2015

Losing Vision: What Can Art Gain in the Absence of Sight?

Seana Rothman
Scripps College

LOSING VISION: WHAT CAN ART GAIN IN THE ABSENCE OF SIGHT?

by

SEANA ROTHMAN

SUBMITTED TO SCRIPPS COLLEGE IN PARTIAL FULFILLMENT
OF THE DEGREE OF BACHELOR OF ARTS

SUSAN RANKAITIS
JULIA HAFT-CANDELL
NANCY MACKO

DECEMBER 12, 2014

Introduction

My senior project aims to challenge the dominant visual mode of interaction with art through a personal lens. As a child growing up, I was not afraid of the dark. I didn't need a night light to soothe me to sleep and I had little problem navigating my dim house by memory and touch if I needed to get something. Even today, I often find my way around in the dark rather than turning on the light, hurting my sensitive eyes in the middle of the night. My familiarity with the dark stems largely from my history of visual impairment. I developed nearsightedness around eight years of age. This condition has since worsened past the level of most of my nearsighted peers. During the day, I wear glasses or contacts to correct my vision which I remove before going to bed. There is always a period of time before I go to sleep and after I wake up when I experience my uncorrected vision; I see fuzzy shapes and blobs rather than detailed forms. I have gotten used to the nature of my eyes and rely on touch as equally as sight when I'm not wearing glasses or contacts.

This isn't to say that I fully experience blindness since I still have most of my vision and can see with optical aids; however, I empathize with the visually impaired and blind. This is because my father, who grew up with severe nearsightedness, lost most of his vision late in his adult life due to glaucoma and a few botched eye procedures. Today, he has one functioning eye, and it is only capable of low vision. Glaucoma is commonly known as the silent thief of sight because it "develops slowly and sometimes without noticeable sight loss for many years" (Primary Open-Angle Glaucoma). In primary open-angle glaucoma, which is the type that my father has, insufficient fluid drainage causes pressure to build up in the inner eye over time, eventually damaging the optic nerve, leading to permanent vision loss.

Unfortunately, my father didn't catch the warning signs of glaucoma before it was too late and the disease had progressed to an advanced state. I get tested for glaucoma every time that I go to an optometrist since it is a hereditary disease and I have a chance of inheriting it. Luckily, if caught early, glaucoma can be managed and will usually not lead to significant loss of vision (Ibid).

Growing up with my dad in his apartment, I would often help him read fine print and fill out various forms. If we went out to a restaurant, I would read the menu out loud for him. Because my dad couldn't drive, we had to find alternate modes of transportation which either meant getting a lift from someone else or riding public transportation. These small things impacted my life, but not nearly as significantly as the times when I wanted to show my artwork to my dad, which I knew he could not fully see.

Is there another way to create art that would be more accessible to my dad and the other blind and visually impaired? This is the question that I am examining in my project. In general, the question of accessibility for the visually impaired has remained largely untouched in the art world. Blindness is a challenging area to maneuver, especially since I am not blind myself. However, I believe that emphasizing the use of senses other than vision to create and interpret works can engage the visually impaired. Shifting focus from the visual to the tactile, auditory, olfactory, and even gustatory has the potential to open up a rich new world of possibilities for artists and museum-goers alike. There is much for us to consider in art beyond the world of sight.

Inspired by my relationship with my father, I created a series of closed-eye drawings composed of memories of our life together. These drawings largely incorporate the physical spaces and the experiences we shared. I transferred the ink from one of my drawings to a slab of

clay, which I carved according to the dimensions of the original drawing. The slab was cut into smaller pieces, fired in the kiln, and then hung up on the wall in my gallery room to be touch accessible to visitors. I also crafted wire versions of my dad and our cat, both of which were attached to the walls. The installation is covered completely by black-out fabric curtains, so that no light can enter. The floor is carpeted in order to give a homey feel. The experience of interacting with my work was intended to make visitors feel as though they were touching my personal history.

When a person approaches my installation, they are reminded that they can touch the artwork in the room. For a sighted person, the experience of feeling the clay surface and wire may be more unfamiliar than to the visually impaired, as sighted people tend to interpret space through a reliance on vision rather than touch. My work subverts the traditional gallery setting by allowing sighted and non-sighted people equal access. In the process, I examined my relationship with my dad in order to share my experiences with other people.

