interpret written information in an environment far more suitable for three-dimensional elements, which is precisely why dyslexic individuals struggle to read. Broadly speaking, the piece is aims to shift the stigma

that accompanies dyslexia, and reveals the harmful effects of the public education system can have on dyslexic students.

DEDICATION

To my grandmother who sent me the book that changed my life, *The Dyslexic Advantage*, to my parents for their unwavering support, to my ninth-grade self, to my fellow dyslexics and to all students who hate popcorn reads as much as I do.

ACKNOWLEDGEMENTS

I would like to extend a huge thank you to my committee chair, Sharon Daniel, for her invaluable guidance and support over the past two years, and to my committee members Warren Sack and Dee Hibbert-Jones for their insightful feedback in the creation of this project. Thank you to all DANM faculty, administrative and technical teams, and finally, to the DANM cohort of 2019.

INTRODUCTION:

In his speech, *The True Gifts of The Dyslexic Mind*, Dean Bragonier reveals several statistics about the dyslexic population. He explains that dyslexic men and women make up 10 to 20% of the population. Disproportionately, 70% of youth in Juvenile Hall facilities and 50% of adolescents in rehabilitation for substance abuse are dyslexic. Simultaneously, 1 in 2 NASA employees, 40% of self-made millionaires and 35% of entrepreneurs are dyslexic and on the MIT campus, dyslexia is colloquially referred to as the "MIT disease" (00:7:15-00:08:40). These numbers clearly demonstrate both the potential of the dyslexic mind, and the unfortunate consequences that may follow a dyslexic student's limited access to appropriate support and information regarding their learning style.

With recent findings in neuroscience and educational psychology it has become clear that there are strengths associated with dyslexia that can be applied to many high demand occupations in the fields of entrepreneurship, engineering, architecture and the arts (Bragonier 00:02:00-00:02:10). Unfortunately traditional classroom practices tend to overlook dyslexic strengths and magnify dyslexic weaknesses. Furthermore, most educators lack foundational knowledge of dyslexia (Washburn 6) and in many cases, are reluctant to suggest an evaluation due to a lack of resources for dyslexic students (Hanford 00:11:30-00:11:40). As a result many dyslexic individuals go undiagnosed. Because of this, students tend to struggle with low self-esteem and depression, which often leads to juvenile delinquency (Pryor-Kowalski 22). Given the massive contributions dyslexic individuals have made to the

fields of business, engineering, and the arts, it is in society's best interest to help individuals with dyslexia succeed in school and pursue vocations in which they are likely to excel.

Neither Contradictory Nor Coincidental is an interactive video installation that illuminates this problem. It places planes of written language in a three-dimensional environment, to emphasize the difficulty of interpreting two-dimensional symbols in an environment more suitable for three-dimensional material, which is one of the reasons dyslexic individuals struggle to read. By including the voices of twenty dyslexics, the piece is intended to provide viewers with a well rounded understanding of dyslexia and demonstrate why disadvantaging dyslexic students is a disservice to society. By extension, it encourages the audience to look at all non-neurotypical minds through this framework, questioning what strengths are found in cognitive abnormalities, rather than viewing these abnormalities as something to be corrected.

HISTORICAL CONTEXT:

COGNITIVE DISABILITIES AND ART:

Though dyslexia remains an untapped theme in the world of contemporary art, artists with disabilities have been creating work to portray unique perceptions of the world for years. The use of three-dimensional virtual environments as a medium for storytelling has become increasingly prominent.

One recent example of this is the Guardian's, *The Party* which is a seven minute, 360 video piece depicting the experience of an autistic teenager, Layla, attending her mother's party in her own home. The piece was written by author

Sumita Majumdar, who is autistic herself, and is meant to raise awareness for the common problem of undiagnosed autism in women. The video is filmed from Layla's perspective and the footage is skewed to mimic the symptoms of autism. The piece begins with a scene of Layla's family making preparations for a party. The sounds of footsteps, silverware clattering and water running are intense and blend together. The viewer can hear Layla's inner dialogue. She expresses feeling overwhelmed already, doubting whether she will be able to make it through the celebration. Throughout the party, she is constantly reminding herself to practice normal body language. "Smile, don't stare," she says to herself, "I have no idea what my face is doing. How does everyone else know?" she wonders. As party guests speak to her, their faces become foggy and their voices are drowned out by background noise. Jarring sounds of champagne bottles popping, and guests singing happy birthday blare in Layla's ears as the scene becomes blurred and glitchy. Layla attempts to use psychological exercises to calm herself but feels too overwhelmed and eventually retreats to her quiet bedroom where she can recover from the experience. At the end of the piece, the screen reads "Women and girls on the autism spectrum are less likely to be diagnosed than males, often with negative consequences for their well being." As the ending credits play, the viewer can hear the voices of various autistic women describing their experiences.

The Party is a significant precedent to *Neither Contradictory Nor Coincidental* for a variety of reasons. Like *The Party*, *Neither Contradictory Nor Coincidental* stresses the consequences of undiagnosed cognitive differences. Both

also use virtual three-dimensional environments to convey personal narrative and simulate symptoms. Another important note is that both pieces were created by individuals who have the disability they are discussing, and the manner in which the disabilities are presented is reflective of each unique thinking style. As explained by Neuroscientist Dr. Manuel Casanova in his speech at the 2013 Conference on Dyslexia and Talent in Norwalk CT, dyslexia and autism are both caused by an abnormal spacing of neurons within the cerebral cortex. Casanova explains that within the cerebral cortex, there are clusters of vertically stacked neurons called mini columns. These mini columns are strung together by axons, which allow them to communicate and give us the ability to carry out complex tasks. In Casanova's recent findings, the mini columns in dyslexic brains are spaced abnormally far apart, causing axons to be accommodatingly long. This allows information stored in far regions of the brain to easily come together to form a cohesive thought. On one hand, this is what leads to creativity and big picture thinking skills as it allows dyslexic individuals to recognize subtle connections between two seemingly unconnected things, and combine them in innovative ways. On the other hand, it is what causes a five-time slower phonetic processing speed and poor attention to detail. Additionally, as explained by the Eide psychologists in their book *The Dyslexic Advantage*, this structure gives dyslexic individuals strength in "the ability to see phenomena from multiple perspectives, using approaches and techniques borrowed from many disciplines"(61). On the contrary, people with autism have mini columns that are tightly packed, which allows them to perform highly detail-oriented tasks with

remarkable speed and efficiency. However, because the neuron activity remains more localized these individuals struggle with big-picture thinking. Most people fall somewhere between these two extremes (00:07:00-00:09:00).

