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# Preschoolers and Pandas Making Friends: A Journey about Healing from Brain Injury

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## Abstract

Preschoolers that have obtained Non-Accidental Injury (NAI) from familial child abuse are in need of having a unique place for neurorehabilitation in correlation with traditional therapies. My thesis project suggests adding an exhibit annex to an existing giant panda exhibit that will give preschoolers an opportunity to help develop new neuropathways when exposed to mediation and creative activities. Meditation and creative activities are being examined by neuroscientists as an aid in neuroplasticity after brain injury. This thesis reviews the neurotypical preschooler's milestones and the playful means by which they are achieved. Conjoining the contemporary museums' and zoological gardens' outreach to the medical field and a need for a place where preschoolers can heal, giant pandas will make good friends.

State University of New York  
College at Buffalo  
Department of History and Social Studies Education Department

Preschoolers and Pandas Making Friends:  
A Journey about Healing from Brain Injury

by  
Barbara Anne Doucette

Thesis Project  
Submitted in Partial Fulfillment  
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Master of Arts

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For Edith

To the women who inspire me throughout my life's journey:

Stephanie- The Soulful

Amy- The Helper

Linda- The Pioneer

Mildred- The Artist

Muriel- The Poet

Betty- The Musician

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## Chapter One: Introduction

*“The brain is more than an assemblage of autonomous modules, each crucial for a specific mental function. Every one of these functionally specialized areas must interact with dozens or hundreds of others, their total integration creating something like a vastly complicated orchestra with thousands of instruments, an orchestra that conducts itself, with an ever-changing score and repertoire”.*

— *Oliver Sacks*

I have worked with children since I was 18 years old. My hats have varied, from a teacher’s assistant in multiple primary school levels, a kindergarten science teacher, an English as a second language teacher to young Somalian children, and a neighborhood academic tutor. For four years I also volunteered at a cancer hospital. I engaged in arts and crafts activities with children while they were either waiting for their family members or for their own treatments. Through every moment of laughter, frustration, and sadness, I have loved being in the presence of children. Whether it was in an educational or a medical setting, I have always found it to be a mutually fulfilling and valuable experience. I have learned so much about the complexity of life through watching the simple actions of a child remove glue from their hands or become best friends for ten minutes on a playground. I whole heartedly believe childhood is precious and should be cherished for it is never long enough. The fleeting moments of childhood were beautifully written in the poem, “The End,” written by A.A. Milne in his 1927 book of children’s verses Now We Are Six:

*“When I was One,*

*I had just begun.*

*When I was Two,*

*I was nearly new.*

*When I was Three*

*I was hardly me.*

*When I was Four,*

*I was not much more.*

*When I was Five, I was just alive.*

*But now I am Six, I'm as clever as clever,*

*So, I think I'll be six now for ever and ever.”*

As an undergraduate student in college, I pursued my interest in caring for the well-being of children. I studied developmental cognitive psychology and mixed media arts. I also audited classes in neurology at a university, which was engaging. During my psychology studies, I excelled at studying grief and trauma related issues for children. I became very passionate about helping children during sudden life altering trauma. My scholastic training in art focused on sculpture and painting. I wanted to approach working with children in alternative settings that spanned beyond the boundaries of traditional schools and therapies. After being inspired by a child who was enthralled in reading about DNA at the Human Origins Exhibit at the Smithsonian National Museum of Natural History, I entered the museum studies graduate program, pursuing the educational track. During my studies, I spent two semesters interning at the Jacobs School of Medicine and Biomedical Sciences Brain Museum. During my time there, I created a primary school aged workbook, I was a docent for people with intellectual and developmental disabilities, and I designed educational exhibits. I work as a freelance mix-media artist and

professional toy maker. I regularly donate trauma related dolls, i.e. loss of limb, burn, and stuffed animals to children in need. I have been exposed to the reality that child abuse knows no bounds, whether it be economic status, in upper, middle, and lower classes, or whether it is geographical areas, occurring in urban, suburban, and rural communities. Or situations where a husband or wife did not leave their spouse, due to fears of having nowhere to go, as well as fears of leaving their child alone with their spouse. As refugees come to United States there is also the transition and stress of learning a new language and learning a new cultural balance. I have often become concerned that people have become dull to the sensitivity of head trauma, as social media display repetitive GIFs of head-bangs and threats from adults to children as 'humorous replies' to statuses. My volunteer work has included working with child rights advocacy, including missing and exploited children and human trafficking. The idea for this project has been a passion since the first time I had a child reach out to me because they had been harmed and I felt helpless. I entered the museum studies program to learn how to bring together all the strands of my experiences and develop educational programs for children in need of healing due to Non-Accidental Injury (NAI), especially brain injury. Zoos in particular are a great opportunity to support healing in a unique environment.

I decided to focus on preschoolers, children between the ages of 3-5 years old, who had suffered brain injury due to familial child abuse. Choosing the environment for children had to be precise. The inspiration for individualized therapy or group educational programming had to show effectiveness for healing after injury. My research brings together two areas of study: museum studies and neurology.



What I am discussing in my project is how can an annex to a zoo exhibit aid preschoolers with brain injury due to familial abuse, be used as a rehabilitative environment? What kind of exhibit annex is needed to support that endeavor? What kind of lessons are helpful? I will be showing how meditation, yoga, and playful creativity lessons engage sensory receptors within the brain, encouraging new neuropathways and enhancing neuroplasticity.

## Chapter Two: Methodology and Background

### Methodology:

To format this thesis and define my project as innovative, I needed to correlate two distinctive topics: neurology and a zoo exhibit. When combined, these areas offer an innovative approach to therapy. Implementing the approach and making it tangible for a therapeutic use for preschoolers with NAI brain injury meant I would need a muse. Neurology varies from a precise science that lends itself to the delicate art of surgery to the vibrancy of neurologic music therapy. While the inhabitants of a zoo exhibit may change, the concept of the exhibit often stays the same. While waiting for my muse, I turned to a favorite distraction, the Smithsonian's National Zoo's Giant Panda Cams.<sup>1</sup> Broadcasting on camera one, Bei Bei male, one year old giant panda, played in his yard.<sup>2</sup> He rolled into lop-sided somersaults without a care in the world. He bumped into a log, got up, walked away, and somersaulted again into the same log. I thought to myself "look at this fluff ball play." That is what I needed to conjoin the topics: carefree play. The amalgamation between neurology and a zoo exhibit was play. Play allows children to use their imagination while developing their creativity, as well as their gross and fine psychomotor skills, and neurocognitive and psycho-social development.<sup>3</sup> I had noticed something else about giant pandas when I looked at the other Giant Panda Cam and saw Bei Bei's mother, Mei Xiang.<sup>4</sup> She was peaceful and her posture was at rest. Sitting in her own yard under a tree, her motionless stillness that brought serenity to my own breath after watching Bei Bei's panda gymnastics extravaganza. Giant pandas have a way of being with nature that is easily embraced by preschoolers.

For my project, I am proposing adding a guided meditation, yoga, and playful creativity center within the Giant Panda Exhibits at multiple zoological gardens. In my project, I am using

the Smithsonian's National Zoo & Conservation Biology Institute's Giant Panda Exhibit and its past and present inhabitants as an example. The inception of my design is meant to capture a Taoist element, offering a balance of activity and stillness, a place where children can have a respite from abuse. Nurturing preschoolers to engage in guided meditation, yoga, and creative activities aids in developing new neuropathways in conjunction with traditional rehabilitative therapies both occupational and physical therapy.

Museums and zoos have been expanding beyond old methodologies. In 2013, the American Alliance of Museums (AAM) released a report stating,

Museums have long been essential pillars in America's educational infrastructure. But increasingly, museums of all types and sizes are integral to U.S. health care, supporting medical research and training, initiating therapeutic programs for those with memory loss, children on the autism spectrum and veterans with combat-related illnesses, and inspiring healthier nutrition and behavior.<sup>5</sup>

The president of the AAM, Ford W. Bell, quoted from the press release of the report *Museums on Call* stated "This report showcases just one of the many ways museums have become essential community assets and service-providers."<sup>6</sup> Examples of museums, zoos, and aquariums that work in conjunction with the medical society provided in the report:

-The Tucson Museum of Art brings art-making projects to critically ill children at the University of Arizona Medical Center. While dealing with their illness or disability in an unfamiliar environment, children explore and express their feelings, discover ways of working in the visual arts and engage in therapeutic social interaction."<sup>7</sup>

-ZooTV, a partnership between the Great Plains Zoo in Sioux Falls, South Dakota, and the Sanford Children's Hospital, offers comfort and a welcome diversion to patients whose days may include blood tests, injections, and painful treatments. The program utilizes 14 weather-proof cameras to shoot live video in several areas of the zoo. It offers participants a feeling of stability

and constancy when many aspects of their lives are restricted and dictated by illness and treatment.”<sup>8</sup>

-The Cummer Museum of Art and Gardens in Jacksonville, Florida, offers Kids Together Against Cancer, a workshop for families coping with a cancer diagnosis. Clinical social workers and artists gather at the museum for discussion, art-making and support.”<sup>9</sup>

-Autism Speaks has worked with multiple zoos and aquariums such as: Monterey Bay Aquarium, Monterey Bay, CA, Detroit Zoological Society Detroit, MI, and Central Park Zoo, Wildlife Conservation Society New York, NY, offering specially designed programs or areas that have decreased stimuli, less foot traffic from other visitors, and in some cases appointed zoo hours. --

-Art museums such as: Dallas Museum of Art, Dallas, TX, The Hyde Collection, Glens Falls, NY, and Fine Arts Museums of San Francisco—de Young Museum and Legion of Honor, San Francisco, CA strive to offer programming to visitors with Alzheimer's and dementia and their loved ones. The programs can be used for stress relief, but loved ones also find them as a source of bonding and memory recall.<sup>10</sup> I found the examples an inspiring platform, but what I was seeking was a permanent annex within a zoo with sensory options that can be manipulated by the visitor.

With my experience as a docent with the Brain Museum and when I discussed my idea about my thesis project with my peers I realized that I have, from my undergraduate education, an above average knowledge of neurology. But, I am not near the level of neurological professionals. I had to find a comfort level of writing and explanatory discussion for my thesis. To accomplish this, I utilized two different forms of research, one was medical journals, the other was literature from medical advisory websites. I did this to keep a proper balance of not getting into neurological jargon, but to help the reader maintain interest in the forthcoming topic.

A glossary for the neurological terminology is included in the appendix.