Scientific Background on Vision

In order to understand what it means to be visually impaired, we must first understand what it means to see. The main component of the visual system is the eye: an organ shaped roughly like a globe which allows light to enter through the cornea and pupil, passing through the lens (Fig. 1). The light refracted from the lens stimulates the retina at the back of the eye and sends information signals via the optic nerve to the brain. These signals are then processed and interpreted as images. Vision accounts for about 40% of total sensory input to the human brain (Davson 1). The function of an eye can be compared to that of a camera—in both cases, light enters through a lens, which then exposes a sensitive sheet (in the case of eyes, this sheet is

called the retina and is formed of interconnected nerve cells) to develop an image (Rodieck 8). This analogy is not completely accurate, but it gives a general idea of how eyes function.

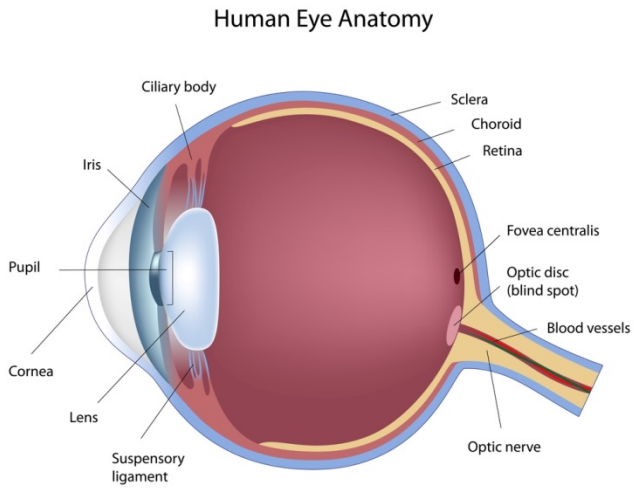

Figure 1: Diagram of the Human Eye; "Human Eye Anatomy"; *Georgia Retina*; GARetina.com, 2012; Web; 26 Oct. 2014.

As with any structure, the visual system is susceptible to defects. Vision tests check the different functions of the eye and can be used to pinpoint certain types of visual impairment in a patient. Visual acuity tests measure the ability to see detail at different distances. Doctors often use Snellen charts to regularly test patients' visual acuity. These charts consist of several lines of block letters in decreasing size from top to bottom (Fig. 2). The lowest row of letters that a patient can clearly read determines their visual acuity, which is measured as a ratio of the distance from the chart over the distance that the average "normally" sighted person can read this same row of letters ("Visual Acuity Test").

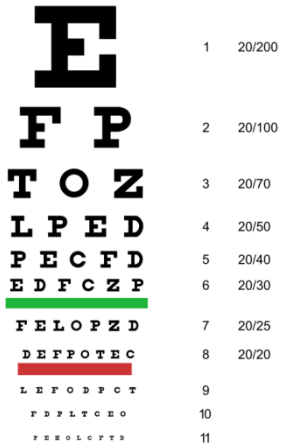

Figure 2: Typical Snellen Chart; "Snellen Chart"; *Jeff Dahl*; Wikipedia, 2008; Web; 7 Nov. 2014.

Patients who demonstrate poor vision regularly visit optometrists, who perform refraction tests in order to determine their prescription for corrective lenses. Some people can benefit greatly from glasses and contacts, while others have problems that cannot be corrected by refractive means. Optometrists also perform visual field tests to check for deterioration in peripheral vision, which can be a sign of serious eye conditions like glaucoma and macular degeneration ("Visual Field"). Routine eye exams are the best way to detect eye problems and prevent or slow vision loss.

According to the World Health Organization, there are six categories of visual acuity: near-normal vision, moderate low vision, severe low vision, profound low vision, near total blindness, and total blindness. In the United States, a person is considered legally blind if their vision is 20/200 at best while corrected, or if their visual field is 20 degrees wide or less ("Low Vision"). It is important to note that "blindness" does not always connote total lack of vision—most blind people still have some level of visual perception, the most basic level being light

perception. Those with light perception can sense changes in lighting and can usually indicate the direction of a light source (VisionAware). Even low vision can still be helpful in performing basic daily activities.