These contrasting neurologic structures and the strengths associated with each are present in the work. While *The Party* takes a literal approach to representing symptoms of autism, *Neither Contradictory nor Coincidental* uses an abstract approach to represent the dyslexic symptom of symbol reversal. Furthermore, *The Party,* is centered around one person and one single experience. *Neither Contradictory nor Coincidental* on the other hand includes the voices of twenty individuals with vastly different experiences, which relates to the dyslexic strength of seeing phenomena form multiple perspectives.

Artists working in traditional mediums have also been making work about cognitive abnormalities. Daniel Mullen, who is an abstract architectural painter, known for his hyper realistic perspective paintings, collaborated with Lucy Engelman to create *A Different kind of Time Sequencing Spatial Temporal Synesthesia*. Engleman has spatial temporal synesthesia, which causes her to visualize time as an endless stack of colored sheets. The collaboration is a series of oil paintings done by Mullen that illustrates this visualization. The series is comprised of twenty paintings that depict the stack from various perspectives. Each painting displays a different section of the stack and represents a specific time period. The sheets are sharp, tidy and evenly spaced. They are brightly colored and semitransparent, slightly resembling layers of colored Plexiglas.

Mullen's paintings inspired my experimentation with placing two-dimensional planes in three-dimensional space to represent the perception of a person with cognitive abnormalities. In Mullen's paintings however, the sheets are uniform and tidy. They create a neat stack moving in one direction. In *Neither Contradictory nor Coincidental*, on the other hand, the layered planes are overlapping, intersecting and expand in every direction. This is an important formal distinction because it illustrates an important component of the dyslexic processing style. Dyslexic individuals struggle with sequential things like time and step-based learning but are skilled at approaching problems holistically. In Mullen's paintings, time is represented by a straight line which the viewer can only see small snippets of at a time. On the contrary, in my piece, the viewer has the ability to zoom out and view all of the project's contents at once. Moreover, there is no intended order in which to view the contents of the piece. The scattered, messy cubes create various overlapping narratives that work together to provide the viewer with a well-rounded, big picture understanding of dyslexia.

INTERACTIVE TEXT:

With the rise of computational media, more artists have been using interactive text in their work. One example of this is the collaborative piece by Romy Achituv and Camille Utterback, *Text Rain*. Created in 1999, *Text Rain* is an interactive installation about the disembodying nature of screen technology. When viewers approach the piece, they see a life-sized mirror image of themselves projected on the wall. In the projection letters rain down from the ceiling. When the letters collide with

viewers' bodies, they stick. In other words, viewers are able to catch letters using part of their bodies, then release them and let them gently float to the ground. The letters are not arbitrary; they make up a poem about language and the body. The installation evokes a sense of wonder and playfulness. In an interview with Smithsonian.com, Utterback explains her aversion towards screen technology and the ways in which it is making us less present with ourselves and those around us. *Text Rain* aims to subvert screen technology and uses it to remind viewers of their own physicality (00:00:15-00:01:50).

Many parallels can be drawn between *Text Rain* and *Neither Contradictory Nor Coincidental.* Both are interactive projections containing text. The two relate not only on a on a material level but also on a conceptual level. As mentioned above, *Text Rain* was born out of frustration with the two-dimensional screen and encourages its audience to be more aware of the physical world. Similarly, *Neither Contradictory Nor Coincidental* is a rejection of society's preoccupation with the two-dimensional and places emphasis on the three-dimensional. An interesting note is that Utterback chose to use written language in her piece. It could be argued that the same effect could have been achieved by using flat shapes, or images related to screen technology. She could have also used other symbols that are used in computation, like zeros and ones or other syntactical elements found in programming languages. Not only did Utterback use letters, she used poetry. That being said, one could argue that *Text Rain* has a similar underlying message as *Neither Contradictory Nor Coincidenta*l; that written language itself is disembodying and disorienting.

A more recent example of work involving interactive text is Tender Claw's 2014 project *Pry*. *Pry* is a long form narrative app that uses mechanics similar to that of text based games and ebooks. It follows the story of veteran, James whose vision is decaying after being injured in the Gulf War. The app is organized into chapters. Each chapter uses interactive text and video to represent specific parts of James' life. Throughout each chapter viewers can use touch screen interactions to see fragments of James' memories as he attempts to processes his trauma. Many of the chapters require a reverse pinching motion, with the index finger and thumb starting together then moving apart, as if you are "prying" James' eyes open. If used on a body of text, this motion will separate lines of text to reveal more text and add depth to the narrative. In other instances this motion can be used to keep James' eyes open and prevents the viewer from slipping out of the current moment and into James' stream of conscious. At one point, braille appears on the screen. The viewer is then able to drag their finger across the braille as James' voice narrates the writing.

Pry, influenced the development of *Neither Contradictory Nor Coincidental* in a variety of ways. Like *Pry,* my piece is embedded with personal narrative and demonstrates alternative ways of reading, forcing the viewer to rely on audio rather text. One thing in particular that strikes me about this piece is the way that it plays with linearity and time. The form itself is linear but the content is not. The app is divided into chapters that are meant to be viewed in a particular order. Once inside a chapter however, the video footage and text representing the past, present and future are completely intertwined. This nonlinearity inspired the organization of my project.

As mentioned briefly in my discussion of Daniel Mullen's work, dyslexics struggle immensely with sequential things and step-based learning. For that reason it was important to me that the content of my piece not be constrained to a particular order. Therefore, viewers of my piece have the ability to jump around at a pace of their choice, sometimes revealing layers of overlapping text and several different narratives at once. In the same way, *Pry* uses layers of text and video to represent the complexity of James' PTSD. Because *Pry's* storyline is not entirely clear, the viewer is allotted some freedom in their interpretation of the piece. Similarly, because of the non-linearity of my project, viewers may be left piecing together elements of different narratives in order to determine its overarching message.

