

LIVING WITH CHARLES BONNET SYNDROME:  
A LITERATURE REVIEW AND COLLECTION OF CASE STUDIES

by

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HONORS THESIS

Submitted to Texas State University  
in partial fulfillment  
of the requirements for  
graduation in the Honors College  
Spring 2022

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## ACKNOWLEDGEMENTS

I would foremost like to dedicate this thesis to my mother, *Meredith Johnson Le Blanc*, who became the impetus of my life's pursuit of medicine and science after a stroke that struck her with a visual impairment and the condition concerning this project, among others. Thank you so much for enlivening my purpose.

Another thank you goes to my thesis advisor, *Dr. Rebecca Deason*, who encouraged my ideas without question and aided me throughout this process.

To my best friend, *Kennedy Farrell*, words cannot explain how much you have changed my life. Thank you so much for aiding me throughout this process. I love you.

To the many other friends and family members, that I will not name for the sake of being too long-winded: thank you so much for your unbounded love and support of my endeavors.

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## **Abstract**

The etiology of visual impairment is quite diverse with an array of causes and magnitudes. The incidence of this condition often arises at hand with attendant complications that individualize the person's experience. Charles Bonnet Syndrome (CBS) is a prospective disorder that often materializes after the onset of visual impairment. This condition is characterized by visual hallucinations, also known as phantom visions, albeit unaccompanied by delusions. The literature on this condition is widely lacking leading to various inconsistencies in epidemiology. Although sufferers can distinguish their hallucinations from reality, the lack of understanding of CBS can lead individuals to question their sanity. This inclination paired with the degree of one's symptoms can result in a variety of outcomes. This present thesis serves as an amalgamation and review of the current research and a collection of three case studies. By overlapping experiences of these individuals with the current literature, new courses of research can be hypothesized. Moreover, this project serves to educate and spread awareness about CBS and the experiences of those afflicted by its colorful symptoms.

## I. INTRODUCTION

### A. *Charles Bonnet Syndrome: General Background*

Anthropomorphic gargoyles, multicolored porcupines, and a dancing caricature of George Jetson all appear to be figments of an overactive dreamscape. Although these images are beyond the constraints of reality, all three are plausible symptoms of a curious condition known as Charles Bonnet Syndrome. Charles Bonnet Syndrome (CBS) is a condition that may develop secondary to visual impairment. This condition is marked by intense, visual hallucinatory experiences with a variety of unique manifestations. These hallucinations can range from simple colors and patterns to complex images similar to those described above (Skorin, 2005). Those experiencing these types of visual hallucinations tend to have preserved cognitive function and awareness, such that this condition occurs without delusions (Jurišić et al., 2018). This feature contrasts with other diagnoses associated with hallucinations such as paranoid schizophrenia and other psychoses.

Charles Bonnet was a Swiss philosopher who first recounted this condition when observing his grandfather, Charles Lullin, who was visually impaired due to cataracts (Damas-Mora et al., 1982). Bonnet detailed Lullin's vibrant accounts of his visual hallucinations, which Lullin maintained were purely fictitious and often amusing (Sacks, 2013). This early collection of research was amassed in 1760, a mere two centuries before the eponym "*Charles Bonnet Syndrome*" would even be considered (Damas-Mora et al., 1982). Charles Bonnet was a pioneering scientist of his time and dabbled in a multitude of disciplines (Sacks, 2013). Like many philosophes of the 17th century, the conception of the "tabula rasa" (the philosophy that knowledge comes from experience) influenced his

hypotheses on the brain and this condition (Sacks, 2013). Bonnet theorized about a modular conformation of the brain, with diverse segments each with separate functionalities (Sacks, 2013). Moreover, Bonnet believed that although Lullin was without visual stimulus, his visual brain was pulling from memory rather than sensation to create his pseudo-hallucinations (Sacks, 2013). This notion is not too far from what is commonly accepted today. Despite this early conception of CBS research, most of the current literature on CBS has been conducted in recent decades. This fairly recent focus means there remain critical gaps in the knowledge of this syndrome. This point is worthy of being echoed to stress the importance of continuing research on this incredible condition.