Though seeing may seem simple to the sighted, it actually involves an intricate series of processes, any of which can potentially fail and lead to visual impairment. The most common forms of visual impairment are due to refractive errors, including nearsightedness, farsightedness, and astigmatism (Fig. 3). Nearsighted eyeballs are elongated in shape, while farsighted eyeballs are flattened, and astigmatic eyeballs are irregular. Because of the curvature of the cornea due to eye shape, light does not focus properly on the retina, leading to blurred vision. The nearsighted can focus on objects close-by but not far away, because images focus in front of the retina (Gabbert). Nearsightedness, which I experience, is also referred to as myopia. In contrast, the farsighted can focus on faraway objects but not close-by objects, because images focus behind the retina (Ibid). Astigmatics have trouble focusing on both near and distant objects, as light is refracted to multiple areas of the retina instead of concentrating in one place (Ibid).

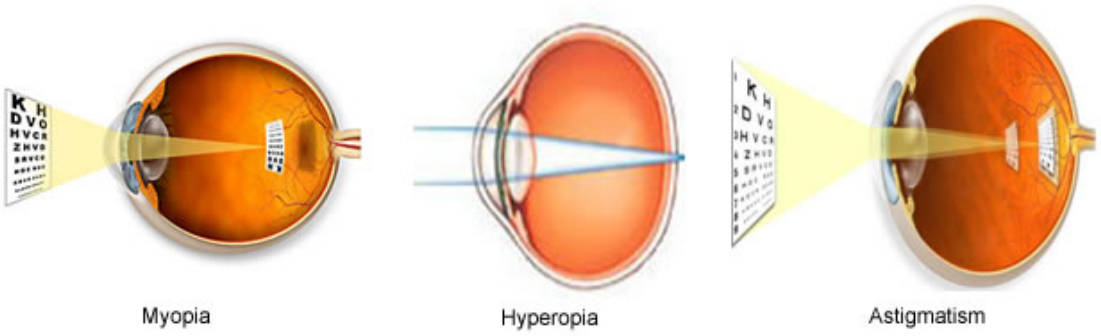

Figure 3: Refractive Errors; "Myopia, Hyperopia, Astigmatism"; *Parvathi Eye & Retina Center*; Vizion Care, 2008; Web; 2 Nov. 2014.

Refractive errors can be corrected through use of lenses, such as glasses and contacts. With a glasses prescription of -7.00 diopters, I have what is considered to be "high" or severe myopia (RNIB). My uncorrected vision causes forms to appear blurry and lights to flare. I can only see an object clearly if it is a few inches away from my eyes, so details such as writing, peoples' faces, and pictures are extremely hard for me to make out. I can, however, see the general outlines of shapes, which allows me to navigate my surroundings. It is lucky that I am able to achieve 20/20 vision with corrective lenses, because some other people with visual impairments cannot.

Besides refractive errors, other conditions leading to visual impairment include muscular weakness of the eyeball, genetic diseases, trauma, and age-related deterioration. Amblyopia, also known as lazy eye, results in reduced vision from a misaligned eye. Due to a combination of poor positioning and weak musculature, one eyeball does not face straight and therefore sees blurred images in comparison to the other eyeball. The brain learns to tune out the input from the weaker eye, and over time this can lead to permanent vision loss (Amblyopia). Amblyopia can be treated by covering the dominant eye with a patch so that the weaker eye is forced to work harder and eventually become stronger.

Retinitis pigmentosa (RP), an inherited genetic abnormality, affects 1 in 5000 people across the world (Ioseliani 245). RP causes a gradual loss in peripheral and night vision due to the degeneration of retinal photoreceptor cells, which can eventually manifest into total blindness. The progression of retinitis pigmentosa varies from person to person, as some can maintain useable levels of vision into late adulthood, while others lose most of their vision at an early age (Retinitis Pigmentosa).

Retinopathy of prematurity, in contrast to retinitis pigmentosa, occurs in premature infants with abnormally developing retinal blood vessels. In severe cases, the retina detaches from the wall of the eye, leading to blindness; however, most cases of retinopathy of prematurity resolve themselves without causing permanent vision loss ("Retinopathy of Prematurity"). This is one cause of congenital blindness, or blindness present from birth.

Cortical visual impairment is another condition that can strike prematurely, and results from damage to the visual parts of the brain. Vision loss occurs independently of the physical structure of the eyes. That is to say that the eyes receive visual input and send signals to the brain, but the brain cannot properly process this information, leading to visual impairment ("Cortical Visual Impairment"). Children with this condition may have fluctuating levels of vision throughout the day, and can be treated to improve their vision over time.