Laurie Anderson and Hsin-Chien Huang also use interactive text in their 2017 collaboration *Chalk Room*, an installation and VR experience that acts as a story archive. The physical installation consists of a large room with chalkboard walls covered in writing and drawings. There are four stools in the center of the room, with VR headsets and controls on each. The VR environment consists of a maze like structure covered in writing and drawings. Throughout the piece, Anderson uses her own voice to guide and narrate the experience in a poetic and eerie manner. Some of the stories reference her past work and others explore social constructs like time and language. The viewer moves through tight, intricate corridors and large open spaces, periodically encountering animated drawings and large objects made up of letters. Some are literal objects, like a massive tree or conga line, and others are abstract terrains floating through space.

In an interview with Eye Film Museum Anderson stresses her goal of instilling a feeling of disembodiment in viewers. She explains that one can lose one's self mentally while viewing any piece of artwork, however *Chalk Room* allows viewers to lose themselves mentally and physically. She describes the piece as a hybrid between film, sculpture and dance. Although viewers can feel their feet planted on the floor while they have the VR headset on, they temporarily have the sensory experience of flying. It was important to Anderson that viewers experience unlikely perspectives in *Chalk Room*. She explains in an interview with Louisiana Channel, "people forget when they do it to look up and back and around because we're so oriented to things that are presented in front of us…my goal is to make an experience that frees you" (00:02:20-00:07:15). Moreover, in the project's trailer, Huang explains that chalk room could be interpreted as a journey through one's mind and the stories represented in the piece, as a collection of memories (00:01:0-00:01:15).

Huang and Anderson's discussion around *Chalk Room* inspired much of the form and interactivity of my piece. Huang's description of the piece as a collection of memories, and Anderson's as a hybrid between film and sculpture lead me to think of my project in similar terms; as a collection of stories organized spatially. I was also inspired by Anderson's goal of disembodiment and her desire to give viewers the ability to experience unique perspectives. Similarly, *Neither Contradictory Nor Coincidental* is meant to create a feeling of disorientation in viewers by allowing them to rotate the environment and see the piece from multiple vantage points.

OVERVIEW OF PROJECT:

Neither Contradictory Nor Coincidental is an interactive video installation. The piece is displayed on a 7’ by 9’ projection screen with a pedestal positioned roughly 7’ in front of it. The pedestal contains a mouse that the viewer can use to navigate the piece.

Figure 1: Piece installed.

The piece begins with a rotating cube in the center of a star field. A voice narrates the writing on the sides of the cube that state a definition of dyslexia, strengths that accompany dyslexia, the cost of educating a dyslexic child and a brief description and instructions for the following portion of the piece. After the intro, the projection opens up into a three-dimensional virtual environment with ninety semi-transparent cubes that are randomly distributed throughout the space. The cubes are fairly large

and many are overlapping. They are textured with images of either handwritten or typed text. The handwritten cubes are white with black handwriting and contain my own personal experiences with dyslexia, while the typed cubes are black with white text and are transcriptions of interviews with other dyslexic individuals.

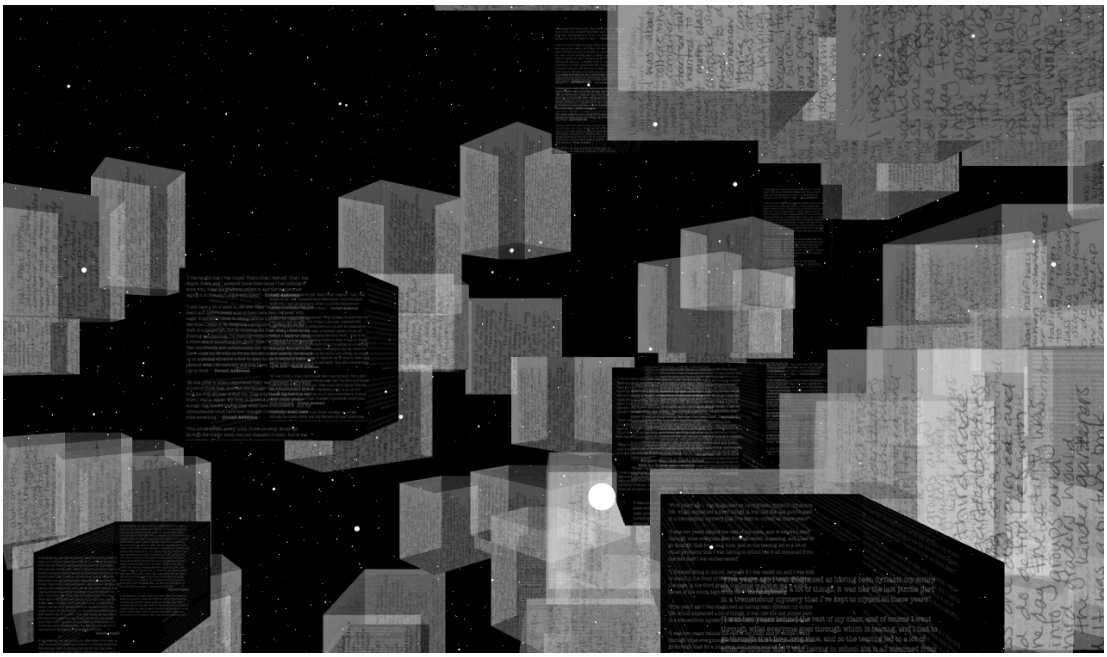
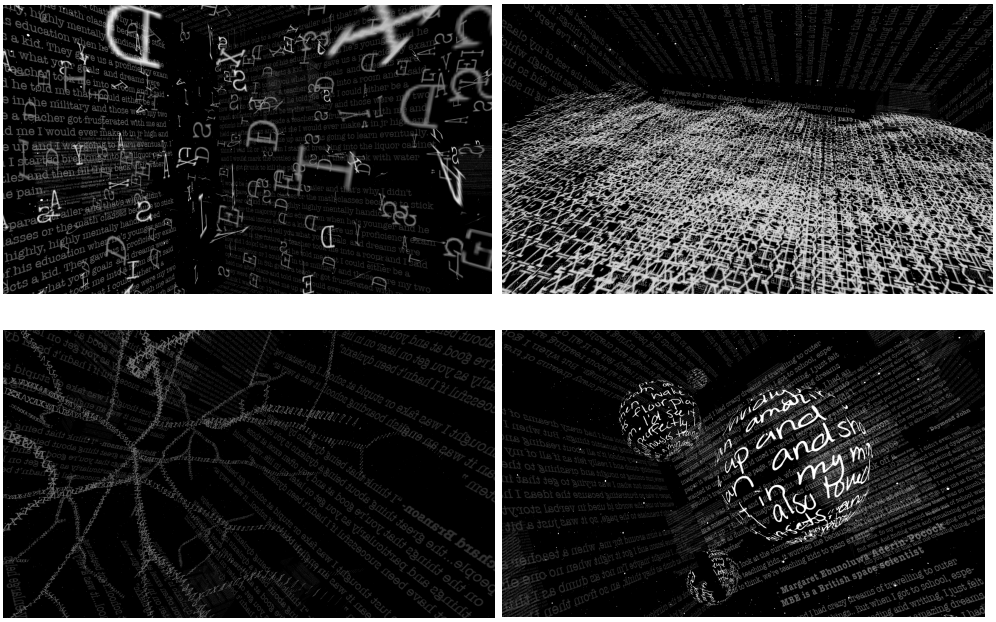


Figure 2: Overview of piece.