### *B. Visual Hallucinations*

Visual hallucinations are defined as visual perception in the absence of an external stimulus (Sacks, 2013). These experiences are characterized under two general categories: unformed and complex (Skorin, 2005). Unformed hallucinations, also known as phosphenes, are the most common type of visual hallucinations (Sacks, 2013). This variety includes color distortions, flashes or streaks of light, geometric patterns, shapes, etcetera (Skorin, 2005). More complex hallucinations involve fully formed imagery enabling diverse forms (Teeple et al., 2009). These hallucinations are seemingly boundless and often comprise visions of faces, objects, animals, plants, etcetera (Teeple et al., 2009). Charles Bonnet Syndrome can present both of these hallucinations. Some experience a single type, and others experience both varieties. Another paramount feature of this condition is that hallucinators have preserved insight and cognitive awareness. Most, if not all, individuals with CBS are completely lucid and aware of the “*unreality*” of their visions (Jurišić et al.,

2018). However, this does not entail that hallucinations cannot confuse. When hallucinations have context with the individual's surroundings and environment, there may be a short period of perplexity about the reality of the vision (Sacks, 2013). For example, someone may hallucinate geese floating on a lake or people on a road. This period of confusion is usually brief, and the individual's awareness returns after someone denotes the unreality of their perception (Sacks, 2013). In many ways, hallucinations are not unlike experiences, and they may have an impact on the individual or none at all.

There are various other visual distortions and formations that may be coupled with Charles Bonnet Syndrome. Although a good portion of individuals with this condition are emotionally indifferent to their visions, some experience autoscopic hallucinations or hallucinations of the self (Dias & Suraweera, 2020). Concerning another visual abnormality, Sacks (2013) reported a case of a woman who would hallucinate multiplications of objects and figures within her visual perception. Hallucinations have also been found to vary in size from mammoth structures to diminutive people and animals. The latter example, Lilliputian hallucinations, is quite common among individuals with CBS (Blom, 2021). This variety has been theorized to have caused cross-cultural lore and myths concerning fairies and sprites (Sacks, 2013).

Since hallucinations pull from experience and memory, it is safe to assume that visions may have personal or cultural significance for some individuals. For example, a musician may hallucinate musical notation and a Japanese person may have visions of kabuki masks or *oni* demons (Sacks, 2013). Moreover, Christians are more likely to hallucinate figures of Jesus and Satan (Larøi et al., 2014). Culture influences hallucinations just as hallucinations have influenced culture. Like the previous example on sprites and

fairies, there are a multitude of narratives and fables in history that could have geneses within hallucinatory experiences. Religion, for example, has been greatly influenced by hallucination - Aztec priests would ingest hallucinogenic plants before rituals, the anointment of sainthood and demonic possession in Christianity was grounded in hearing voices and seeing angels, among others (Sacks, 2013; Larøi et al., 2014). It has been estimated that 62% of cultures have some practices rooted in a variety of hallucinations (Larøi et al., 2014). This fact could concern a completely separate project, but it is interesting to comprehend how hallucinations like those of Charles Bonnet Syndrome may have impacted culture before the birth of modern psychology and experimental research.

### *C. Previous Research & Variables*

Vision loss is more common with increasing age, which has led researchers to previously consider CBS as an exclusively geriatric condition (Jones & Moosajee, 2020). In actuality, CBS can arise from a multitude of ocular pathologies and affects a wide range of patients. Much of the current research on CBS is focused on age-related macular degeneration, which is one of the primary causes of visual impairment in the developed world (Niazi et al., 2019). Macular degeneration is first denoted by small yellow splotches within the retina, also known as drusen, with little to no visual impairment (Niazi et al., 2019). This complication may eventually cause choroidal hemorrhage in the macula, the area of the retina that processes central vision (Niazi et al., 2019). This abnormal leakage can lead to the formation of scar tissue and permanent damage to visual perception. In a research study conducted by Knight (2006), approximately 42.9% of a sample of 56 individuals with macular degeneration experienced a variety of visions. However, that

same study concluded that there was a higher occurrence of Charles Bonnet Syndrome in patients with diabetic retinopathy (Knight, 2006). Retinopathy is defined as a disease of the retina that causes vision loss (Engerman, 1989). More specifically, diabetic retinopathy occurs from retinal occlusion and aneurysm secondary to the increasingly common condition of diabetes (Engerman, 1989). Both diabetic retinopathy and macular degeneration generally affect older populations (Farida et al., 2012). There have also been a number of studies that have investigated CBS as an early indication of dementia (Pliskin et al., 1996; Terao et al, 2000). Pliskin et al. (1996), assessed the cognitive function of a sample of older adults and found that those experiencing Charles Bonnet Syndrome had lower performance on average. Although this experiment sought to investigate the relationship between CBS and other conditions related to aging, more research needs to be done in this area before strong conclusions can be drawn