Relating brain injury and its effects on preschoolers required a trifold method of research. First was to understand a neurotypical preschooler's neural development starting with a look at in vivo neuronal development. Second was examining the neurological damage caused by NAI brain injury due to familial abuse. Third was utilizing developmental milestone markers used by medical and educational professionals to set a baseline of neurotypical cognitive development. The meditation, yoga, and creative play lessons offered in this exhibit will rely on three specific types of play that help preschoolers achieve their milestones during rehabilitation. 1) Social play- an interactive play, where children share an environment, which often leads to expanding communication including verbal and word recall during stories. This marks the beginning of imaginative play, when children start to invite others to play and start to seek a common goal in their play.<sup>11</sup> 2) Parallel Play/mimicking (non-teasing manner) is a constant throughout preschool, though it requires little socialization at times, it can involve communication. This type of play involves both a mimic of peers and their surroundings and is ideal for following yoga positioning.<sup>12</sup> 3) Object play is exploratory for hand-eye coordination by using an introduction to arts and crafts, dolls, and stuffed animals for example. This can be interactive or solitary.<sup>13</sup>

The exhibit is designed to be an embracing and natural environment. It is nurturing to preschoolers where they can engage in guided meditation, yoga, and creative activities to aid in developing new neuropathways in conjunction with traditional rehabilitative therapies i.e.; psychological, occupational, and physical therapies.

In 2009, the Human Connectome Project (HCP) launched a five-year long project. Their goal was to develop “a unique opportunity to understand the complete details of neural connectivity.”<sup>14</sup> The task was to construct neural connection maps from multiple people during

in vivo and throughout a number of human life spans. The goal was to give a glimpse into understanding how the brain reacts to stimuli, effecting emotions, behaviors, thoughts, and consciousness.<sup>15</sup> According to a licensed marriage and family therapist, Linda Graham, who has used HCP for her own work

Neuroscientists can observe the ring of individual neurons. They can see neurons growing branches toward each other in real time. Neuroscientists can measure cell volume structures of the brain and see how a specific activity or experience contributes to further growth in that area. Meditation, and yoga have shown encouraging effects on building and reconstructing neuroplasticity.<sup>16</sup>

Specific lessons will be discussed in the project chapter in Chapter 5.

Adding the element of playful creativity for aiding neuroplasticity, I am adding lessons that involve both visual arts and music. Both mediums of creativity offer a substantial promise for promoting healing. Neuroscientists discovered, following the review of multiple types of neuroimaging, that there are ‘enhancements in the functional connectivity’ after an individual engages in creative activity.<sup>17</sup> According to a team of researcher at University Erlangen-Nürnberg in Nuremberg, Germany, “The improvements in the visual art production group may be partially attributable to a combination of motor and cognitive processing”.<sup>18</sup> Music is unique because it ‘encompasses the entire brain.’<sup>19</sup> Two clinical neuropsychologists at the University of Melbourne, Australia, Drs. Dawn Merrett and Sarah Wilson stated “Primary and secondary sensory areas are involved in music as they provide necessary tactile and kineasthetic feedback during music production, such as singing or playing an instrument.”<sup>20</sup> Music guided neuroplasticity can be intertwined within different lessons provided in the exhibit; examples will be shown in Chapter 5.

Statistics regarding child abuse are inconsistent, as non-government organizations and the United States government statistics do not correlate. One of the difficulties regarding statistics of child abuse according to the Center of Disease Control (CDC) is that:

Statistics tell only part of the story because many cases are never reported to social service agencies or the police. Estimates from self-report data indicated that more than 1 in 7 children have experience one or more forms of child abuse or neglect in the past year.<sup>21</sup>

The CDC statistics regarding child abuse were based upon U.S. state and local child protective services (CPS). In 2012, CPS estimated that over 686,000 children were victims of maltreatment, a number based upon the roughly 3.4 million referrals they received regarding children being abused or neglected. Of those 686,000 children, roughly 78% are victims of neglect, 18% are victims of physical abuse, 9% are victims of sexual abuse, and 11% are victims of other types of maltreatment.<sup>22</sup> It is even more difficult, according to the Center of Disease Control, to find statistics regarding brain injury from child abuse:

However, there are several challenges that make tracking the occurrence of abusive head trauma difficult, including limitations in available national datasets, inconsistency in definitions of abusive head trauma, and variation in how these definitions are applied. Historically, national and state-based morbidity datasets have not been adequate for tracking abusive head trauma, due mostly to the lack of completeness and specificity of external- cause-of-injury codes (ICD-9-CM E codes) in injury-related hospitalization and emergency department records.<sup>23</sup>

As people advocate at governmental, professional, and social levels for justice, they must also seek the best care for the child, which includes optimal healing and the ability to have a healthful life.

People with medical and psychological conditions can never be denied access to museums and zoos. Many cultural and historical organizations are going beyond the American Disabilities Act (ADA) requirements by setting higher standards of comfort and accessibility for all guests.<sup>24</sup> The American Alliance of Museums (AAM), using Dr. Screven's study regarding

the future of disability inclusive exhibits, stated that the progress of museums in recent years has made it possible to include design features that assist people with special needs into public environments.<sup>25</sup> For example, according to the AAM, the National Gallery of Art in Washington, DC is setting a strong example in a multi-site museum accessibility study that will test and measure the outcomes of specific educational protocols for people with visual impairments.<sup>26</sup>

Background:

### *Neurotypical Preschoolers*

To summarize the infrastructure of a neurotypical preschooler's brain, I examined the primary functions of neural pathways and their relation to damage due to NAI brain injury. Throughout the prenatal stage, trillions of neurons are formed, more than will ever be needed in a neurotypical child's lifetime.<sup>27</sup> As the fetus' brain grows at a rapid rate in vivo, neuron and synaptic connections will relocate via neuronal migration. The neuronal migration happens due to synaptogenesis and myelination.<sup>28</sup> Synaptogenesis is the process of linking neuron to neuron and myelination is the process of dressing the axon with its proper fatty layer for protection.<sup>29</sup> The process of neuronal migration is the linking of neurons from the gray matter in the brain through the white matter to reach specific locations that control bodily functions.<sup>30</sup> Neuronal migration governs specific functions in the body in response to chemical signals i.e.; brainstem and midbrain.<sup>31</sup> The brainstem and midbrain are the primal areas, which control the autonomic functions for survival i.e.; heart rate, breathing, sleep, to developing thought process and memory.<sup>32</sup> In vivo is the time for the brain to develop its foundation for the basic architecture for learning, health, and behavior.<sup>33</sup>



Postnatal, synaptogenesis and myelination excel rapidly, constructing neuropathways.<sup>34</sup> Neuropathways are developed by the construction of nerve fiber tracks that were created in vivo.<sup>35</sup> The brain starts with 100 billion neurons and 2,500 synapses per neuron.<sup>36</sup> The brain continues the task of connecting pathways by either conjoining or eliminating neurons that are exposed to environmental stimuli.<sup>37</sup> This process is known as synaptic exuberance and pruning. When precise connections to the targets that are needed for functioning are formed and what is not needed is eliminated, hence pruning.<sup>38</sup> The majority of postnatal changes include increase in size and volume, development of processes, and establishment of mature synaptic connections.<sup>39</sup>

#### *Milestones from the ages of 3-5*

The ages from 3-5 years old are referred to as the “blossoming years.”<sup>40</sup> The verb “blossoming” best describes the rapid rate of a preschooler’s neurological development. Between these years is the height of synaptic exuberance and pruning.<sup>41</sup> This development is highlighted in the forthcoming examples of play, which demonstrate the rapid pace that preschoolers develop, from emotional dependence to discovering autonomy, while physical gross and fine motor skill develop.<sup>42</sup> Neurocognitive development depends on both physical and psychological structural foundations. The brain is reorganizing and recognizing itself by forming new neural connections, developing new thoughts, memories, desires, movements, and skills. Through repetition the myelination increases, causing the brain plasticity to decrease, as neuropathways become more defined.<sup>43</sup> The process of neuroplasticity is starting to slow down.<sup>44</sup>

To understand the juxtaposition between a neurotypical preschooler and a preschooler with NAI brain injury there must be a form a measurement of mental health and physical

achievements. This is achieved through developmental milestones and play. The following information is based on both medical and educational sources.

I will be approaching the milestones and how they are actively achieved through play when applied to a neurotypical child. As the neurons go through the differentiation processes and establish mature synaptic connectors they lay the basic architecture for preschoolers. Pediatric developmental theorists consider play an *essential experiential* for the physical development during the developing years.<sup>45</sup> The reliance on learning through play in a safe and stable environment is crucial for optimal wellness. Hand-eye coordination yoga, which correlates with vision, is the main point of interest when discussing NAI brain injury in this thesis. The American Academy of Pediatrics (AAP) states that play allows children to use their creativity while developing their imagination, dexterity, and physical, cognitive, and emotional strength.<sup>46</sup> As milestones become more defined in the thesis the benefits of play become more defined. When a child plays, according to the AAP, the play allows for healthy brain development while preparing them to interact with the world around them.<sup>47</sup>

There are two types of interactive play with adults that are a natural part of development for children to obtain their neurotypical milestones. The first is unstructured play, when a child uses unlimited creativity and imagination to develop play scenarios to either find their own identity or mimic an adult's actions.<sup>48</sup> The second is semi-structured play, a guided play with joint attention by parent and child. This type of play helps with structured learning and helps to guide a child with coexisting in the environment around them.<sup>49</sup> When coordinating structured and unstructured play with diverse types of active play, it gives children an opportunity to relearn skills and regain trust around adults.

When gauging the development of a neurotypical preschooler and the recovery after NAI

brain injury, both medical and educational professionals rely on developmental milestones. This information offers an insight for the preschooler's natural and/or recovery ability and orientation, though this is not unchallengeable and final. This insight is a marker that guides professionals in assessments and feedback for care management.<sup>50</sup> Assessments collect information in two formats: formative and summative. Formative provides 'direct feedback from observations' and summative provides 'data points to be used at the end of a time period.'<sup>51</sup> The listing of milestones below are achievements of neurotypical preschoolers.

### Three Year Olds

-Visually: Have 20/20 vision.<sup>52</sup>

-Physical: Gross motor functioning, feet become more stable with movement pattern adjusting into a normality with alternating feet while walking, running, and stair climbing. They can use stairs both up and downward without the assistance of a guide rail. They can hop and balance on one foot.<sup>53</sup> Hand-eye coordination is excelling at this point with gross motor movement turning into fine motor functioning. Hand dexterity begins to become more active while engaging in their surrounding environment and in developing autonomy, such as dressing themselves.<sup>54</sup>

-Cognitive: Fine motor skills and cognitive development go "hand in hand" as three year olds start using puzzles, 3-6 pieces, and make block towers, 6-9 blocks.<sup>55</sup> They start to learn to place objects in an opening.<sup>56</sup> Physical and verbal development is the most noticeable. Three year olds begin to increase their language, as well as communication skills and identification. They develop vocabulary of several hundred words.<sup>57</sup> The sound of their speech is becoming clearer and their sentence structure is coherent.<sup>58</sup>

-Social/Psychological: Preschoolers communicate with others in play, sharing and taking turns during play, and welcoming others to play. Children start to mimic behaviors from social

encounters and the surrounding environment of peers and adults.<sup>59</sup> During play preschoolers explore their imagination while playing with toys, the use of stuffed animals and dolls encourage nurturing.<sup>60</sup> When unable to communicate properly or overwhelmed with emotion, children at this age resort to temper tantrums.<sup>61</sup> They can be around new caregivers for minimal periods of time, as they become more comfortable, i.e., daycare.<sup>62</sup>

#### Four Year Olds

-Visually: Have 20/20 vision.