By clicking and dragging the mouse the viewer is able to change their vantage point and by using the mouse wheel the viewer is able to zoom. With these controls the viewer can position the camera inside of cubes. If the camera is positioned inside of a white cube, an audio file of my voice describing my own experiences begins to play. When the camera is positioned inside of a black cube, audio begins to play of an interview with another dyslexic individual.

Figure 3: View from inside of white cube.

Free floating white letters that spell out the word dyslexia also appear and move around the interior of each cube. The floating letters behave differently depending on the cube that the viewer is inside. In some of the cubes, hundreds of letters create a gradually rippling digital terrain. In others, hundreds of letters fall slowly from the ceiling to the floor of the cube, rotating slowly at various speeds creating a visual effect similar to rain or falling flower petals. Upon entering some of the cubes, a treelike structure made up of tiny letters begins growing from the center outward. In some, groups of letters move quickly across the interior of the cube in intervals. In many cubes hundreds of letters float lazily around and gently bounce off the walls as if in an environment with no gravity. The behavior of the letters is influenced by the content of the interviews.



Figures 4-7: View from inside of black cubes.

For example, in the cube associated with space scientist Maggie Aderin-Pocock, letters make up several spheres of varying sizes that are orbiting around one and other, creating a miniature model of our solar system. In another cube where an individual discusses their hobby of building models of spacecraft, letters make up the shape of a rocket. More generally, in interviews where participants expressed frustration and anxiety the letters move rapidly and in interviews with a somber tone, the letters move more slowly.

CONCEPTUAL DESCRIPTION OF PROJECT:

This section provides an in depth description of the unique ways the dyslexic mind operates, benefits and drawbacks of this thinking style and the ways in which these cognitive phenomena are represented in the piece. It also addresses the issue of learning disabilities and privilege and by extension examines how undiagnosed dyslexia can affect sufferers.

MATERIAL REASONING:

Neither Contradictory Nor Coincidental plays with the juxtaposition between two-dimensional text and three-dimensional space to emphasize one of the key dyslexic strengths: material reasoning. As explained by psychologists Brock L. Eide and Fernette F. Eide in their book, *The Dyslexic Advantage,* material reasoning skills are "abilities that help us reason about the physical or material world-that is, about the shape, size, motion, position, or orientation in space of physical objects, and the ways those objects interact" (42). Dyslexics possess this strength because they have highly developed grid cells, which are a group of cells located in the hippocampus responsible for spatial processing. Consequently, the dyslexic mind attempts to interpret two-dimensional text with this region of the brain. This poses problems because when the human brain processes a 3D object it subconsciously creates several mirror images of that object. This happens so that if we encounter the same object again but it is upside down or facing another direction, we recognize it as the same object. Most people learn to suppress this ability when reading and writing,

however dyslexics cannot or have difficulty doing so. As a result, many dyslexic individuals see and write words and letters backwards and have trouble distinguishing between letters with horizontal or vertical mirrors like b and d or p and q (Eide 45-49).

Neither Contradictory Nor Coincidental aims to visualize this. By placing two-dimensional planes of text in a three-dimensional environment and giving the user the ability to change their vantage point and rotate the environment the user is able to experience firsthand the dyslexic struggle of reading.

Though having prominent material reasoning skills can pose challenges with reading and writing, it is highly valuable in many professions. Dyslexic individuals with prominent material reasoning strengths often excel as visual artists, designers, engineers, electricians, mechanics, builders, computer scientists, software architects, physicists, and chemists (Eide 44). Many of the dyslexic individuals included in this project demonstrate prominent material reasoning strengths. One example is British Space Scientist Maggie Aderin-Pocock. Although Aderin-Pocock spent much of her childhood in the remedial classes at school, she went on to become a world-renowned space scientist. In an interview with *Made by Dyslexia* Pocock states:

> Primary school is all about reading and writing...I just felt incredibly dumb...If you are an academic scientist your life depends on writing papers. And I realized that if my life was going to depend on my written word, I don't think I would excel as a scientist. So I realized that I was more hands-on and so I

went into science and engineering. So my first degree was in physics and my second degree was in mechanical engineering (00:00:17-00:01:45).

As a space scientist Aderin-Pocock has spent her career designing space instruments and conducting research for The European Space Agency and NASA. In 2009, she won an MBE for her contributions as a scientist and educator. Aderin-Pocock also works as a television presenter and is a co-host for the documentary program, *The Sky at Night* (University of Leicester). Given Aderin-Pocock's story, it is clear that material reasoning skills do not hold much value in early schooling. Because much of traditional teaching methods rely so heavily on written language, dyslexics with these strengths struggle to keep up. Furthermore, these strengths are not easily detected in classroom settings because many of the visual spatial tests used on standardized and IQ tests measure two-dimensional spatial abilities (Eide 43).

INTERCONNECTED REASONING:

Another core strength of dyslexia outlined by the Eide psychologists is the interconnected reasoning strength, which is, "the ability to spot, understand, and reason about connections and relationships."(dyslexicadvantage.org) In other words, the ability to detect connections between two or more, seemingly unconnected things, stored in distant regions of the brain. Individuals with prominent interconnected reasoning skills are gifted in understanding large systems and the way that they operate. Some of today's highest demand vocations in fields of business and technology require strong interconnected reasoning strengths. They require keeping

track of several different elements with in a larger system and understanding how those elements work together. Furthermore, interconnected reasoning gives one the ability to "unite all kinds of information about a particular object of thought into a single global or big picture view and to determine its gist, or more essential or relevant aspects in particular contexts"(Eide 61). In other words, interconnected reasoning helps one grasp overarching concepts rather than focusing on fine details.