Macular degeneration, also referred to as age-related macular degeneration (AMD), is the leading cause of blindness in the elderly (Ioseliani 2). AMD harms the macula region of the eye which is responsible for sharp, central vision ("Macular Degeneration"). AMD can occur in two forms: dry generation and wet degeneration (Ioseliani 2). Dry degeneration is caused by the accumulation of endoretinal fat deposits, which eventually kills retinal photoreceptors, causing vision loss over time. Wet degeneration involves the growth of abnormal blood vessels under the retina, quickly leading to vision loss (Ibid).

Cataracts are a distinctive sign of visual impairment, as they cause eyes to appear white and cloudy. Specifically, cataracts obscure the eye lens due to aging, disease, and long-term exposure to UV radiation (What Causes Low Vision?). Surgery can be performed to replace the

clouded lens with a new one, and is generally highly successful in patients with healthy eyes. For those with other complications, however, cataract surgery isn't an option.

Glaucoma, which is the disease that my father has, can occur any time from birth to adulthood. It is characterized by damage to the optic nerve, leading to vision loss. In the most common form of glaucoma, primary open-angle glaucoma, intraocular pressure rises slowly over time due to poor fluid drainage, and symptoms are not usually detected until the disease has progressed to an advanced stage (Primary Open-Angle Glaucoma). Angle-closure glaucoma, which develops suddenly when the angle between the iris and cornea closes, blocks drainage canals and sharply increases intraocular pressure (Types of Glaucoma). There is another more poorly-understood type of glaucoma called normal-tension glaucoma, in which the optic nerve is damaged even though intraocular pressure isn't high (Ibid). Congenital glaucoma occurs in babies with faulty development of the eye's drainage canals (Ibid). All forms of glaucoma can lead to visual impairment and while they can usually be managed if detected early, vision loss already caused by glaucoma is irreversible.

As someone who has a family member with glaucoma, I am four to nine times more likely to get glaucoma (Are You at Risk for Glaucoma?). African Americans are especially at risk for this disease, with glaucoma rates six to eight times higher than in white populations (Ibid.) Additionally, people of East Asian descent are predisposed to angle-closure glaucoma, and Japanese to normal-tension glaucoma (Glaucoma in Asian Populations). In order to test for signs of the disease, optometrists perform tonometry and ophthalmoscopy exams, which check the inner-eye pressure and the optic nerve, respectively (Five Common Glaucoma Tests). People who are more likely to develop glaucoma should regularly visit optometrists to get screened at least once every couple of years after age 35.

This spectrum of visual impairments demonstrates the complicated nature of visual perception and the many ways that it can break down. Not only can conditions occur within the structure of the eyeball itself, but also in the visual parts of the brain and their connection to the eyes. However, the senses are not isolated from one another; there is increasing evidence that perception is multimodal and senses are interrelated (Heller and Ballesteros 9). Therefore, when discussing visual impairment, it is crucial to understand the other senses and how they relate with one another.

Somatosensory

For those who have it, touch is an incredibly useful yet underrated tool of perception. The sense of touch is scientifically referred to as the somatosensory system, which receives "multisensory information from touch, scanning movements, and from body-centered reference cues" (Heller and Ballesteros 29). Not only can the body sense direct physical contact, but it can also sense vibration, moisture, temperature, and pain (Møller 186). On a basic level, somatosensory information allows humans to avoid physical harm and navigate and interpret their surrounding environment.

The somatosensory system consists of various receptors embedded in skin, muscles, tendons, and joints, and the pathways that connect these receptors to information processing areas in the brain (Møller 190). Mechanoreceptors are specialized nerve endings at various depths in the skin tissue which respond to physical stimuli (Ibid. 191). Types of mechanoreceptors differ in hairy and hairless (glabrous) skin: hairy skin contains hair-follicle receptors, tactile disks, and Ruffini endings, while glabrous skin contains Meissner's corpuscles, Merkel's discs, and Pacinian corpuscles (Fig. 4). These receptors differ in their depth within the

skin and their modes of adaptation, responding either to slowly varying stimuli or rapidly changing stimuli (Møller 222).