-Physically: Gross motor functioning, more limb independence, stable when holding a single leg up or a single arm above their head. Able to do jumping jacks, throw and catch balls.<sup>63</sup> Fine motor skills and dexterity continues to develop.<sup>64</sup>

-Cognitive: At 4 years of age, their cognitive behavior tightly intertwines thought processes and actions. Preschoolers become little bundles of energy when they learn, and it often helps memory retention. Singing and dancing, often interpretively, is a staple of their behavior. They can retell a story, remembering various parts and predicting the end. General time span comprehension starts i.e.; "dinner will be soon" and "we need to leave the playground in a few minutes."<sup>65</sup>

Preschoolers are able to play board and card games with color, number, same and different match recognition.<sup>66</sup> Vocabulary can develop to more than 1,000 words.<sup>67</sup> There is a use of full sentences with correct grammar including using "he" and "she", as well as past and present tense.<sup>68</sup> This is when they enter the "why?" phase and they are not afraid to ask over and over "but, why?".<sup>69</sup> Like to discuss what they are interested, which is the mark of a growing independence.<sup>70</sup>

-Social/Psychological: Behavior towards others is more interactive with their peers, more gender awareness and choosing to interact with their own gender.<sup>71</sup> Preschoolers fully engage their

imagination within their play, occasionally with imaginary playmates, still struggling separating imagination from reality.<sup>72</sup> Preschools like to 'fit-in' more with peers, especially those of their own gender.<sup>73</sup>

#### Five Year Olds

-Visually: Have 20/20 vision and developed vestibular system and can close eyes while independently moving limbs.<sup>74</sup>

-Physical: Gross motor functioning; five year olds are fully mobile, they can do a somersault, go on a swing, and pump arms and legs, skip, and move forward and backward with ease. Fine motor skills and dexterity continues to develop.<sup>75</sup>

-Cognitive: At 5 years old, their cognitive behavior tightly intertwines thought processes and action. Their vocabulary is more than 2,000 words, using clear and coherent speech.<sup>76</sup> The "why" questions now have focus and they seek to try to answer their own questions.<sup>77</sup>

-Social/Psychological: The arch between 4 years old and 5 years old starts to blend as they reach school age. They want to please others and be accepted by friends, peers, and authority figures, therefore they are more likely to agree with rules.<sup>78</sup> They can now can decipher between real and imagination.<sup>79</sup> They need and will demonstrate more independence.<sup>80</sup> They still tend to identify more with the same gender and now feel closer to same gender parent/guardian.<sup>81</sup>

#### *Brain Injury in Preschoolers*

According to the Blue Knot Foundation, the most prevalent type of damage regarding psychosocial behavior is to the cortex and the limbic system. Injury to the cortex causes a decline in activity and an increased reaction to minor stressors.<sup>82</sup> Part of the limbic system is the amygdala and the hippocampus. The amygdala controls the release of the stress hormone

adrenaline, which engages the brain and body to perceive danger and triggers response.<sup>83</sup> The amygdala ‘processes’ and ‘generates’ emotional responses to survival to environmental surroundings. When the hippocampus is injured it decreases in volume, causing fight/flight/freeze reactions to non-threatening stimuli due to confusion of their own identity. There are also strong concerns of damage to the corpus callosum and the left hemisphere that cause social psychological effects due to alteration of hormones releasing stressors such as cortisol.<sup>84</sup> Correlating the insults leads to both the mental and physical need for building new neuropathways. Other notable mental health effects listed by Brain Injury Association of America (BIAA) are; lowered self-esteem, restlessness, lack of motivation, mood swings, denial, and anxiety.<sup>85</sup>

The visible effects of NAI brain injury that effect a preschooler are boundless, due to a NAI brain injury resulting from solely or any combination of Shake-Choke-Bang (SBC) and neglect, including intentional malnourishment, isolation, and sexual abuse, which can physically alter multiple regions of the brain.<sup>86</sup> The visible effects vary from and are not limited to: speech-compression and recall, vision- impairment and loss of, hearing- impairment and loss, mild to chronic headaches, motor coordination (hand/eye coordination), spasticity of muscles, paresis and paralysis, seizure disorders- infrequent to frequent, balance disorders including dizziness and vertigo, and mild to chronic fatigue.<sup>87</sup>

### Chapter Three: Literature Review

The sources for this project include studies on NAI brain injury, specifically in preschoolers. This is often a controversial subject, due to highly publicized legal matters involving Shaken Baby Syndrome (SBS). However, it is not the objective of this project to take sides with any public or private legal argument. The cause of the NAI brain injuries discussed in this project are due either solely or any combination of Shake-Bang-Choke (SBC), as well neglect including intentional malnourishment, isolation, and sexual abuse. I will not be using specific information of child abuse that has not already been previously published due to the Health Insurance Portability and Accountability Act of 1992 (HIPAA), which includes Patient Safety Confidentiality, and out of personal respect to harmed children.<sup>88</sup>

#### *History*

Child abuse, though long recognized as a serious problem, is still often ignored by the general public; it is perceived as a matter for legal and medical authorities. In the United States, during colonial and slavery times, child abuse was accepted and often encouraged. Dr. Howard Markel, professor of pediatrics, psychiatry and the history of medicine at the University of Michigan, discussed in his *New York Times* article that it was not until April 10, 1874, when ten-year-old Mary Ellen Wilson testified in court, two years after her abuse was discovered by a neighbor, that issues surrounding child abuse arose.<sup>89</sup> Dr. Markel, who has written extensively on the social and cultural history of medicine, discussed that due to the lack of legal and medical help for children in 1872, Wilson's abuse was reported to the American Society for the Prevention of Cruelty to Animals (ASPCA). In Mary Ellen's testimonial before the New York State Supreme Court, she recounted being locked in dark rooms and receiving severe beatings to the head. Other causes of NAI, including NAI brain injury, are neglect, including

malnourishment/malnutrition (as worded by government and children's rights organizations), isolation, abandonment, sexual abuse, witness to violence, and forced alcohol and substance abuse. In his article, Dr. Markel, goes on to discuss how it was Mary Ellen's bravery in court that helped to develop the first legal aid for child protection, the New York Society for the Prevention of Cruelty to Children.<sup>90</sup>

In 1962, a defining paper entitled "The Battered Child Syndrome" was published in *Journal of the American Medical Association* by C. Henry Kempe and his colleagues. Dr. Kempe was a pediatrician from a German Jewish family who escaped Nazi Germany in the 1930s. During his career in the United States at the University of Colorado Medical School, Dr. Kempe attempted to understand the injuries, such as fractures and convulsions, he noticed in children who had no known history of trauma.<sup>91</sup> In the 1950s, Dr. Kempe established one of the first national Child Protection Teams.<sup>92</sup> When he and his colleagues released their paper in 1962, it started an "avalanche of publicity [that] led to the enactment of child abuse reporting laws."<sup>93</sup> No longer was child abuse viewed as an uncommon occurrence, stating that the "beating of children is not confined to people with a psychopathic personality or of borderline socioeconomic status. It also occurs among people with good education and stable financial and social background."<sup>94</sup> The paper also noted the reluctance of doctors to address the possibility that the injuries they witnessed in children could be due to familial child abuse.<sup>95</sup> Dr. Kempe later went on to establish The Kempe Center in the 1970s, a center that focuses on the issue of child abuse, which is still active today.<sup>96</sup>

Today, child abuse remains a common issue in the United States, according to Dr. Martin Teicher, who is the director of the Developmental Biopsychiatry Research Program at McLean Hospital and a professor of psychiatry at Harvard Medical School. This is made more difficult by



the fact that medical and educational professionals have often been given limited training in identifying abuse as laws silently change. Dr. Teicher discusses how most child abuse legislation and punishment is decided state by state, even if under federal mandate.<sup>97</sup> Dr. Teicher goes on to discuss the research conducted by him and his colleagues at McLean Hospital on the effects of child abuse on brain development. This research has demonstrated that child abuse causes a “cascade of effects,” including psychiatric disorders, hormonal changes, and brain abnormalities.<sup>98</sup> In conclusion, Dr. Teicher states that with this information he hopes that “new understanding of childhood abuse’s impact on the brain will lead to new ideas for treatment” and that a stronger emphasis needs to be placed on preventing the abuse of children.<sup>99</sup>

### *Neuroplasticity*

As discussed by the preeminent developmental pediatrician, Nandini Mundkur,

Plasticity is an intrinsic property of the central nervous system, reflecting its capacity to respond in a dynamic manner to the environment and experience via modification of neural circuitry. In the context of healthy development, plasticity is considered beneficial, facilitating adaptive change in response to environmental stimuli and enrichment, with research documenting establishment of new neural connections and modification to the mapping between neural activity and behaviour. Less is known about the impact of this plasticity in the context of the young, injured brain.<sup>100</sup>

Dr. Mundkur, whose work has heavily focused on early detection and intervention services for developmental disorders, also discusses how research in psychology and neuroscience, over the past few decades, has indicated that brain development and behavior in children can change in response to their experiences. This topic is being studied at many different levels and on many different time scales. Dr. Mundkur explains that the brain is not static and changes throughout one’s entire life, however plasticity is at its maximum during the first few years of life and continues to decrease over time.<sup>101</sup> The type of neuroplasticity that is discussed in this project is

adaptive plasticity. According to Dr. Mundkur, adaptive plasticity relies on the altering neuronal circuitry, including “axonal sprouting.”<sup>102</sup> Dr. Mundkur explains that “axonal sprouting” is when healthy axons grow new nerve endings to connect or reconnect to the damaged neurons. Undamaged axons can therefore connect to other damaged neurons by "sprouting" new nerve endings to form new neural pathways.<sup>103</sup> Both options will offer aid in neuroplasticity.

### *Child Abuse and Brain Injury*

To relate this neurological research to child abuse, I first had to find a definition for child abuse. Just as child abuse legislation can vary greatly, so do definitions concerning what constitutes child abuse. I therefore choose a definition from an international organization. The World Health Organization defines child abuse thusly: ‘Child abuse or maltreatment constitutes all forms of physical and/or emotional ill-treatment, sexual abuse, neglect or negligent treatment or commercial or other exploitation, resulting in actual or potential harm to the child’s health, survival, development or dignity in the context of a relationship of responsibility, trust or power.’<sup>104</sup> As previously discussed, the type of child abuse that this project will focus on is brain injury.