While interconnected reasoning is a highly valuable skill, this type of thought process can cause a multitude of difficulties while working with language. Because in most languages, homophones exist, and certain words and phrases can be interpreted both figuratively and literally, dyslexic individuals often have trouble narrowing down their interpretation. In other words, because an unusual interpretation of a given word, stored in a distant region of the brain, is just as strongly connected to the appropriate region of the brain via an abnormally long axon, a dyslexic individual is more likely to use the unusual or creative definition, rather than the appropriate one. The time spent deciphering meaning, in combination with the prolonged amount of time it takes one neuron's signal to travel to another distant neuron, causes a five time slower phonetic decoding speed. This is also the reason that dyslexia is often accompanied by, or misdiagnosed as ADHD. Because the thought process of dyslexic individuals with strong interconnected reasoning abilities can seem random to outsiders and because the jumping between distant bodies of thought can be incredibly distracting, many dyslexic children and adults are misdiagnosed (Eide 61-72).

One dyslexic individual that demonstrates both the advantages and tradeoffs with interconnected reasoning strengths is Richard Branson. In an *In Depth With Graham Bensinger* interview Branson explains that until age fifty he could not remember the meaning of the words net and gross. He of course understood the conceptual difference between profit and turnover, but would get the specific terms confused. It was not until his colleague drew him a picture that the definitions stuck. He states:

> So I'm dyslexic and I was hopeless at school... and I could never comprehend things like net or gross, I would just ask people is that good news or bad news...a senior director penciled in a piece of paper blue and he put a fishing net in the blue sea, then he put some fish in the net and said 'the fish in your net are your net profit' and I went 'hey presto I know the difference between net and gross' (00:00:00-00:01:20).

In addition to the interview with Richard Branson, the piece illustrates the concept of interconnected reasoning in multiple ways. First off, most of the cubes are overlapping and quite literally interconnected. Secondly, the sensitivity of the mouse and the ability to quickly jump between interviews represents the dyslexic mind's ability to quickly jump between bodies of thought. Finally, one of the main goals of the piece is to provide viewers with a well-rounded understanding of dyslexia. By providing viewers with the stories of twenty dyslexic individuals and allowing them to determine the gist of dyslexia, the piece mirrors a dyslexic, interconnected thought process.

NARRATIVE REASONING:

Another dyslexic strength that is that inspired the form of the piece is the narrative reasoning strength which is "the ability to construct a connected series of 'mental scenes' from fragments of past personal experience (that is, from episodic or personal memory) that can be used to recall the past, explain the present, simulate potential future or imaginary scenarios, and grasp and test" (Eide 79) Unlike non-dyslexic individuals who rely more evenly on both episodic and semantic memory, dyslexic individuals rely far more heavily on their episodic memory. In other words, rather than storing specific facts in one location of the brain, individuals with dyslexia store fragments of memory separated by the five senses in the appropriate, sense specific location. Dyslexic individuals then pull fragments of that memory together to mentally reconstruct the moment. This allows dyslexic individuals to experience thought remarkably vividly and play out or test hypothetical scenarios in their mind. (Eide 80-86)

The highly developed episodic memory of dyslexic individuals is what yields storytelling skills. An example of a dyslexic individual with prominent narrative reasoning strengths whose voice is included in the piece is Steven Spielberg. In an interview with *Friends of Quinn* he states:

> In my case I was unable to read... I was at least two years behind the rest of my class...If I was called on and I was told to stand in the front of the class and to open my book and read from the book in the third grade, that day would become another long day in a long series of the worst days of my life...making movies became my great escape (00:00:30-00:05:35).

The narrative reasoning strength also comes with drawbacks. Because dyslexic individuals rely so heavily on episodic memory, they absorb most information through examples and personal experiences, rather than abstract facts. This is also the reason that dyslexic students have trouble memorizing things like state capitals, multiplication tables, and formulas unaccompanied by wider context. All of these are commonly taught and tested subject matter in grade school. Reliance on episodic memory is also the reason that dyslexic students often appear to be less organized than their non-dyslexic peers because it is more difficult for them to remembering important dates and deadlines. (Eide 87-90)

Episodic memory can also cause difficulty when articulating ideas. Because dyslexic students primarily retain information that has been embedded in stories, when asked questions on exams about the key principles of subject matter, they often answer with examples and fail to provide an abstract definition. From a teacher's perspective this can seem like the student has not fully grasped the information, or like they are talking around their answer. This can cause tremendous difficulty on vocabulary sections of standardized tests. Because standardized tests are typically given in Scantron format, students are limited to four abstract definitions. Though

language is generally challenging for dyslexic students, given the opportunity to write in examples of vocabulary words being used would be a better measure of their understanding. It is also important to note that dependence on episodic memory poses the greatest problem to younger dyslexic students. This is because their range of experience is still fairly small, and therefore they have fewer examples to draw from. This however significantly improves as the child grows older (Eide 87-90). The dyslexic narrative reasoning strength is what inspired the decision to use personal narratives rather than simply describing symptoms of dyslexia.

UNDIAGNOSED AND IMPROPERLY TREATED DYSLEXIA:

Another goal of the piece is to highlight the toll that dyslexia can take on one's well being if gone undiagnosed or misunderstood by educators. In their article, "What Do Pre-service Teachers from the USA and the UK Know about Dyslexia?" authors Washburn, Blinks-Cantrell and Joshi discuss their findings on a study conducted on both pre-service and in service teachers. They explain that while teachers generally understand dyslexia to be a learning disorder that causes difficulties with language, most lack foundational knowledge about dyslexia and the most effective methods to help dyslexic students improve their reading and writing skills. Additionally, many of the teachers who participated in this study still held common misconceptions about dyslexia. For example, an overwhelming number of teachers who participated in the study thought that dyslexia was primarily a visual disorder that could be corrected by wearing special lenses. Participants also thought

that symbol reversal was the sole criteria in diagnosing dyslexia. Fortunately the majority of teachers from the study did understand that dyslexia is not correlated with low intelligence (Washburn 6-7).