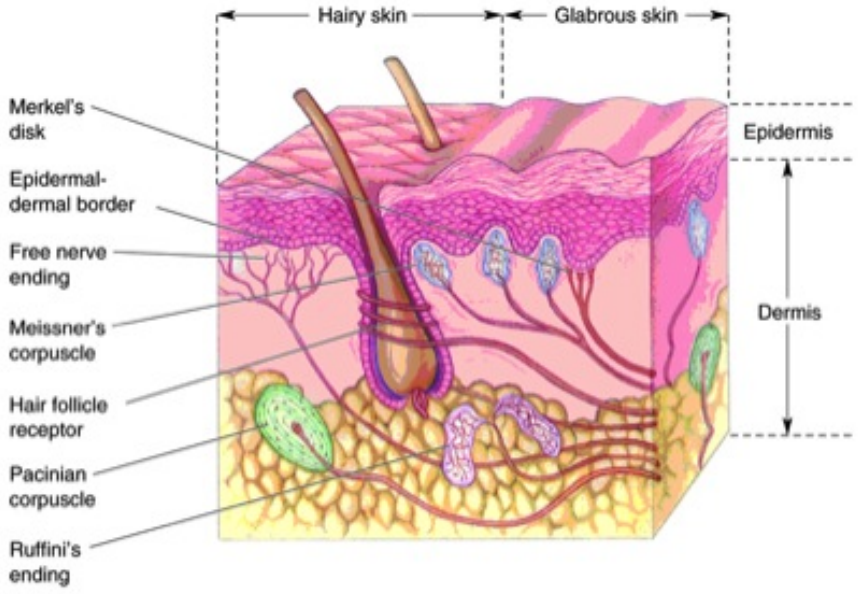

Figure 4: Mechanoreceptors; "Somatic Sensory Receptors in the Hairy and Glabrous Skin"; *Shannon Whitten*; Physiology of Sensation and Perception, 2012; Web; 15 Nov. 2014.

Other types of receptors include thermoreceptors, which sense temperature (Møller 191), and nociceptors, which respond to noxious (damaging) stimuli (Ibid. 206). Signals from these receptors travel through different pathways to the brain where they are interpreted, cueing the brain to send back a corresponding response signal. Activation of warmth receptors prompts sweating and increased blood circulation to cool the body down, while activation of cold receptors prompts muscle contractions to warm the body up. In the case of pain signal reception, the brain instructs the body to move out of harm's way.

Western science has long favored vision as the dominant sense, especially for spatial processing. Vision is traditionally considered a "distal" sense, as stimuli arise from distant objects, while touch is traditionally considered a "proximal" sense, as stimuli arise from direct contact with objects (Heller and Ballesteros 28). In truth, these senses are much more complicated and involve both external references and body-centered references (Ibid. 43). Hungarian psychologist Geza Revesz (1878-1955) studied the relationship between touch and blindness, and found that blindness does not preclude spatial knowledge (Ibid. 28). Sighted people are advantaged in processing spatial information because vision provides more reference information; however, the blind are perfectly capable of navigating their environment.

Visually Impaired Artists

While the term "blind visual artist" may seem like an oxymoron, there are plenty of blind and visually impaired artists who work in every type of media. From performance art to painting, sculpting, music, and photography, the blind have done it all. Even media considered purely visual, such as photography, are accessible with proper instruction to the blind.

One artist who challenges visual dominance in art is Carmen Papalia, a young blind man from Vancouver. He lost most of his vision as an adult due to retinitis pigmentosa. Papalia is well-known for his project series entitled *Blind Field Shuttle* in which he leads groups of people with their eyes closed on tours of different spaces (Papalia). He calls *Blind Field Shuttle* "an exchange of trust" that allows participants to "realize the opportunities for learning and knowing that become available through the nonvisual senses." In addition, Papalia has conducted *The Touchy Subject* in the Guggenheim Museum, a series of one-on-one tours of the building using

only hearing and touch to navigate artworks and spaces. Given the all-pervasive "no touch" policy in museums, *The Touchy Subject* is a breath of fresh air and challenges the status quo.

Esref Armagan, a congenitally blind Turkish painter, is famous worldwide for his bold and expressive paintings. Armagan originally became an artist to better understand the world around him. Completely self-taught, Armagan developed his own artistic technique of applying oil paints to canvas with his fingers. Scientists at Harvard became fascinated by Armagan's ability to paint using a three-point perspective (Figure 5), so they asked to scan his brain; they discovered that his visual cortex, long considered to be purely dedicated to sight, lit up whenever he was drawing (Armagan). Scientists used to think that understanding perspective was reserved for the sighted, but Armagan proved them wrong.

Figure 5: Armagan, Esref. *18*. 2013. *Esref Armagan*. Web. 8 Dec. 2014.