According to Dr. Elizabeth E. Gilles of the Child Neurology Foundation, identifying an abusive head injury is unlike other injuries; abusive head injury is a distinct form of brain injury in which the history offered by the person who injured the child is biomechanically inconsistent with the severity of injury.<sup>105</sup> Dr. Gilles, a pediatric neurologist, goes on to discuss how terminology on abusive injury to the head was once labeled under the umbrella term "child abuse."<sup>106</sup> But over time; the terminology has attempted to become more specific to the injury.<sup>107</sup> The terms “battered child syndrome” and “shaken baby syndrome” (SBS) became the norm in

the medical and social/psychological fields. In addition to the work of Dr. Gilles, the work of another pediatric neurologist, Dr. Patrick Barnes of Stanford Medicine, has proven that while SBS was originally often identified as a whiplash only type of injury, brain injury in children involves more than whiplash. Dr. Barnes, who combined imaging findings with clinical findings, laboratory testing, and pathologic and forensic examinations, explained that blows to the head and other assault mechanisms can include battering (hitting and kicking), strangulation, suffocation, and/or any combination of assaults.<sup>108</sup> Dr. Gilles and Dr. Barnes explain that today, the proper term is Non-Accidental Injury (NAI). And other battering actions can be classified as Shake-Bang-Choke (SBC).<sup>109</sup>

The Brain Injury Association of America (BIAA) explains that after NAI brain injury, the neurons, nerve tract, and the sections of the brain that were harmed in the cases of NAI brain injury are effected. According to the BIAA, damage to the brain this will cause neuronal damage.<sup>110</sup> As previously mentioned, the majority of neural migration happens during in vivo and is happening through the preschool years. BIAA states that when the neurons are damaged it will affect many facets of the brain's neurocognitive functions for such as hand/eye coordination, vision, and psychosocial behavior.<sup>111</sup> Impairments can range from mild to severe.

The non-visible effects of NAI brain injury results from solely or any combination of SBC, neglect including intentional malnourishment, isolation, and sexual abuse is not limited to the information listed below. These are shared examples from the Blue Knot Foundation in Australia and Brain Injury Association of America, who also highlight a number of issues when working with abused children in therapeutic and academic situations. After having obtained a NAI brain injury a preschooler can suffer multiple effects from the damage, due to the types of abuse and combinations of abuse. A mainstay of NAI brain injury is the psychosocial aspect of

abuse. The effects are bifold: 1) Direct psychological, either one of or any combination of depression, unprovoked argumentativeness, or frustration, often a sense of isolation (correlating with direct neurological injury); 2) Neurological, can cause depression, confusion, memory loss/retention, emotional disposition (correlating with psychological).

### *Play*

Preschoolers are driven by a “natural instinct” to play, whether it is learning new skills or discovering autonomy. According to Dr. Richard L. Gaskill and Dr. Bruce D. Perry, the basics of play start at the preschool years and set the neurological foundation of pre-academic learning. This includes, increasing learning behaviors by developing an understanding of reading and writing by letter identification, along with the grasping basic concepts of arithmetic, problem solving skills, and muscle development and coordination, abstract thinking, and presocial behavior.<sup>112</sup> Dr. Gaskill is a senior clinician educator of family medicine at The University of Chicago, and Dr. Perry is a senior fellow of the Child Trauma Academy in Texas and professor of psychiatry and behavioral sciences at Northwestern University Feinberg School of Medicine. Dr. Gaskill and Dr. Perry discuss that a part of a child’s social development is learning to express their thoughts and feelings with other children and adults. The preschool age is when children to express emotions such as; empathy, anger, and fear in a verbally and physically situation appropriate manner.<sup>113</sup>

As discussed in the methodology section of Chapter 2, play helps children develop their gross and fine psychomotor skills, and neurocognitive and psycho-social development, while also using their imagination and developing their creativity.<sup>114</sup> Dr. Regina M. Milteer and Dr. Kenneth R. Ginsburg, both pediatricians, discuss how children in the United States living at or

below the poverty line experience a number of educational and health disparities, including an impediment to their right to play. Many children are not experiencing the benefits of play at home or in school. Benefits of play, according to Dr. Milteer and Dr. Ginsburg, are enhancement of physical health, health brain development, development of social and emotional ties, and a development of resilience.<sup>115</sup> Both authors conclude that special consideration must be given to provide safe places for children to play, specifically children living in poverty. This can include a stronger emphasis on free exploratory play in schools, supervised after-school programs, community-based programs, and parental engagement at home. Dr. Milteer and Dr. Ginsburg also encourage child health professionals, specifically pediatricians, to take on a stronger role as advocates for the inclusion of play.<sup>116</sup>

### *Museums*

In 1993, the Smithsonian Center for Education and Museum Studies published an article written by Dr. Chandler Screven, Director of the International Laboratory for Visitor Studies and Professor of Psychology at the University of Wisconsin, Milwaukee, which stated that museums and zoos "offer 'untapped potential' for communicating social, cultural, and scientific information, correcting misconceptions and improving attitudes and cognitive skills."<sup>117</sup> Dr. Screven goes on to discuss how museums and zoological parks respond to the changing dynamic in society in a multitude of ways. Museums have been expanding beyond old methodologies and are opening to possibilities of being a place of wonder and a place to wander on one's own whether it is with guided therapy/lesson or their own discovery with an exhibit. Dr. Screven explains that "human learning and motivation, developmental psychology, cognitive science, educational psychology and instructional design have important implications for teaching and

motivating museum visitors.”<sup>118</sup> However, he goes on to discuss that there have been very few real-world examples of these techniques being used in museums.

Other ways in which the role of museums have been expanding is through the programs, services, and experiences they try to provide to their visitors. Lisa Roberts’ essay, “Changing Practices of Interpretation,” from 1997, in the book *Reinventing the Museum: The Evolving Conversation on the Paradigm Shift*, examines innovators in the museum field from the 19<sup>th</sup> century. Roberts discusses individuals like John Cotton Dana, director of the Newark Museum, who created exhibits to begin drawing in new visitors to his museum, including housewives, workers, and immigrants.<sup>119</sup> Roberts also discusses the innovations of Arthur C. Parker of the Rochester Museum of Arts and Sciences, who helped to expand the community-service role of museums. Parker initiated programs for loaning materials to schools, as well as programs for the unemployed and for promoting patriotism during World War II.<sup>120</sup> In the same book, Joseph Pine II and James H. Gilmore’s 1999 essay, “The Experience Economy,” discussed the importance of experiences as a service to customers, including to visitors of museums. According to Pine and Gilmore, “experiences are memorable events, revealed over time, that engage individuals in an inherently personal way.”<sup>121</sup> The important aspect of providing customers with experiences, including visitors in museums, is not entertaining them, but engaging them.<sup>122</sup>

The role of museums has continued to expand since the 1990s. In 2010, Lois H. Silverman wrote *The Social Work of Museums* where she describes about how museums have continued to change with “a growing belief among practitioners, policymakers, and the public alike in the power of museums to inspire hope and healing, improve lives, and better the world.”<sup>123</sup> Silverman, who is a professor in the Department of Recreation and Park Administration at Indiana University, Bloomington, has focused her research on the potential of

museums. Silverman discusses how museums are evolving from their traditional roles and have begun to embrace their role as agents of social change. Silverman specifically examines how museums are continuing to evolve in chapter 7, “Toward the next age,” as they are no longer just serving the privileged of society. Silverman writes,

From individuals with dementia to victims of violence and persecution, many of society’s most vulnerable people are finding support in and through museums. As illustrated in our survey, museums are providing service to relationships complicated by such difficult circumstances as stress, addiction, cognitive or physical disability, depression, grief, life-threatening illness, and mental illness. They are aiding people as they cope with unemployment, displacement, imprisonment, trauma, terrorism, war, prejudice, discrimination, stereotyping, and stigma. Museums are tackling issues like sexual violence, domestic violence, inequity, poverty, homelessness, substandard living conditions, illiteracy, and historical trauma.<sup>124</sup>

Museums have continued to change their relationship with their clients by working with social workers, art therapists, and social service agencies as collaborative partners. Silverman discusses how museums have been applying fundamental interventions of social work, by building these types of relationships, museums are able to help foster therapeutic experiences.<sup>125</sup>

In June 2013, the American Alliance of Museums assembled a report to showcase some of the important ways that museums are contributing to health care. The report included information about helping patients, training medical professionals, and educating the public about health and wellness needs.<sup>126</sup> The report also highlights ten aspects of health care that museums have already begun highlighting, which includes Alzheimer’s, autism, disease prevention, health literacy, hospital outreach, medical training, mental health, military and veteran’s health, nutrition and wellness, and visual impairment. A wide arrange of institutions have begun implementing programs focused on health care issues, including art museums, children’s museums, history museums and historic sites, natural history museums, science-technology centers, public and botanical gardens, zoos and aquariums.<sup>127</sup> The American Alliance

of Museums concludes the report with examples of museum programming focusing on health care issues in all 50 states and the District of Columbia. Examples include: *ArtHaven*, an art therapy program at the Leepa-Rattner Museum of Art at St. Petersburg College in Tarpon Springs for adolescents with mental health, developmental or social issues and the *Play Our Way* program, a playtime for children with autism, at the Children's Museum and Theatre of Maine in Portland, Maine.<sup>128</sup>



## Chapter Four: The Project

Having searched for the muse, I approached the topic of NAI brain injury by meditating on my vision of what would be a suitable place for state of mind, brain, and body healing before starting the design that was unlike other designs. Instead of my usual technique of hiking and dog walking with a sketchbook and letting the inspiration flow, this project was different, every perspective would be viewed from an abused child's emotions and needs. It was consider abuse first, then consider function and format.

Approaching the design, I consulted an essay I read in class that provided an interesting topic discussion. It regarded revenue and visitor experience, on how to keep a single theme within a museum/ museum exhibit. "The Experience Economy," written by Joseph Pine II and James H. Gilmore, emphasizes the importance of directness and creating a complete experience without being frivolous.<sup>129</sup> I found the theme of the article to be a helpful guide to keep the design simple and complete, as over stimulation to children during the preschool years can be overwhelming. This is especially true of preschoolers with NAI brain injury. According to the essay experiences "occur within any individual who has been engaged on an emotional, physical, intellectual, or even spiritual level."<sup>130</sup> I believe that defines what I am seeking for the preschoolers and their caregivers to be able to individualize their therapeutic needs.

"The Experience Economy" section titled 'enriching the experience' guest participation had two objectives.<sup>131</sup> Each objective was taken into delicate consideration when developing the exhibit. The first objective is both passive and active involvement with the exhibit. Passively, the participants either view or listen to the exhibit. Actively, the participants become engaged with the exhibit. Pine and Gilmore continue break down the sections- 'the coupling of these dimensions thus defines four "realms" of an experience-- entertainment, education, escapist, and

esthetic.’<sup>132</sup> Thus, developing “personal encounters” for the participants to “creatively explore” characteristic of each “realm” of the exhibit is paramount.<sup>133</sup> The concept of passive and active objectives worked well with my theory of lessons that involve multiple types of play that would aid neuroplasticity.

As I read the essay I pulled out the questions that Pine and Gilmore presented and started to write down answers, sketching brief answers, before completing a whole idea. Examples of the questions are listed below to help gauge the importance of design for abused children (or people with disabilities).