Furthermore, as explained in the APM Reports documentary *Hard to Read*, many public school teachers are specifically instructed to avoid using the word dyslexia. This is because in most states, once a learning disability is diagnosed, the school has a legal obligation to provide that student with proper support, which is expensive (Hanford 00:11:30-00:11:40). Former special education teacher Fran Bowman states, "They would say, 'we don't use the word dyslexia because once you open Pandora's box, you have to serve those children'" (Hanford 00:11:20-00:11:30). Pam Guest, mother of dyslexic son, Dayne Guest, describes her experience around this issue. She states:

> So I asked the teachers if he was dyslexic, I said it, I said the word, is he dyslexic, and they say no. They said he had characteristics similar to those of dyslexia but they would not say that he was dyslexic and I asked the psychologist why she used that phrasing and she said she would never say that a student is dyslexic, 'we don't do that' and I said 'what do you mean you don't do that?' And she said that 'it is not on our realm of professionalism to say that a student is dyslexic we will never do that' (Hanford 00:02:45-00:03:50).

As a result, many individuals with learning disabilities go undiagnosed. As outlined in Myrna Orenstein's article, "Picking up the Clues, Understanding Undiagnosed Learning Disabilities, Shame, and Imprisoned Intelligence," individuals with undiagnosed learning disabilities often suffer from depression, low self-esteem and extreme shame. Orenstein explains that because Undiagnosed Learning Disability Sufferers or (ULD) sufferers cannot attribute their difficulties to a learning disorder, they become overbearingly self critical, blaming their failures on personal flaws like laziness or stupidity.

Furthermore, because ULD students do not qualify for special accommodations, they are more likely to be caught in a shaming learning experience such as reading aloud or attempting to solve math problems in front of the class. This causes ULD students to live in a constant state of anxiety and shame, and more problematically, avoid learning new material at all costs, thus creating "imprisoned intelligence"(Orenstien 39). There are several examples of this represented in the *Neither Contradictory Nor Coincidental*. Dyslexic student Billie Gibson describes his struggles in *Hard to Read*, "It just got so overwhelming that I would constantly have these anxiety attacks. It just got to a point where I just refused to go to school" (00:18:20-00:18:30). Cornell Anderson, author of *Janitor's Secret,* is another example of imprisoned intelligence. In his interview with *Embracing Dyslexia* he states, "I was taught that I was stupid, that's what I learned that I was stupid, dumb, and I accepted those titles cause I had nothing to work with. I had the grades to reflect it, and the teachers are saying it so I couldn't argue with them." Anderson is an

incredibly talented artist and engineer. With no formal training Anderson creates hyper realistic drawings and builds functional models of air and spacecraft of his own design. Unfortunately, Anderson's dyslexia was not diagnosed until his mid 40s. Because he did not receive proper support, he was unable to graduate from high school. Anderson also enrolled in an adult education class in an attempt to earn a General Education Development diploma. For ten years he struggled to earn the required 250 points. He was only 8 points away from passing when they revamped the test and all of his points were discredited. Because Anderson was not able to earn a GED he is unable to be admitted to any engineering training programs and pursue the career he really wants. In his *Embracing Dyslexia* interview he expresses his frustration around this issue:

> At that point is when I discovered that I was dyslexic. But it kind of hurt to know that, know all the damage that was done and that it took me over 30 years to find out. They could have figured this out when I was in school. My level of dyslexia is pretty much severe enough that there's no way they could have overlooked it. And my circumstances could have been changed if somebody would have done something…I'm sitting here as a janitor I'm cleaning toilets when I want to be designing a propulsion system for an aircraft or a spacecraft. But I'm mopping the floor when I want to be drawing and painting, I'm washing windows when I want to design a schematic...I'm not getting that opportunity and unfortunately the opportunity will never be there...and that is extraordinarily frustrating (00:10:50 - 00:12:10).

For many students this frustration is what leads to rebellious behavior. Individuals with learning disabilities are overrepresented in juvenile detention centers and are more likely to commit multiple offenses than their non-disabled peers (Pryor-Kowalski 22). In his TedX talk, *The True Gifts of the Dyslexic Mind*, founder and Executive Dyslexic of Noticeability Dean Bragonier shares his own personal narrative of past shame around learning and how it affected him while entering high school. Bragonier explains:

> You're transitioning into high school and you're thinking who am I going to be... we knew instantly that we are not going to be the smart kid…chances are we looked at the kid after school smoking reefer on the bleachers or the kids throwing rocks through glass and we think I can be that guy (00:06:25-00:07:05).

In the short documentary, *Overcoming Dyslexia*, Bill Austin also describes his experience in public schools. He was diagnosed with dyslexia but did not receive sufficient support. He states:

> Society makes you feel very isolated when you have it because you don't learn the same way as other people. We were given a proficiency exam that was supposed to tell you what your goals and dreams were going to be in the future, a teacher took me into a separate room and told me that I could be a trash collector or I could work in the military and those were my two options in life...At twelve or thirteen years old I started breaking into the liquor cabinet

> and I would mark the bottles, then fill them back with water after I got drunk just to kill the pain (00:03:10-00:04:30).

This attitude that develops in struggling students is exactly why early and accurate diagnosis, in combination with curricula more suited to students with dyslexic processing styles is critical for future generations. In Jonathan Glazzard's article, "The Impact of Dyslexia on Pupils' Self-esteem," Glazzard discusses his quantitative and qualitative research, which reveals that the most prominent factor in a student's self-esteem is a diagnosis of dyslexia and appropriate accommodation provided by educators and legal guardians. Without diagnosis and accommodation, students in this study expressed feelings of isolation, stupidity, and disappointment. One student in Glazzard's study reported that they:

> … found it hard so I just gave up. I'd be just naughty in general. I would not do the work purposely just to annoy the teacher. I used to try to get sent out of lessons so I needn't do as much work. I didn't know I was dyslexic but I knew I was finding it hard. Now I know I'm dyslexic, I don't think it gives me a reason to mess about (64).

However, when students were properly diagnosed and accommodated, their self-esteem and behavior improved (67).

DYSLEXIA AND PRIVILEGE:

It is also important to emphasize that this is an issue predominantly in public schools. In her talk, *Dyslexia and Privilege*, speaker Samantha Coppola compares and

contrasts her own experience with dyslexia, to a student of the same age from a different background. Coppola comes from a family with means to provide her with prestigious specialized education, while her counterpart Eva comes from an impoverished neighborhood and was raised in foster homes. Between tuition for a world-renowned school for dyslexics, private tutors, and ongoing evaluations from an educational psychologist, Coppola's parents spent $400,000 to ensure that their daughter received adequate education for her learning style. Because formal diagnosis requires an evaluation that costs on average $5,000, Eva was not diagnosed until age sixteen. She was enrolled in her public school's special education system, alongside students with Down syndrome and mental retardation. Copolla, at the age of eighteen was giving TedX talks and received a nearly perfect reading score on her ACT, while Eva who may have had the potential to be valedictorian, is still illiterate. (Copolla) These contrasting experiences clearly demonstrate the importance of diagnosis and proper support.