There have been several studies that have investigated the presence of Charles Bonnet Syndrome in adolescent samples. Jones & Moosajee (2020) reported on the largest sample of pediatric patients (*aged 9-19*) with Charles Bonnet Syndrome to date. Most of the children that participated in the study experienced diseases within the retina. The most common condition being Stargardt's disease, a macular dystrophy that presents itself in the early stages of childhood (Jones & Moosajee, 2020). Although the sample size was only 13, these researchers expounded the fact that CBS has a remarkable range. It has yet to be determined whether age has a significant impact on the development of Charles Bonnet Syndrome. However, it has been found that younger patients were more inclined to report hallucinations which may skew the age distribution in consequence (Abbott et al., 2007).

The significance of age as a predictor for CBS is a query that is still presently debated. However, it is clear that Charles Bonnet Syndrome can arise in patients from all age groups.

Various other research has sought to understand what other variables may be predictors of Charles Bonnet Syndrome. The extent of visual impairment has not been found to be an indicator of Charles Bonnet Syndrome (Abbott et al., 2007; Jones & Moosajee, 2020). Other researchers offer a contrasting opinion to this idea suggesting that more severe vision loss may account for more complex hallucinations (Burke, 2002). In a large-scale study conducted by Gilmour et al. (2009), this factor was tested in a sample of 258 participants with varying levels of visual impairment. It was found that with worsening acuity (sharpness of vision) subjects were more likely to experience CBS (Gilmour et al., 2009). However, there was no correlation between the development of CBS and the initial visual impairment (Gilmour et al., 2009). This contradiction is yet another example of how the absence of definitive research has impaired the epidemiology of this condition.

#### *D. Personal Outcomes & Stigma*

The diversity in the prognosis of CBS can give rise to a variety of personal outcomes (Cox & Ffytche, 2014). Complex hallucinations can elicit a multitude of emotional responses due to their limitless possibilities (Teunisse et.al., 1996). For example, the hallucination of a penguin may be amusing while visions of apparitions and ghouls may evoke a more frightening experience. Moreover, the intensity of one's symptoms may conjure differing attitudes in separate individuals (Cox & Ffytche, 2014). For example, someone whose hallucinations persist throughout the day may find their visions more agitating than someone who experiences them infrequently. Additionally, hallucinations

may interrupt what remains of the individual's visual field or are confined to the impaired areas.

The hallucinatory symptoms of this condition alone are commonly attributed to psychosis and other related disorders. In that regard, the diagnosis of Charles Bonnet Syndrome is reassuring for most individuals (Cox & Ffytche, 2014). This is a genuine fear, as there are a few accounts of people whose conditions were misdiagnosed as schizophrenia in the past (Brda et al., 2011). With the stigma that is already attached to hallucinations, it can be imagined that these horrible notions are intensified with the added misnomer of psychosis. Westernized cultures are also more inclined to distinguish reality from the imaginary which may skew cross-cultural comparisons of individuals with CBS (Al-Issa, 1995). In that matter, western cultures are more disposed to label someone as “out of touch” with reality or psychotic (Larøi et al., 2014). This fact has been expounded in a multitude of experiments, most (*if not all*) of which concern psychotic-type hallucinations (Vanheusden et al., 2008).

Visual impairment alone is a handicap no matter the degree but with the added pressures of Charles Bonnet Syndrome, there are even more obstacles the individual may face including factors, like stigma, that are outside of the condition itself. Without a definite strategy for the treatment of CBS, researchers have proposed treatment by targeting negative outcomes and educating medical professionals (Cox & Ffytche, 2014). Doing so can encourage early intervention and implementation of strategies that may ease any negative effects.