To incorporate the ‘Four Realms’ Pine and Gilmore asked the following questions:

1) “In what kind of environment should guest be immersed? How should it affect their senses? What could we add (or take away) that would encourage guest to just want to be there?”<sup>134</sup> As a toy maker, I am often asked to make dolls and stuffed animals, something huggable. When I pass my creation to its new keeper their first reaction is to hold their arms out and hug, even the adults. But I was faced with the concern that some of the abused preschoolers I addressed were exposed to intentional isolation, sexual abuse, and SCB, which can lead to a fear of contact from others. The space needed privacy but could not be enclosed. Sensory integration should be controlled by the visitor’s wishes/needs and aid in therapeutic healing. To encourage preschoolers, I wanted to maintain a feeling of innocence and wonderment, that’s where the giant pandas do a wonderful job just being themselves.

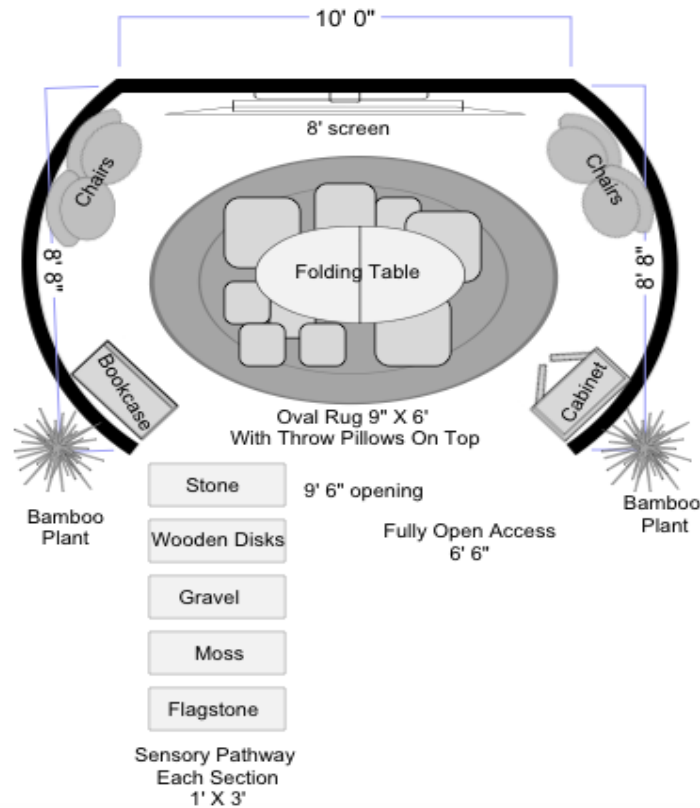
2) “What would make the learning experience more active? What should guest do while they learn?”<sup>135</sup> I want to add an interactive meditation screen that has options for the preschoolers to choose from with different levels of visual stimuli. There are options for a simulated painting screen that allows the preschooler to engage in playful creativity. By using a similar technology

that follows body pattern in video game playing, their body can become different artist's tools. The learning aspect comes in the form of an aid to help guide new neuropathways. By using meditation, yoga, and playful creativity it will help preschoolers achieve their milestone rehabilitation, per ability.

3) "What information or activities would engage your guests in the exploration in the knowledge or skills? What should guests learn while experiencing what you have to offer?"<sup>136</sup> I have designed the space for meditation, yoga, and playful creativity, but within the design there is a foldable table, multiple sized pillows, sitting pillows, and chairs placed to the side. As all of this is easily moveable, as this design is meant to be utilized for their therapeutic needs. I tried my best to make it a child first healing environment that also keeps the caregiver in mind. The chairs allow for conversation, either one on one or in a group. The table gives a space for arts and crafts, puppet play, block building, etc. Except for the screen, cabinetry, and side pathway everything is moveable for wheelchair access. The guidelines for wheelchair access are as follows: any pathway must remain 36 inches (91cm) long, doorways must be 32 inches (81 cm) wide.<sup>137</sup>

4) "How can we incorporate elements of fun, spontaneity, and surprise? What would make your guests' stay more fun and enjoyable?"<sup>138</sup> This was my hardest question by far, and quite honestly, I think I went through multiple sketch pages and Sharpie pens. But my view kept coming back to my favorite distraction - the giant pandas.

Black and White version of the exhibit, *A Journey with Giant Pandas*



After answering the four questions from “The Experience Economy,” I examined the ‘Five Principals to Creating Experiences.’<sup>139</sup>

The first principal was to engage in a theme that can “alter a guest’s sense of reality.”<sup>140</sup> Being based on giant pandas, naturally my influence would be China. During my time as volunteer at a cancer hospital, I had numerous meaningful conversations with a Taoist doctor. It was a very tender time in my own life, as what she had said was not about words, it was about “being.” For the exhibit, I aimed for simple, clean, and what is organic to China’s natural beauty.

The second principal was that “the richest venues possess themes that fully alter one’s sense of reality by simultaneously affecting the experience of time, space, and matter.”<sup>141</sup> This principal will be abundant in the screens functioning and options.

The third principal is that “engaging themes integrate space, time, and matter into cohesive realistic whole.”<sup>142</sup> This exhibit was designed to be used in correlation with traditional therapies for preschoolers with NAI brain injury. A safe place, away from hospitals, lawyers, even law officials, where they can make friends with “fluff balls” and watch them in their own exhibit and on giant panda cam. A place where they are a preschooler.

The fourth principal is that “themes are strengthened by creating multiple place within a place.”<sup>143</sup> As previously mentioned, most of the contents within the exhibit are completely moveable for easy access and plenty play/therapeutic options.

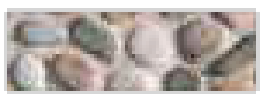
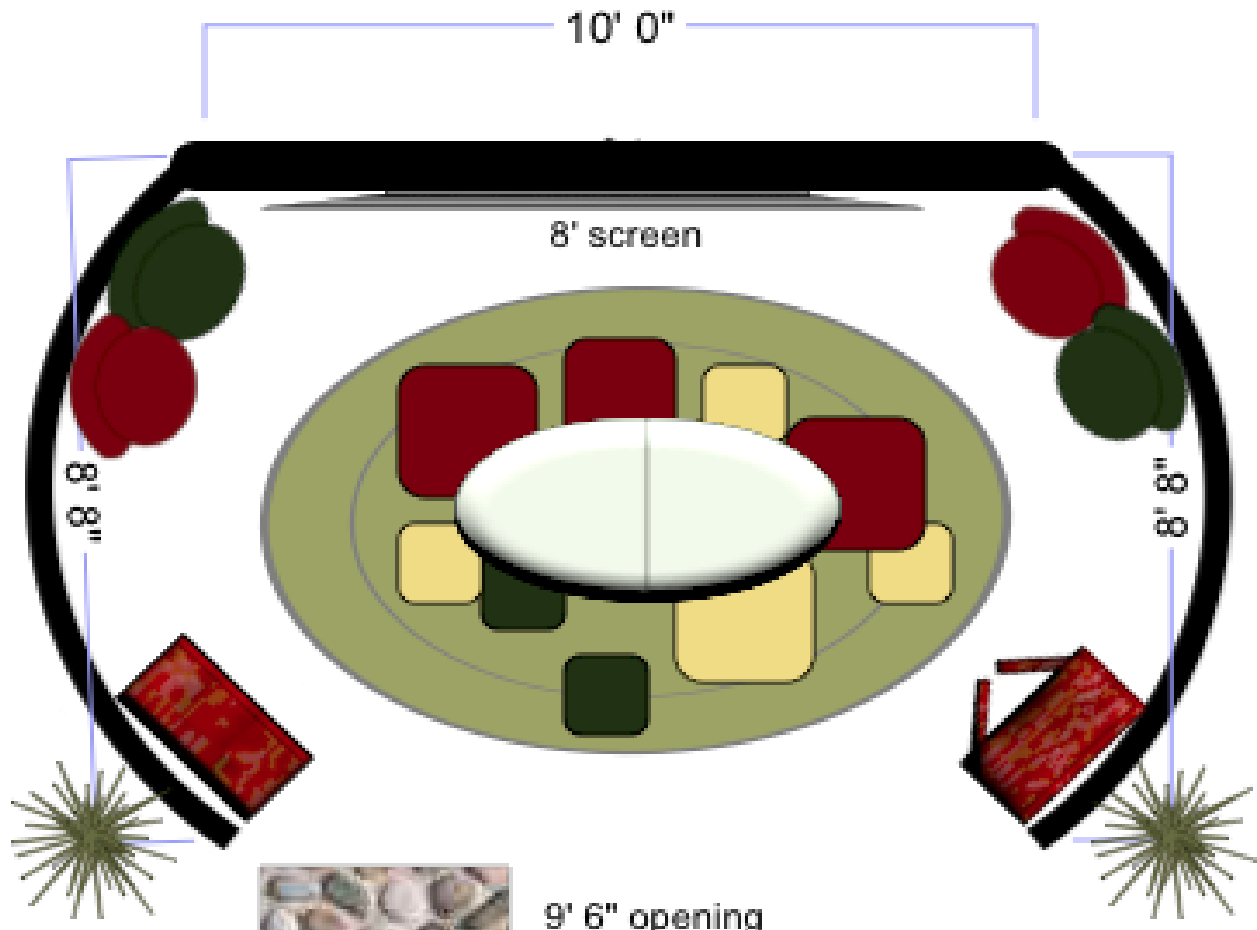
The last points from “The Experience Economy” that helped me to form my exhibit were; “Eliminate Negative Cues” and “Engage the Five Senses.”<sup>144</sup> These were the hardest.

To eliminate negative cues, I tried to put myself in the mindset of an abused preschooler to the best of my ability. After my years of advocacy and research, I sat still in my living room as small as I could for what seemed to be close to an hour and imagined the world around me as huge and hurtful. What around me would seem like, for lack of better wording’ what felt like objects of punishment, what felt like loneliness: how would I want to be able to move about but still be safe. Pine and Gilmore referred to this as ‘inconstant visual or aural cues,’ I perceived it as removing the harm and engaging the peace.<sup>145</sup>

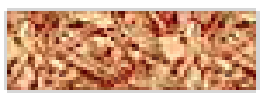
To engage the five senses, Pine and Gilmore state “Most experience stagers actually start by developing an impression they wish guests to take away, and then creatively think about different themes or story lines that effectively bring together the impressions in one cohesive

narrative.”<sup>146</sup> But in the case of this exhibit’s purpose the design is simple yet unique. There is not one way of being within it. Another thought has come to mind, am I keeping in mind children who have recently lost sight, hearing, speech? I do not know if I have the answers. Installing the exhibit design and putting it to the test will assist with assessing its impact.