By including the stories of parents, former teachers, and students of varying backgrounds, *Neither Contradictory Nor Coincidental* emphasizes the financial and emotional toll undiagnosed and improperly treated dyslexia can have on individuals and their families. Furthermore, the piece highlights the lack of resources for dyslexic students in public schools. On the contrary, it also includes the voices of several famous dyslexics to stress the direct correlation between dyslexia and certain talents.

TECHNICAL DESCRIPTION OF PROJECT:

The project was coded in the Java based programming language, Processing. It uses Processing's built-in 3D library, P3D, and Jonathan Feinberg's PeasyCam library. The key classes included in the program are the Cube class, and the Person class. The Person constructor takes in an mp3 file, six images, and a string. The audio file contains audio from an interview, the images are transcriptions of the interview and the string is the name of the person being interviewed. The Cube class has two constructors. The main constructor takes in a Person object, a PVector to store the position of the Cube, a second PVector to store the size of the cube, and PeasyCam object. The second Cube constructor differs in that it does not take in type Person and takes in images of my own handwritten experiences. Instead of using the built-in box function offered by P3D, the Cubes were programmed manually, by creating six two-dimensional rectangles with the beginShape, vertex and endShape functions, and positioning the six rectangles into the shape of a Cube. The position and size of the Cubes are randomly generated and each Cube object is created and stored in an ArrayList each time the sketch runs. There is also a Letters class that handles the activity of the Letters within each cube. The program has one Letters object that changes position and behavior based on the position of the camera.

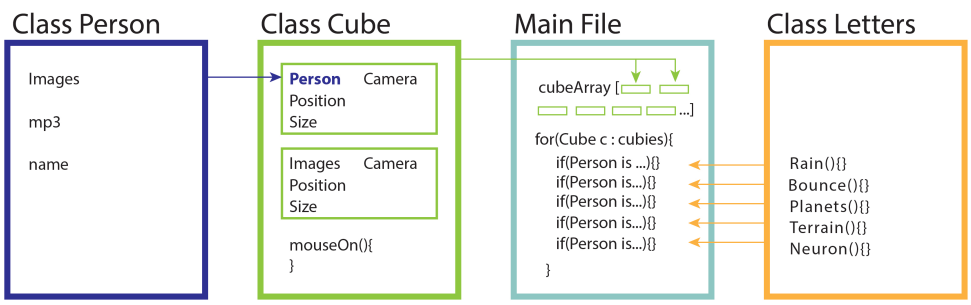


Figure 8: Map of program.

The program is set up on an X,Y,Z coordinate where position 0,0,0 is in the center of the environment and the camera is always facing 0,0,0. The viewer can change the position of the camera by clicking and dragging the mouse to orbit around the world.

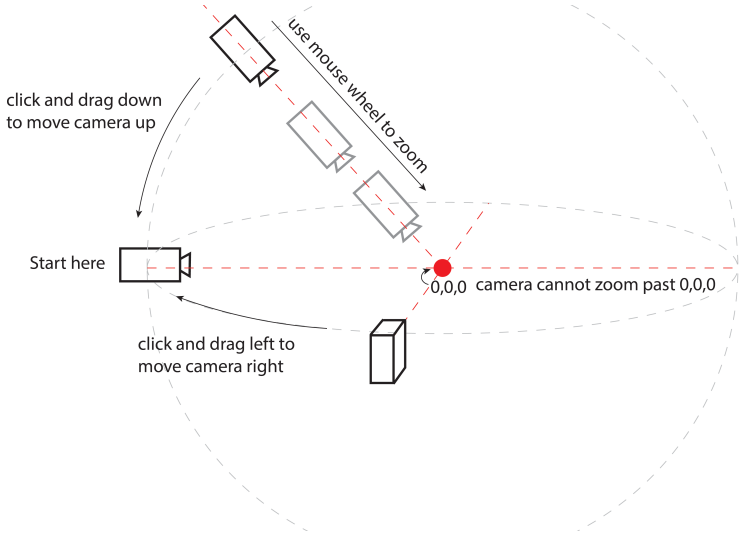


Figure 9: Camera controls.

The audio is triggered by a method within the Cube class called mouseOn. MouseOn checks to see if the camera is positioned inside of the Cube and returns true or false.

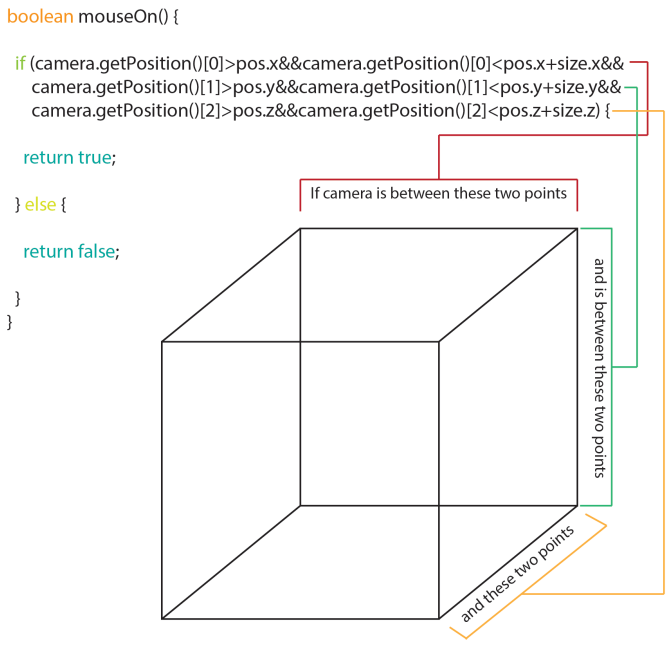


Figure 10: MouseOn method diagram.