## II. NEUROPHYSIOLOGY

With the current research, the neurophysiological understanding of Charles Bonnet Syndrome is not entirely understood. However, there are several researchers who have theorized the neurological origins of this condition, some providing unique and oftentimes contrasting hypotheses. With the accumulation of more research on CBS, we can formulate more treatments, educate professionals, and perhaps eradicate this condition in the near future.

The central visual system is composed of these fundamental components: the eye (retina), optic nerve, chiasm, optic tract, and visual cortex (De Moraes, 2013). The optic nerve is the pathway that connects the eyes to the posterior brain, the occipital lobe, which crosses at the chiasm (De Moraes, 2013). Therefore, stimulus of the right visual field is processed in the left occipital lobe. Lesions along these areas can produce completely unique conditions for an individual. For example, macular degeneration is a condition that directly affects the central retina (Niazi et al., 2019). Whereas a stroke depletes blood supply to vital nerves and may affect the optic nerve or the occipital lobe itself (De Moraes, 2013). It is quite clear that visual impairment is not a homogenous disability. Thus, it is safe to assume that one's Charles Bonnet Syndrome is completely individualized. In the early years of CBS research, it was widely believed that the condition only results from direct diseases of the eye such as macular degeneration and others (Sacks, 2013). This does not appear to be the case and CBS can be a sequel of any condition that causes a visual impairment. These differing areas may also account for varying neurological effects and thus may result in diverse hallucinations and inceptions of Charles Bonnet Syndrome if acquired.

One connection that helps explain the neurological basis of Charles Bonnet Syndrome resides within a more familiar condition. This condition is known popularly as phantom limb sensation. What constitutes a phantom limb is the presence of sensation in a limb that was previously amputated (Schley et al., 2008). This condition is present in a substantial number of amputees at upwards of 55% (Schley et al, 2008). Some researchers even believe in the universality of the condition across all amputees (Sacks, 2013). Charles Bonnet Syndrome has also been referred to as “*phantom vision*” by many researchers (Sacks, 2013). “*Phantom*” meaning hallucination in the absence of perception for both conditions. The sensation of a phantom limb can originate as minute tingling and burning, but could eventually explode into crushing, pinching, and other extreme varieties like contorting (Hanakawa, 2012). Charles Bonnet Syndrome and phantom limb have a multitude of similarities as they both involve the loss of sensation. Although the onset varies from person to person, in both of these conditions it is generally accepted that symptoms arise after a great period with the initial impairment alone (Hanakawa, 2012). Thus, both of these conditions stand for the plasticity (or malleability) of the brain, the ability to reorganize and mold after an intense change (Hanakawa, 2012). However, phantom limb tends to have a quicker onset than CBS (Sacks, 2013).

There is much we can learn about CBS through phantom limb research which is ample when compared to the former (Farida et al., 2012). The mechanisms by which the inner workings of the brain rewire after the removal of the limbs or impairment of vision could quite possibly be generalized across these two conditions. For example, the rapid denervation of nerve cells in the visual system can in turn spur an overactivity in the sensory regions leading to fully formed hallucinations (Farida et al., 2012). This process of

rapid denervation occurs during the amputation of a limb as the procedure also severs vital nerve connections (Farida et al., 2012). However, there are a few clear differences across these two conditions. For example, a phantom limb resembles actual sensation while phantom vision, CBS, is more fantastical. Additionally, phantom limbs may be manipulated and moved while the individual with CBS cannot influence their hallucinations as far as we know.

W. Burke (2002) applies the brain's functional diversity to expand on the neurophysiology of deafferentation as a plausible cause of CBS. The author themselves experienced CBS hallucinations after a disruption in their foveal vision (Coltheart, 2018). Deafferentation, as previously discussed, occurs when a region in the brain loses certain nerve connections. Burke (2002) suggests that some deafferented neurons retain vital connections and become hyperexcitable through these unaffected linkages to other regions in the brain. Owing to the brain's diversity in function, the excitement of different connections in the brain may indicate certain types of visual hallucinations (Burke, 2002). Such that, hallucinatory faces are localized in the superior temporal sulcus and hallucinatory sceneries are localized in the ventral-occipitotemporal cortex (Burke, 2002). The process of deafferentation is also associated with the pathogenesis of phantom limb sensation. This condition can fall under a more general umbrella of "*deafferentation pain*" which correlates it with other conditions that arise without amputation (e.g., hypoalgesia, spinal cord injuries, etc.) (Hanakawa, 2012). The hyperactivity of these unimpaired neural connections in the brain after visual impairment and amputation are probable explanations for the causes of Charles Bonnet Syndrome and phantom limb sensation respectively (Coltheart, 2018; Hanakawa, 2012).