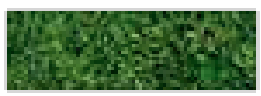
Color version of the exhibit, *A Journey with Giant Pandas* shown on next page



9' 6" opening



Fully Open Access  
6' 6"



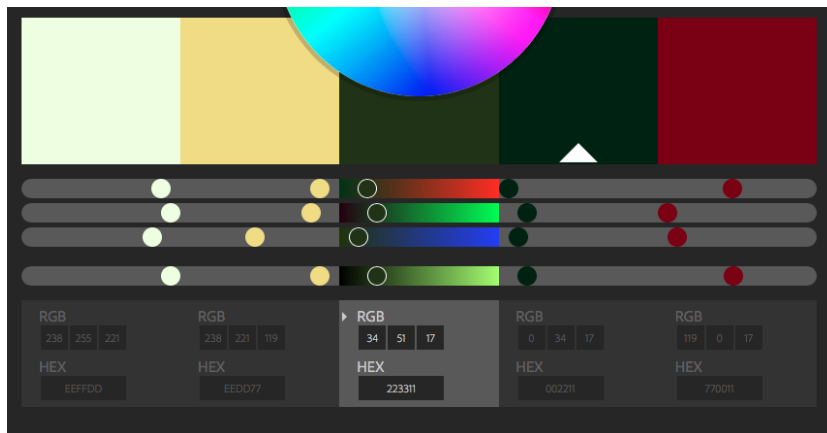
Sensory Pathway  
Each Section  
1' X 3'

To choose a color foundation, I searched through old textbooks from when I studied Chinese art as an undergraduate student. While I did develop a focus for flora and fauna to match the Smithsonian’s National Zoo & Conservation Biology Institute Giant Panda Exhibit, I did not find anything with the playful giant panda I was seeking, so I needed a modern artist. I came across Lu Ye Guang while looking for colorful ink artists. Mrs. Guang is a Gongbi and Xieyi painter. She studies the beauty of birds, flora, and fauna. She is known for “delicate, graceful, religious and powerful” paintings.<sup>147</sup>



Lu Ye Guang 1967- Wuxi, China, Untitled, Undated

26” x 26” (66cm x 66cm) Chinese Rice Paper, Ink





Interactive Screen Options:

- Smithsonian's National Zoo & Conservation Biology Institute *Giant Panda Cam* or Zoological that the exhibit is located

- Yinlianzhui Waterfall, China



- Bamboo in a gentle breeze with the sound of wooden wind chimes



- Giant pandas playing in the snow with traditional Taoist Meditation music





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- Interactive painting screen that is body activated



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Example shown is a smaller scale-The Cleveland Museum of Art, Cleveland, Ohio, ARTLENS *Make Your Mark* – Visitors were provided with three abstract painting techniques, represented by different objects from the museum’s collection, and are invited to become a virtual abstract painter by utilizing the techniques of pour, drip, and gesture to create art of their own.

The construct of the exhibit would remain as true, organic, and natural as possible to the feel of China. Outside of the exhibit is labeled an area for two plants, I would like to use *Artemisia annua* (wormwood/mugwort) it has an earthy scent that is calming. As for cabinetry and the table I have chosen Jichimu wood, also known as bird wood due to its feather like patterning. The sensory pathway leading to the exhibit consists of; stone, wooden disks, gravel,

moss, and flagstone. The furniture and rug would have to be of commercial quality. Flooring, walls, and lighting options may be an issue, as this exhibit is an annex within an existing exhibit.

I designed the annex for mediation, yoga, and playful creativity with preschoolers. The design is sized to be for personal interaction ranging from 1-2 adults and 2-3 children depending on the activity. Within the design are removable, a craft table, pillows, and four chairs allowing for easy access for mobility during activities. Though this room was designed for preschoolers with NAI brain injury it is not exclusive and all would be welcomed.

There are similar types of lessons I mentioned throughout this project that are active in museums and zoological gardens but they not housed in annexes nor are they readily available to public medical and psychological services. Examples of three yoga programs and one music program are;

-Children's Museum of Pittsburg's *Relax*- '45 minutes of stretching, focused breathing, and meditation.'<sup>153</sup>

- Wow! Children's Museum in Lafayette, Colorado's *Dance & Yoga Studio*- Dance, offers tap, ballet, and barre with costume options. Yoga, an opportunity for adults and children to bond "introducing new vocabulary words." They also suggest animal yoga- "bark during downward dog or sing your favorite nursery rhymes as you hold a balancing pose.'<sup>154</sup>

-Huston Zoo: 'What's better than gorillas at sunset? *Yoga and Gorillas at Sunset!* Spend a relaxing evening with your family posing like our great ape family at our gorilla habitat.

Whether you are new to yoga or just looking to strengthen your practice, we will discover how you can make a difference for animals, both locally and worldwide.'<sup>155</sup>

-Rock and Roll Hall of Fame's *Toddler Rock*- "uses popular music to teach nearly 400 select Head Start children each week through music, movement, singing, and storytelling" and

“promotes positive interaction between children, their parents, caregivers and teachers.”<sup>156</sup> The program works with children within the museum as well as outreach. The *Toddler Rock* program has worked with the Council for Economic Opportunities in Greater Cleveland Head Start to teach Cleveland's underserved three- to five-year olds and their teachers. They have also partnered with the University Hospitals Case Medical Center, Beck Center for the Arts led by Dr. Deforia Lane, ‘an internationally acclaimed music therapist, leads twelve music therapists who work with the toddlers once a week.’<sup>157</sup>

Much like the Rock and Roll Hall of Fame *Toddler Rock* program I propose my annex having similar vibe. Allowing children within the exhibit space to participate in creative activities with a direct narrative encouraging child and caregiver to work in harmony. The *Toddler Rock* embraces the principals of “music, movement, singing, and storytelling’ enhancing a child’s ability for ‘success later in life increase exponentially.’<sup>158</sup> Just as the *Toddler Rock* program offers a creative activity, the *A Journey with Giant Pandas* annex will be a place of healing for children with NAI brain injury when correlating traditional medicine and therapies with mediation, yoga, and creative activities.

I thought about what I would do if I had the time with the child who had inspired my project in the exhibit. What would I say? What would I chose as my lesson plan or therapy plan? When the time with them came to end in my life, I had known they would have visual difficulties for the rest of their life, a balance disorder, and started to live with chronic pain. They could not stand the idea of being touched. I believe my moments with them would be sitting with them quietly watching the waterfall on the interactive screen with a stuffed giant panda on our laps until one of us made a joke about having to use the restroom. And let the natural course of playful creativity engage and offer to do some yoga.

## Chapter Five: Lessons

## Meditation Example:



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## Belly Breathing Meditation

Today, An An (meaning tranquil in Chinese) the panda is going to walk you through one of his favorite meditations. Close your eyes and imagine you are following An An out into the panda yard. As you walk outside you see all the trees An An likes to climb and the hill he likes to roll down. The two of you find a nice patch of soft, green grass where you can relax. You and An An lay back on the grass and look up at the bright blue sky. You both place a pink lotus flower on your stomachs to watch your breathing. As you inhale through your nose, you can see the flower rising. Hold for two seconds and exhale out your nose. As you exhale, imagine the pink lotus flower on your and An An's stomachs sinking as you let out your breath. Next as you inhale, imagine you are smelling a beautiful flower, like the pink lotus. As you inhale through your nose, imagine the smell of that flower. Hold for two seconds and exhale out your nose.

Repeat these breathing exercises ten times.

## Yoga Examples

Guiding preschoolers through yoga-esque poses based on a panda's playful day and life.



The Bamboo Pose<sup>160</sup>-

Stand with legs shoulder width apart. Arms straight down at your sides. Straight posture, tall and proud like a tall bamboo stalk. Deep breaths like wind brushing by your panda nose. You are strong bamboo, standing tall and proud taking deep breaths.



The Ready to Play Pose<sup>161</sup>-

Arm and legs wide, look around you!

You are loved!

You are ready to greet the people and have fun.



The I Love Me Pose<sup>162</sup>-

It's okay to be around friends and want some quiet time.

Fold your legs in, tuck in your arms and give yourself a ginormous hug!

There is no one like you, you are special and beautiful inside and out.

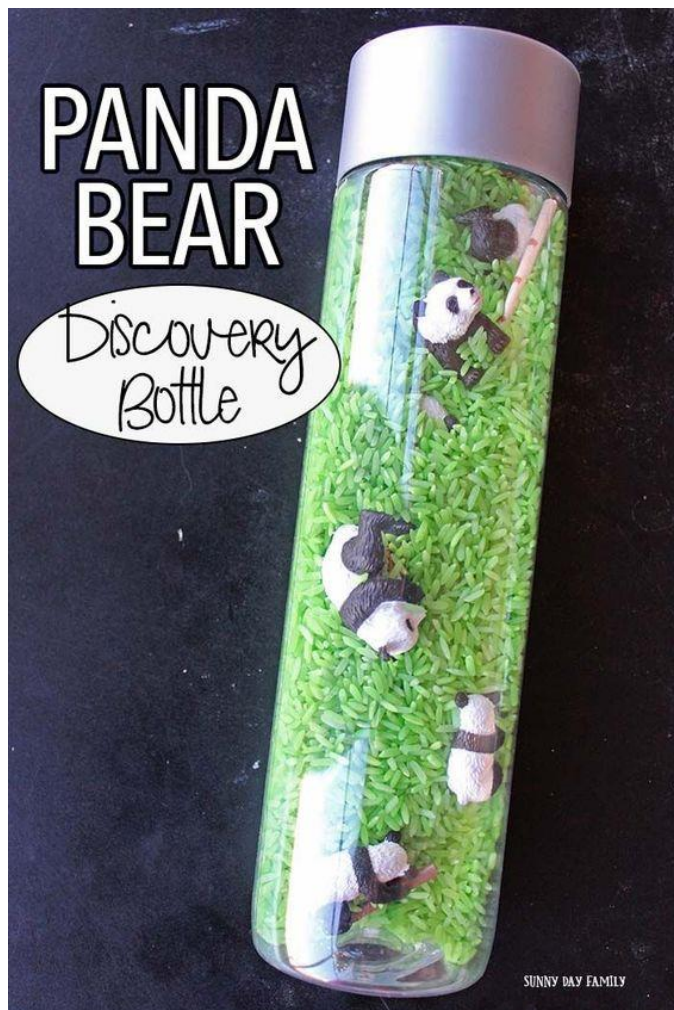
To be your friend is a wonderful thing.

When you hug yourself in the I Love Me Pose you are your own friend too.

So hug yourself tightly, you are a great person to know.

## Creative Activities

For the panda discovery bottle activity, each child will be provided with a set of supplies



including: a clear bottle (with a lid); green colored rice (dye rice with food color and vinegar mixture); miniature pandas, small craft dowels, and a brown or green marker. Each child will begin by coloring their wooden dowels with the markers to look like bamboo. Next the child will put their bamboo (the colored wooden dowels) into the bottle and begin to fill it with the green colored rice. As they slowly add the rice in, the child should begin putting in the miniature pandas. Roughly an inch to two inches of space should be left unfilled in the bottle, as to allow the contents to move

freely when the child plays with the bottle. Once the child has completed these steps, the cap of the bottle should be sealed closed with glue (under adult supervision).<sup>163</sup>





#### Mini Panda Habitat:

For the mini panda habitat activity, each child will be provided with a set of supplies including: a clear plastic bowl; pebbles; short (fake) bamboo stalks; and miniature pandas. Each child will begin by adding the pebbles into the bowl. Next the child will begin putting the stalks of bamboo into the pebbles, arranging the pebbles and bamboo stalks according to how they imagine their mini panda habitat will look. Once the mini panda habitat is set up just right, the child can begin adding the miniature pandas. This is great activity that if the child takes it home, they can play with it or redo their habitat whenever they may be feel stressed or overwhelmed.