In the draw function in the main file, the program loops through the ArrayList of cubes and displays each Cube object. There is a conditional within the loop that checks if the mouseOn method for each cube has returned true. If it has, the program plays the audio file associated with the Person object that is attached to the given Cube. If the mouseOn function returns false, the program pauses the audio file.

```
for (Cube c : cubies) { For all the cubes
  if (c.person!=null&&c.mouseon()==false && c.person.song!=null) {  If there is a person attached to this cube and the camera is not inside this cube
   c.person.song.pause();  pause the audio file associated with this cube
  } pop out of this conditional
  if (c.person!=null&&c.mouseon()==true && c.ctint > 0) { If there is a person attached to this cube and the camera is inside this cube
   c.person.song.play(); play the audio file associated with this cube
   if (c.person.song.position() == c.person.song.length()) { If audio file reaches the end
    c.person.song.rewind(); rewind audio file
    c.person.song.play(); start audio file from begining
   } pop out of this conditional
  } pop out of this conditional
}
```

Figure 11: Conditional that determines the playing and pausing of audio files.

There is another multifaceted conditional nested within the previously mentioned conditional, that checks for specific names of Person objects then calls specific Letters methods depending on which cube the camera is inside.

OBSTACLES:

The greatest technical obstacle I overcame was the program lagging. The main file of the program is just over one thousand lines of code, and the additional classes range from two hundred to five hundred lines of code each. Additionally, the program creates ninety instances of class Cube each time it runs, meaning it handles an overwhelming amount of data. One way I cut down on the complexity of the program was creating two constructors within the Cube class. Having only one of the constructors take in type Person meant that most of the Cube objects contained far less data and allowed the program to run more smoothly. I also created several

functions within the Letters class that determine how the letters would behave within each Cube. In other words, instead of having several instances of class Letters running inside of each cube simultaneously, only one instance of class Letters is created and displayed. The location of the letters changes based on the position of the camera and what viewers are able to see.

Another problem I encountered was the program freezing if two Person Cubes were overlapping. If the camera fell into an area where two audio files began playing at the same time the program would crash. Initially I attempted to create a recursive function called check. This function was called while creating the Cube objects and populating the Cube ArrayList. It contained a series of nested loops that checked if any point of the Cube being created was positioned inside of any previously created Cubes. If any of the points on the current Cube were inside of any previously created Cubes the function would recursively try again. If not, the function would pop out of the recursive loop and a Cube would be created and added to the ArrayList. Ultimately this function did not work. Despite hours of debugging there was always one instance of two Person Cubes overlapping. If I were given more time I would have perfected the function and implemented it in the final program, however because I needed to prioritize other elements of the project, I chose to hard code the positions of the twenty Person Cubes. The rest of the cubes' positions are randomly generated.

GOALS AND EXPECTED OUTCOMES:

Neither Contradictory Nor Coincidental, while intended for the general public, is perhaps most impactful in an academic setting. The goals of *Neither Contradictory Nor Coincidental* are to raise awareness of the lack of resources for dyslexic students in public schools, to provide viewers with a well-rounded understanding of dyslexia and to empower dyslexic audience members while also validating their hardships. University galleries work well for this piece in that it is more likely to reach students who may be struggling, and educators who may not have an accurate understanding of dyslexia. By extension raising awareness among scholars may inspire them to conduct deeper research on dyslexia and develop curricula geared towards students with dyslexic processing styles.

Given that the piece deals with issues of reading, it could also be interesting in public libraries. If given appropriate attention, dyslexia is often diagnosed in early childhood as a child learns to read. Because public libraries are especially popular among families with young children, the piece could inform parents of the benefits a dyslexic thinking style and stress the importance of early diagnosis. Additionally, because libraries are likely a stressful place for dyslexic children, the piece may provide some form of encouragement and inspiration.

CONCLUSION:

I consider my art practice a tool to communicate and process my own personal experiences, as well as a means of expressing my positions on critical social issues.

This project fits into that practice in that it includes my own struggle with dyslexia in order to speak to the larger issue of inadequate resources for dyslexics at public schools and society's narrow view of intelligence. It also continues a strategy used in many of my most recent projects, which is collecting the experiences of multiple individuals combining them into one project. I used this method in my 2016 interactive installation, *Invisible*, and in my 2017 print series *Weight of Words*. The subject matter of this work is also tied to several of my previous pieces. Both my 2015 interactive video series *Dyslexic Interpretation,* and my 2017 video installation *Cortex* aimed to highlight the benefits of dyslexia. One way that this project differs from my previous work is that it does not include any pictorial or illustrative elements. The entire project is made up of geometric shapes and written language. Additionally this is the first piece that uses audio interviews rather than only written transcripts.

I have always found making work about dyslexia to be deeply rewarding. My project sparked a number of interesting conversations with viewers. Several viewers with a range of disabilities felt they could relate; some self reflected and concluded that they may have undiagnosed dyslexia and some were simply curious and wanted to learn more. Given that feedback, I consider this project successful.

That is not to say that there is not room for improvement. One area that I am not fully content with and received criticism for is the difficulty of navigating the piece. While it is important for the piece to be disorienting and the abruptness of the navigation works on a conceptual level, it prevented many viewers from positioning

themselves at a vantage point from which they could see some of the more intricate letter formations. It also at times prevented viewers from staying inside one cube long enough to hear a significant portion of the interview. I also observed that some viewers enjoyed quickly spinning the environment around more so than staying in one place and listening to or reading the content itself. To prevent this in future iterations, I plan to make the controls more intuitive and less jolty. Another area that could use improvement is the intro portion of the piece. I chose to add this portion because I felt that viewers might need some general background information about the subject matter and chose to narrate it so that viewers, particularly dyslexic viewers, would not have to read. The piece is programmed to reset after one minute of mouse inactivity, and jumps into the main portion of the piece when the mouse is clicked. During the reception however, the piece was seldom left alone for more than thirty seconds, proving the intro section to be unnecessary. When the piece did reset, viewers tended to immediately click the mouse, and skip through some important information. In future iterations I plan to eliminate the introductory section, put all of the information in the wall description, and put navigation instructions on a small sign near the controls.

In the future I also plan to conduct interviews myself rather than collecting them from various sources. While collecting the interviews from outside sources allowed me to include interviews with a number of famous dyslexics, it was limiting in that I could not control the content of the interviews. Furthermore, conducting the interviews myself would have given me the opportunity to provide interviewees with

information and resources, which in some cases may have helped shift participant's negative perception of dyslexia.

Neither Contradictory Nor Coincidental underwent countless changes. Though the finished product is vastly different from what I envisioned making one year ago, the project was successful. I look forward to further developing this work and for the conversation around learning differences to continue growing.

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