The neural activity of visual hallucinations has been investigated in the past via neuroimaging. In an experiment conducted by Ffytche et al. (1998), participants experiencing CBS were connected to an fMRI and asked to signal the onset of hallucinations. The data collected in this experiment was cross-analyzed with a control group whose neural activity was measured when presented with a collection of visual stimuli. It was concluded that the areas on the cerebrum that encode specific stimuli correlate with the locations that are stimulated when experiencing similar hallucinations. In that matter, visual hallucinations are not localized to an unrelated location on the brain, but rather converge in the areas that encode the corresponding visual stimuli.

It is important to note that CBS tends to decline for a significant number of patients. Researchers hypothesize that this phenomenon is due to deafferented neurons becoming resensitized to visual stimuli over time (Burke, 2002). Burke's hallucinations were only temporary (Burke, 2002). The idea perseveres that more research should be conducted in this locale, suggesting that greater vision loss may enable more powerful and persisting hallucinations (Burke, 2002). As previously discussed, this criterion is nevertheless debated.

There have been a few medicinal strategies that have been proposed previously to ease Charles Bonnet Syndrome. However, the evidence is purely anecdotal and has not produced any clear paths for treatment. A good portion of these studies have focused primarily on selective-serotonin reuptake inhibitors (SSRIs) which is more famously applied to treat depression. The research has found significant resolve of CBS hallucinations after treatment with low dosages of various SSRIs (Lang et al., 2007; Berman & Barak, 2013; Dias & Suraweera, 2020). This successful remission of Charles

Bonnet Syndrome after administration of medication has allowed researchers to postulate on the serotonergic mechanisms of visual hallucinations (Land et al., 2007). Although these studies showed some success, it is necessary to continue research with much larger samples and wider framework to ensure the veracity of these claims.

### **III. ADAPTATION AND GROWTH**

Post-traumatic growth is defined as an experience of positive life outcomes after the occurrence of immense hardship (Tedeschi & Calhoun, 2004). This phenomenon has been quantified in various inventories and is noted by a great sense of personal strength, magnification of one's spirituality, and strengthening of interpersonal relationships (Kashdan & Kane, 2011). The act of harnessing suffering as an avenue for positive change is an age-old behavior that can be observed in an array of religious teachings and philosophies (Tedeschi & Calhoun, 2004). The consensus on higher degrees of post-traumatic distress as predictors for greater personal growth is inherently mixed (Kashdan & Kane, 2011). However, researchers have applied similar systems when studying the outcomes of individuals with hallucinations and acute visual impairment.

Visual impairment often has a quick onset that heralds a handful of immense changes for the individual. The drastic modification of the visual field may, in turn, affect one's individual routine. Daily tasks like reading newsletters, driving, and sometimes even walking become increasingly complicated depending on the level of impairment. Visual impairment affects even the individual's social standing and emotional well-being as many are faced with social isolation from their peers (Knight, 2006). These changes require constant adaptation and rehabilitation as the individual adjusts to their new reality. To

quantify how an individual may cope with their condition it is necessary to evaluate their coping skills, interpersonal relationships, and comorbidities they may face (Knight, 2006). Charles Bonnet Syndrome is an example of a secondary condition that entangles one's personal journey as the individual must adapt to an auxiliary condition with its own separate symptoms and hardships.

In a qualitative study conducted by Dixon et.al. (2018), the overall attitudes of a handful of individuals experiencing varying levels and types of hallucinations were assessed. The participants of this study recognized the traumatic nature of hallucinations and how their experiences have complicated their daily life. However, these individuals also detailed a great deal of personal growth (Dixon et.al., 2018). Although this article provides an example of the growth a person might experience after the onset of their hallucinations, this research failed to mention Charles Bonnet Syndrome. Previous research has found that those experiencing CBS have indifferent attitudes towards their visual perceptions (Cox & Ffytche, 2014). For many with CBS, hallucinations are a mere nuisance rather than something integral to their identity (Cox & Ffytche, 2014). This finding begs the question if individuals with CBS have experienced any magnitude of personal growth due to their symptoms, or does this indifference prevent them from undergoing true positive change?