## Chapter Six: Conclusion

Children with NAI brain injury due to familial child abuse deserve a place to call their own, to meditate, practice yoga, and creatively play during rehabilitation that is different from medical and legal situations. The lessons, whether my own examples or already existing programs which partake in meditation, aid these children's brains in creating new neuropathways. Interactive exhibits offer a chance for healing and an opportunity for life beyond abuse. Through interactive programming working with caregivers allows for assessing progress by using milestone development. Each NAI brain injury is different, each tragedy behind child abuse will never fit into a graph or formula. *A Journey with Giant Pandas* enhances the transition from abuse to normalcy and aides the traditional medical and therapeutic treatment.

In 1993, The Smithsonian Center for Education and Museum Studies published an article by Dr. Screven that, in my belief, had the greatest statement about museums written "museums offer untapped potential."<sup>165</sup> Absolutely! The American Alliance of Museums encourages the unification between museums and medicine. Previously mentioned, by encouraging programs to help cancer patients focus on art during chemotherapy, watch ZooTV during painful procedures, they are adamant about going above and beyond what is expected from the ADA.

Museums and zoological gardens are striving to become approachable and alternative places of learning. The Rock and Roll Hall of Fame started Toddler rock, a program for 3-5 year olds to aid in developing dexterity, cognitive thinking, self-esteem, and social skills. The program has expanded to hospitals and head start programs. The Houston Zoo offers a program that lets children learn about animals while bending like one and acting like them too. I had proposed adding an annex to zoological gardens for preschoolers to have a place for rehabilitation and work with caregivers while recovering from NAI brain injury.

Presenting the project *Preschoolers and Pandalas, Making Friends - A Journey About Healing from Brain Injury* was its own journey, from a memory of a harmed child, to the discovery of how after two millennia, in 2009, neuroscience is just starting to grasp the East meets West philosophy of meditation and yoga and how its effects on neuroplasticity can effectively be used as a place of neurorehabilitation. The design and concept behind *A Journey with Giant Pandalas* is also viable to many facets of neurorehabilitation including stroke recovery by engaging in sensory creative projects (sensory box lesson), Parkinson's Disease by engaging in yoga, and a unique place for family bonding when a family member is stricken with Huntington's Disease. *A Journey with Giant Pandalas* project has focused on the neurological aspect but this does not limit the annex to neurological based trauma, it would also be an asset to cardiac recovery, orthopedics- for balance and stance exercises, and a special environment to hold Mommy/Daddy and Me classes during infancy. Thesis projects are meant to be professional but I hope this was personal to the reader as well.

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Glossary<sup>166</sup>

American Disabilities Act (ADA)- The ADA prohibits discrimination on the basis of disability in employment, State and local government, public accommodations, commercial facilities, transportation, and telecommunications. It also applies to the United States Congress. To be protected by the ADA, one must have a disability or have a relationship or association with an individual with a disability. An individual with a disability is defined by the ADA as a person who has a physical or mental impairment that substantially limits one or more major life activities, a person who has a history or record of such an impairment, or a person who is perceived by others as having such an impairment. The ADA does not specifically name all of the impairments that are covered.

Amygdala- Part of the brain's *limbic system*, this primitive brain structure lies deep in the center of the brain and is involved in emotional reactions, such as anger, as well as emotionally charged *memories*. It also influences behavior such as feeding, ... and the immediate "fight or flight" stress reaction that helps ensure that the body's needs are met.

Asanas- "steady, comfortable posture"

Axons- A long, single nerve fiber that transmits messages, via electrochemical impulses, from the body of the *neuron* to dendrites of other *neurons*, or directly to body tissues such as muscles.

Cortex- The outer layer of the *cerebrum*. Sometimes referred to as the cerebral cortex.

Gray Matter- The parts of the brain and *spinal cord* made up primarily of groups of *neuron* cell bodies (as opposed to *white matter*, which is composed mainly of *myelinated* nerve fibers).

Brainstem- the part of the central nervous system connecting the brain to the spinal cord. The brainstem contains pathways sending information to and receiving information from the spinal cord and peripheral nerves. It also contains neurons that control respiration and regulation of heart rhythms.

Gray Matter- areas of the brain made up of neuronal cell bodies, dendrites and synapses; without a lot of myelin, these areas appear gray in freshly dissected brain tissue.

Limbic- A group of evolutionarily older brain structures that encircle the top of the *brain stem*. The limbic structures play complex roles in emotions, instincts, and behavioral drives.

Health Insurance Portability and Accountability Act (HIPAA)- a US law designed to provide privacy standards to protect patients' medical records and other health information provided to health plans, doctors, hospitals and other health care providers.

Hippocampus- A primitive brain structure, located deep in the brain, that is involved in *memory* and learning.

Meditation- the process of quieting the mind in order to spend time in thought for relaxation or religious/spiritual purposes. The goal is to attain an inner state of awareness and intensify personal and spiritual growth. In practice, meditation involves concentrated focus on something such as a sound, image or feeling.



Myelination- (myelinate)- to form myelin (compact fatty material) around an axon.

Neurons/Nerve cell- The basic unit of the *central nervous system*, the neuron is responsible for the transmission of nerve impulses. Unlike any other cell in the body, a neuron consists of a central cell body as well as several threadlike “arms” called *axons* and *dendrites*, which transmit nerve impulses. Scientists estimate that there are approximately 100 billion neurons in the brain.

Neural pathway- Set of connected neurons that are regularly activated in sequence to produce a specific function; neural circuit or network.

Shaken Baby Syndrome (SBS)- Characteristic injuries caused by violently shaking an infant. Shaken baby syndrome has distinctive features, including hemorrhage (bleeding) into the retina, hemorrhage and swelling of the brain, and patterned bruising and fractures (breaks) of the child's ribs or bones where they have been twisted from the shaking. Shaken baby syndrome is the most common cause of infant death due to head injuries and one of the most serious kinds of child abuse.

Synapses- the place where one neuron connects to another. The synapse includes the nerve terminal of the first neuron, the place on the second neuron with receptors, and the space between them. The electrical signal in the axon of the first neuron triggers a chemical signal to be released into the gap that is tasted by receptors in the second neuron. (Connect the Neurons)

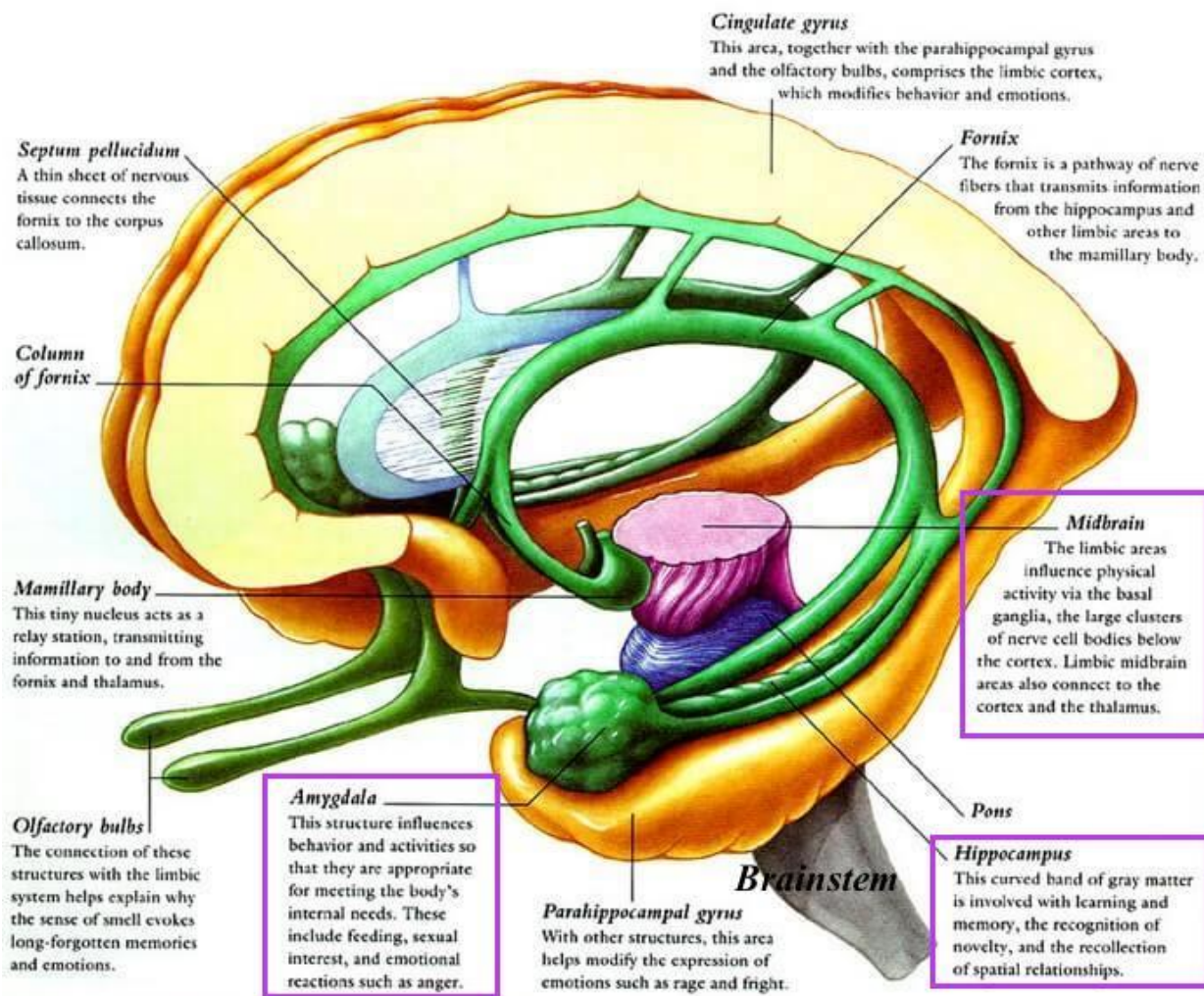
Talairach Daemon- software that locate coordinates within the brain- [talairach.org](http://talairach.org)

Vestibular- 1) Having to do with a structure that is a vestibule (entrance), such as the vestibule of the ear. 2) Having to do with the body's system for maintaining equilibrium.

White Matter- Brain or *spinal cord* tissue consisting primarily of the *myelin*-covered *axons* that extend from nerve cell bodies in the *gray matter* of the *central nervous system*.