Project

Building off my background of scientific and artistic knowledge, I created a touch-friendly installation that is equally accessible to sighted and non-sighted people. As an artist who mostly practices drawing and painting, highly visual mediums that aren't usually accessible to the visually impaired, I wanted to branch out into more tactile expressions. Clay is a classic tactile medium, and has been used to teach art in several schools for the blind (Fukurai, Blagden and Everett). I became interested in ceramic reliefs in particular because they bridge the gap between the 2D medium of drawing and the 3D medium of clay sculpture. I also chose to work with wire because it is another touch-accessible material and because the process of working with wire is incredibly difficult and strenuous, which reflects my struggle in grappling with my own relationship with my father.

As a starting point for my clay piece, I created multiple closed-eye drawings, all of which are inspired by childhood memories of my father. I finally decided on one drawing to transform into clay, because I liked the imagery and thought it would translate well into 3D. The drawing came from a memory of my father and I walking down the street of our old neighborhood together (Figure 6). I transferred the ink from the drawing to a slab of clay, and began carving out my relief (Figure 7). I used different techniques of creating relief, raised lines, and textures to give my work more variety.

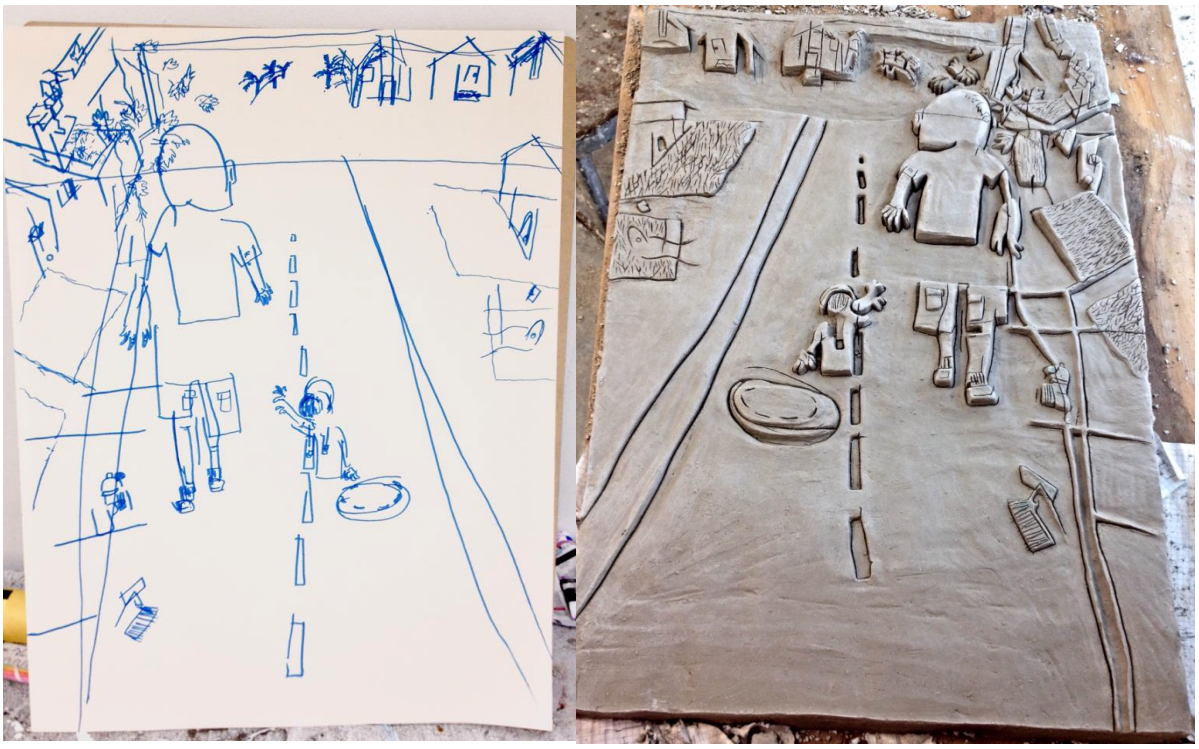

Figure 6. Rothman, Seana. *Walking With Dad*. 2014. Marker on Paper. (left)

Figure 7. Rothman, Seana. *Walking With Dad.* 2014. Clay. (right)

My wire figure started from a curiosity with the medium and how I could transform it with no prior experience in metal-working. The piece evolved into a full-scale representation of my father, not meant to be completely accurate but rather to evoke a feeling of importance and authority, as father figures often represent to children (Figure 8). The process of creating *Wire Dad* was strenuous and frustrating but ultimately satisfying, and I saw it as a metaphor for dealing with my relationship with my father who now lives on the other side of the world. We have always struggled to communicate our feelings, but I believe that we have become closer in the past few years. Our relationship has never been easy, and there have been a few snags on the

journey—just like the sharp wire ends poking out in some parts of the work—but it is still beautiful and important to me.