#### **IV. CASE STUDIES & FUTURE PATHS**

##### *A. Case Studies*

For this section of this present thesis, the author aspired to contact a handful of individuals with Charles Bonnet Syndrome to converse about their overall experience with

this magnificent condition. By engaging in conversation with individuals living with CBS, their experiences and attitudes are much better elucidated and future paths to research can be proposed. Criteria of participation were 1) limited to those older than 18 years of age, 2) cognitively aware individuals, and 3) those not experiencing other varieties of hallucinations (e.g., auditory, gustatory, etc.). Recruitment was done via a Facebook group that the researcher was an established member of, and contact information was exchanged after participants indicated their interest. Interviews were set up via zoom and lasted no longer than an hour. The questions asked are outlined in *Appendix A*, however, it is important to note that these questions were a general guideline rather than a concrete method. Most interviews were guided by the participant's willingness to talk about their experiences and establish a conversation.

Participant A, a 49-year-old female, developed Charles Bonnet Syndrome secondary to left homonymous hemianopsia (vision loss in the left periphery) after a stroke following the fungal meningitis epidemic in 2012. Her hallucinations had a rather quick onset with her visions materializing instantaneously after waking from a medically-induced coma. The participant noted intense hallucinatory experiences that often disturbed what was left of her visual perception and were sometimes disconcerting criteria. For example, a common hallucination she experiences is visualizing the carcass of a cat in a bundle of wrapped blankets. She also indicated the presence of dark figures and apparitions. An important feature of this participant's journey is her familial history of schizophrenia. At the onset of her hallucinations, the family was reluctant to accept her hallucinations and her unimpaired sanity. Despite this evident drawback, the participant perseveres with a light-hearted attitude, finding joy and humor in the more comedic visions. She also stresses

the importance of acceptance, embracing the condition as reality, and moving forth in the world:

“That is the main key, acceptance...Accepting what it is... the stress of trying to fight it makes it worse.” - Participant A

The participant additionally nourishes a unique, holistic spirituality that has been augmented by her many adversities. Although she acknowledges the unreality of her visions, she has found significance in her most common hallucination of owls. Her belief system has been the main feature of her coping with this condition as well as others she experiences.

With no clear strategy for the treatment of CBS, it is fairly apparent that the necessity of healthy coping strategies has been magnified in importance for all participants. Participant B, a 56-year-old female, began to experience Charles Bonnet Syndrome after retinal detachment and treatment with silicone oil and extensive lasering. Although this was the inception of her impairment, she continues to experience a multitude of conditions that affect her vision today. One unique feature of this participant has been the stroke of inspiration her hallucinations have ignited. Throughout the interview, the participant displayed various paintings and drawings that depicted her hallucinatory experiences. Gargoyles, mandalas, skeletons, and lava lamp globules are just a few examples of her visions. Participant B maintained that they were always a creative person but turned to art as a way to communicate to others what she sees on a day-to-day basis.

Participant C, a 35-year-old female, experienced Charles Bonnet Syndrome after a traumatic brain injury. One feature of this participant's journey that diversifies her experiences is not only her young age but the fact that she has not suffered extensive vision

loss. Although this may seem to contradict some areas of this paper, it is certain that CBS has materialized in individuals without considerable visual impairment. Charles Bonnet Syndrome is an inherently neurological condition, so damage to the visual system may lead to CBS without considerable blindness in some individuals. This particular detail has hindered her diagnosis and the participant explained that neurologists have said she does not have CBS by citing outdated criteria. The neurologists she has previously dealt with believed that CBS only affected older populations and those with over 60% vision loss. Although this specific framework may make someone more likely to develop the condition, it does not negate her own experiences. This complicated path to being diagnosed has led to her own denial of her symptoms and she expressed being cautious when admitting her hallucinations. Participant C also indicated that family and friends questioned her mental health and even her possible “clairvoyance” when discussing her visions. The participant stated that speaking with the *Royal Institute of the Blind* and the online communities has finally helped her come to terms with her CBS. In these domains, she is accepted without question and given the resources necessary to cope such as various avenues for counseling. Being connected to these groups has been a paramount steppingstone in her journey with this condition.