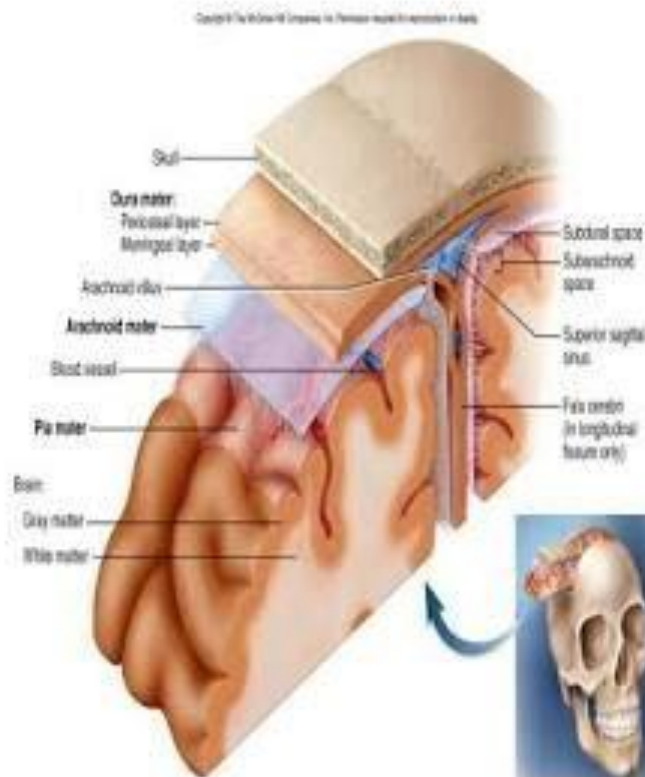
Yoga- a physical, mental and spiritual practice that originated in ancient India. It became popular in the West in the 20th century. The word, yoga, comes from the Sanskrit *yuj*, which means “to yoke.” Thus, yoga is the practice that aims to join the mind, body and spirit. The ultimate goal of yoga is to achieve liberation.

Diagrams of the brain on next two pages



# Gray and White Matter

- Gray matter = neuron cell bodies, dendrites, and synapses
  - forms cortex over cerebrum and cerebellum and central portion of spinal cord.
  - forms nuclei deep within brain
- White matter = bundles of axons
  - forms tracts that connect parts of brain.
  - Ascending and descending tracts in the spinal cord.



<sup>1</sup> “Giant Panda Cam,” *Smithsonian’s National Zoo and Conservation Biology Institute*, accessed October 2, 2017, <https://nationalzoo.si.edu/webcams/panda-cam>.

<sup>2</sup> “Giant Panda,” *Smithsonian’s National Zoo and Conservation Biology Institute*, accessed October 3, 2017, <https://nationalzoo.si.edu/animals/giant-panda>.

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<sup>3</sup> Regina M. Milteer and Kenneth R. Ginsburg, “The Importance of Play in Promoting Healthy Child Development and Maintaining Strong Parent-Child Bond: Focus on Children in Poverty,” *Pediatrics* 129, no. 1 (January 2012), accessed January 13, 2017, <http://pediatrics.aappublications.org/content/129/1/e204>.

<sup>4</sup> “Giant Panda.”

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<sup>5</sup> “Museums On Call: How Museums Are Addressing Health Issues,” *American Alliance of Museums*, accessed February 24, 2017, <http://www.aam-us.org/docs/default-source/advocacy/museums-on-call.pdf?sfvrsn=8>

<sup>6</sup> Ibid.

<sup>7</sup> Ibid.

<sup>8</sup> Ibid.

<sup>9</sup> Ibid.

<sup>10</sup> Ibid.

<sup>11</sup> “Learning Through Play,” *Please Touch Museum*, 2017, accessed January 14, 2017, <http://www.pleasetouchmuseum.org/discover/learning-through-play/>.

<sup>12</sup> Ibid.

<sup>13</sup> “Object Play,” *The National Institute for Play*, accessed January 14, 2017, <http://www.nifplay.org/science/pattern-play/>.

<sup>14</sup> “About – The NIH Human Connectome Project,” *USC Mark and Mary Stevens Neuroimaging and Informatics Institute*, accessed March 15, 2017, <http://www.humanconnectomeproject.org/about/>.

<sup>15</sup> Linda Graham, “Yoga and the Brain: What Neuroscience Can Tell Us,” *Yoga Service Community Resource Paper* 3 (June 2017), accessed October 12, 2017.

<sup>16</sup> Gangadhar and Porandla, “Yoga and Mental Health Services.”

<sup>17</sup> Anne Bolwerk, Jessica Mack-Andrick, Frieder R. Lang, Arnd Dörfler, and Christian Maihöfner, “How Art Changes Your Brain: Differential Effects of Visual Art Production and Cognitive Art Evaluation on Functional Brain Connectivity,” *PLOS One*, July 1, 2014, accessed March 15, 2017, <http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0101035>.

<sup>18</sup> Ibid.

<sup>19</sup> Dawn L. Merrett and Sarah J. Wilson, “Music and Neural Plasticity,” *Lifelong Engagement with Music*, ed. N.S. Rickard and K. McFerran (Nova Science Publishers: 2011), 123-162.

<sup>20</sup> Ibid.

<sup>21</sup> “Suggested Practices for Journalists Reporting on Child Abuse and Neglect,” *Center for Disease Control*, 2016, accessed December 14, 2017, <https://www.cdc.gov/violenceprevention/pdf/childmaltreatment/journalists-guide.pdf>.

<sup>22</sup> “Child Maltreatment: Facts at a Glance,” *Center for Disease Control*, 2014, accessed December 14, 2017, <https://www.cdc.gov/violenceprevention/pdf/childmaltreatment-facts-at-a-glance.pdf>.

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- <sup>23</sup> “Pediatric Abusive Head Trauma: Recommended Definitions for Public Health Surveillance and Research,” *Center for Disease Control*, April 2012, accessed December 14, 2017, <https://www.cdc.gov/violenceprevention/pdf/pedheadtrauma-a.pdf>.
- <sup>24</sup> “Information and Technical Assistant on the Americans with Disabilities Act.”
- <sup>25</sup> “Museums On Call”
- <sup>26</sup> Ibid.
- <sup>27</sup> Ibid.
- <sup>28</sup> Nandini Mundkur, “Neuroplasticity in Children,” *Indian Journal of Pediatrics* 72 (October 2005): 855-857.
- <sup>29</sup> “The Science of Early Childhood Development,” *Center on the Developing Child at Harvard University*, 2007, accessed January 27, 2017, <https://developingchild.harvard.edu/resources/inbrief-science-of-eed/>.  
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- <sup>30</sup> Stiles and Jernigan, “The Basics of Brain Development.”
- <sup>31</sup> Mundkur, “Neuroplasticity in Children.”
- “Information and Technical Assistant on the Americans with Disabilities Act.”
- <sup>32</sup> “Information and Technical Assistant on the Americans with Disabilities Act.”
- <sup>33</sup> “The Science of Early Childhood Development”
- <sup>34</sup> Mundkur, “Neuroplasticity in Children.”
- <sup>35</sup> Ibid.
- <sup>36</sup> “The Science of Early Childhood Development”
- <sup>37</sup> Stiles and Jernigan, “The Basics of Brain Development.”
- “The Science of Early Childhood Development”
- <sup>38</sup> Stiles and Jernigan, “The Basics of Brain Development.”
- <sup>39</sup> Mundkur, “Neuroplasticity in Children.”
- <sup>40</sup> Timothy T. Brown and Terry L. Jernigan, “Brain development during the preschool years,” *Neuropsychology Review* 22, no. 4 (2012): 182-191.
- <sup>41</sup> Ibid.
- <sup>42</sup> Stiles and Jernigan, “The Basics of Brain Development.”
- Brown and Jernigan, “Brain development during the preschool years.”
- <sup>43</sup> “Neuroplasticity,” *MedicineNet*, accessed December 28, 2016, <http://www.medicinenet.com/script/main/art.asp?articlekey=40362>.
- <sup>44</sup> Stiles and Jernigan, “The Basics of Brain Development.”
- Brown and Jernigan, “Brain development during the preschool years.”
- <sup>45</sup> Richard L. Gaskill and Bruce D. Perry, “The Neurobiological Power of Play: Using the Neurosequential Model of Therapeutics to Guide Play in the Healing Process,” in *From Creative Arts and Play Therapy for Attachment Problems*, ed. Cathy A. Malchiodi and David A. Crenshaw (New York: Guilford Press, 2014), 178-191.
- <sup>46</sup> Ibid.
- <sup>47</sup> Ibid.
- <sup>48</sup> Gaskill and Perry, “The Neurobiological Power of Play.”
- “Neuroplasticity.”
- <sup>49</sup> Ibid.

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<sup>50</sup> David Diller, Jordana Haber, Jonathan Heidt, Gloria Kuhn, and Gillian Schmitz, “Understanding the Milestones,” *ACGME*, July 2014, accessed January 24, 2017, [https://www.acep.org/uploadedFiles/ACEP/Professional\\_Development/Faculty\\_Development/Understanding%20the%20Milestones.pdf](https://www.acep.org/uploadedFiles/ACEP/Professional_Development/Faculty_Development/Understanding%20the%20Milestones.pdf).

<sup>51</sup> Ibid.

<sup>52</sup> “Important Milestones: Your Child By Three Years,” *Center for Disease Control and Prevention*, August 16, 2016, accessed January 23, 2017, <https://www.cdc.gov/ncbddd/actearly/milestones/milestones-3yr.html>.

<sup>53</sup> “Developmental milestones record - 3 years,” *MedLine Plus*, September 5, 2016, accessed January 15, 2017, <https://medlineplus.gov/ency/article/002014.htm>.

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<sup>54</sup> Ibid.

<sup>55</sup> Ibid.

<sup>56</sup> “Developmental milestones record - 3 years.”

<sup>57</sup> “Important Milestones: Your Child By Three Years.”

<sup>58</sup> “Developmental milestones record - 3 years.”

“Important Milestones: Your Child By Three Years.”

<sup>59</sup> Ibid.

<sup>60</sup> “Important Milestones: Your Child By Three Years.”

<sup>61</sup> “Developmental milestones record - 3 years.”

<sup>62</sup> “Developmental milestones record - 3 years.”

“Important Milestones: Your Child By Three Years.”

<sup>63</sup> “Developmental milestones record - 4 years.”

<sup>64</sup> “Developmental milestones record - 4 years.”

“Important Milestones: Your Child By Four Years.”

<sup>65</sup> Ibid.

<sup>66</sup> “Developmental milestones record - 4 years.”

“Important Milestones: Your Child By Four Years.”

<sup>67</sup> “Developmental milestones record - 4 years.”

<sup>68</sup> “Developmental milestones record - 4 years.”

“Important Milestones: Your Child By Four Years.”

<sup>69</sup> “Important Milestones: Your Child By Four Years.”

<sup>70</sup> “Developmental milestones record - 4 years.”

<sup>71</sup> “Developmental milestones record - 4 years.”

“Important Milestones: Your Child By Four Years.”

<sup>72</sup> “Developmental milestones record - 3 years.”

“Important Milestones: Your Child By Three Years.”

“Important Milestones: Your Child By Four Years.”

<sup>73</sup> “Developmental milestones record - 3 years.”

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