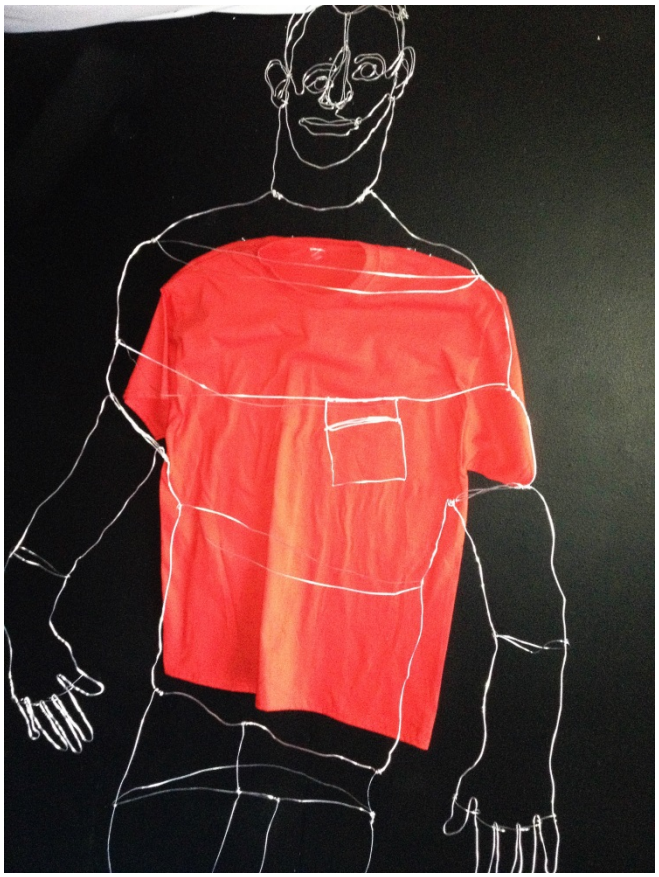

Figure 8. Rothman, Seana. *Wire Father*. 2014. Wire.

My clay piece and wire are set up in a completely darkened room, save for some tea light candles on the floor. Visitors enter through the curtain and are reminded that they can touch the art. The experience is intimate and immersive, almost like stepping into my home and feeling my personal history; this impression is heightened by the carpet on the floor of the room. Though there is a small amount of light, it is be difficult to see clearly which makes my installation primarily a tactile experience. I decided not to leave the room completely dark because the vast majority of visually impaired people still have some level of sight, even if it is just light

perception. The idea that all blind people see pure blackness is false, and I wanted to make sure that I didn't perpetuate this stereotype in my artwork.

Conclusion

> "'Don't you think it easier to look at things with eyes?'
>
> 'Don't you think, Sensei, that we can perhaps look at things more deeply through touching?'"
>
> (Shiro Fukurai, *How Can I Make What I Cannot See?*)

Is it possible that the visually impaired can "see" just like the sighted? Not with their eyes, but with their hands? My fall project explores this idea and allows all types of people, whether sighted or non-sighted, to ponder this question in the context of visual art, a field which is usually inaccessible to the visually impaired. Greater accessibility to the visual arts is important for me personally because of my own vision problems as well as my dad's. Recent scientific studies suggest that the blind can process spatial information just as the sighted can, which means that not only can artwork be accessible to those without vision, but can also be created by those without vision. There are some incredibly talented blind artists in the world, and I barely scratched the surface in my research. However, I believe that by creating this project and sharing my goal, I am opening the visual arts to new possibilities for creating and interacting with works, and fostering a more inclusive community. The most important thing to me is the message that my project carries, and I hope that it influences others to strive for more diversity and accessibility in the art world.

Bibliography

"Amblyopia." *American Association for Pediatric Ophthalmology and Strabismus*. AAPOS, July 2013. Web. 06 Nov. 2014.