### *B. Future Directions*

By compiling the current literature on Charles Bonnet Syndrome and comparing these findings with the experiences of these three individuals, paths to future research can be proposed.

All participants either indicated an altered appreciation of life and/or the world

around them, but it is also important to note that this is indicative of their many experiences and not solely due to their Charles Bonnet Syndrome. The pathogenesis of CBS is a long and windy road full of many hardships, so it can be assumed that personal/spiritual growth is a result of many integrated adversities. Participants also stressed the necessity of acceptance and recognition of the hallucinations. An important path to research that should be considered, is the effects of healthy coping strategies on the overall experiences of the individual. Although medicinal and alternative therapies have been proposed, this research is not yet concrete. By assessing the importance of healthy coping mechanisms, art for example, professionals can suggest alternative modes of easing one's hallucinations or coming to terms with the symptoms.

Another important path to research is to continue the study of younger samples. As discussed previously in this present paper, CBS has been marked as a geriatric condition and attached to dementia and cognitive decline in previous research. By assessing the cognition of a younger sample of individuals experiencing CBS, we can estimate if cognitive impairment is truly comorbid with this condition. As seen with Participant C, the notion that CBS is only experienced by the elderly and severely visually handicapped is still quite prevalent even with medical professionals. Highlighting CBS research with younger samples is incredibly important because it expands the known range and presents this condition as a possibility for *any* person that suffers a visual impairment or brain injury regardless of age. Studies, like the one conducted by Jones & Moosajee (2020), have begun a momentous conversation worthy to be built upon; the fact that even adolescents can experience CBS. What differentiates adolescents with CBS from older individuals, and why is there such a disparity in regard to age?

It is important to expand the research regarding the neural mechanisms behind Charles Bonnet Syndrome as well. As seen in this paper and across the three case studies, the pathogenesis of CBS is diversified. An interesting approach to research would be examining the brain activity of individuals in intervals over a set amount of time. By intervening at the onset of visual impairment and examining neural activity, we could visualize the plasticity of the brain after vision loss and hopefully determine the origin of hallucinations if the participant comes to experience them. Additionally, expanding on research with individuals experiencing hallucinations without substantial impairment (as seen in Participant C) would be an interesting approach. Are there differences in the inception of CBS with differing visual acuity and visual fields?

Although these are simply a few suggestions on the future directions of research, none can truly compare to the original motivation behind this specific project. Charles Bonnet Syndrome is a widely unknown experience of some visually impaired individuals. The hallucinations that are associated with this condition are often intense and condemned in present society. By encouraging CBS research at all magnitudes, we directly propagate the potential for education and destigmatization of this condition. In doing so, the path to acceptance as indicated by the participants included in this project is much easier achieved through the process of empathy. People often refer to empathy as “seeing through the eyes of another”, although this is presently impossible with current technology, the cultivation of research may help us better understand and “see through the eyes” of those with Charles Bonnet Syndrome.

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## APPENDICES

### *Appendix A*

#### Interview and Demographic Questions

- Age?
- When did your visions first begin?
- What condition did you suffer beforehand that eventually led to your visions?
- Describe your visions? Are they complete, complex images (*i.e., people, cartoons, animals... etcetera*), shapes/colors, or both?
- How has your experience been with this condition?
- What is your overall attitude towards your visions?
- Can you describe a few visions or events concerning Charles Bonnet Syndrome that stand out to you personally?
- Are there any ways you cope with your visions?
- Do you ever feel cautious to talk about this condition for fear of how others may perceive you?
- What did/do your family members and friends think about this condition?
- How were you diagnosed?
- Are you aware of a professional that specializes in this condition?
- How has this professional helped you?
- Have you ever encountered a professional that was not aware of this condition?
- Are there any means of support or services that have helped with this condition?
- Are there any coping mechanisms you use to help ease your stress with this condition

- Do your visions affect your day-to-day life? How disruptive to vision are they to you?
- Have your visions affected your outlook on life?