"Are You at Risk for Glaucoma?" *GRF*, Glaucoma Research Foundation 11 Jun. 2013. Web. 7 Nov. 2014.

"Biography." *Esref Armagan*. Esref Armagan, n.d. Web. 8 Dec. 2014.

Blagden, Sue, and John Everett. *What Colour Is the Wind? Insights into Art and Visual Impairment*. Corsham: NSEAD, 1992. Print.

Davson, Hugh, ed. *The Eye*. 3rd ed. Vol. 1. Orlando, FL: Academic, 1984. Print.

Deifell, Tony. *Seeing Beyond Sight: Photographs by Blind Teenagers*. San Francisco: Chronicle, 2007. Print.

"Five Common Glaucoma Tests." *GRF*. Glaucoma Research Foundation, 5 May 2011. Web. 12 Nov. 2014.

Fukurai, Shiro. *How Can I Make What I Cannot See?* New York: Van Nostrand Reinhold Co., 1974. Print.

Gabbert, Cheryl. "Common Types and Characteristics of Visual Impairments." *Bright Hub Education*. Ed. Sarah Malburg. Bright Hub Inc., 12 July 2012. Web. 03 Nov. 2014.

"Glaucoma in Asians." *GRF*. Glaucoma Research Foundation, 5 May 2011. Web. 09 Nov. 2014.

Hampshire, Barry. *Working with Braille: A Study of Braille as a Medium of Communication.* Paris: Unesco, 1981. Print.

Heller, Morton A. and Soledad Ballesteros. *Touch and Blindness: Psychology and Neuroscience.* Mahwah, NJ: Lawrence Erlbaum Associates, 2006. Print.

Hoffman, Donald D. *Visual Intelligence: How We Create What We See*. New York: W.W. Norton, 1998. Print.

Ioseliani, O. R. *New Developments in Eye Research*. New York: Nova Biomedical, 2006. Print.

Jay, Martin. "Scopic Regimes of Modernity." *Vision and Visuality*. By Hal Foster. Seattle: Bay, 1988. 3-23. Print.

Kay, Simon. "Ask the Optician: The Relationship between Uncorrected Visual Acuity and Degree of Myopia." *Specsavers*. Specsavers Optical Group, 2 Apr. 2012. Web. 09 Nov. 2014.

Kennedy, John M. *Drawing & the Blind: Pictures to Touch*. New Haven: Yale UP, 1993. Print.

"Low Vision." *American Optometric Association*. AOA, 2014. Web. 07 Nov. 2014.

"Low Vision and Legal Blindness Terms and Descriptions." *VisionAware*. American Foundation for the Blind, 2013. Web. 07 Nov. 2014.

"Macular Degeneration." *Medline Plus*. U.S. National Library of Medicine, 24 Oct. 2014. Web. 08 Nov. 2014.

Moisse, Katie. "Like a Bat, Blind Man Uses Sound to 'See'" *ABC News*. ABC News Network, 26 May 2011. Web. 06 Oct. 2014.

Møller, Aage R. *Sensory Systems: Anatomy and Physiology*. Amsterdam: Academic, 2003. Print.

"Myopia and High Degree Myopia." *RNIB*. Royal National Institute of Blind People, 2014. Web. 10 Nov. 2014.

Papalia, Carmen. "You Can Do It With Your Eyes Closed." *Art 21*. Art 21 Magazine, 7 Oct. 2014. Web. 15 Oct. 2014.

"Primary Open-Angle Glaucoma." *GRF*. Glaucoma Research Foundation, 5 May 2011. Web. 22 Oct. 2014.

"Retinitis Pigmentosa." American Association for Pediatric Ophthalmology and Strabismus. AAPOS, July 2013. Web. 06 Nov. 2014.

Rodieck, Robert W. *The First Steps in Seeing*. Sunderland, MA: Sinauer Associates, 1998. Print.

Schiff, Richard. “With Closed Eyes: De Kooning’s Twist.” *Master Drawings*, 40.1. New York: Master Drawings Association, 2002. Print.

"Treating Glaucoma." *The Glaucoma Foundation*. The Glaucoma Foundation, n.d. Web. 22 Oct. 2014.

"Visual Acuity Test." *Medline Plus*. U.S. National Library of Medicine, 7 Feb. 2013. Web. 08 Nov. 2014.

"Visual Field." *Medline Plus*. U.S. National Library of Medicine, 7 Feb. 2013. Web. 09 Nov. 2014.