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See the Path: Using Laban's Movement Scales to Address Spatial Awareness After Brain Injury

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SEE THE PATH: USING LABAN'S MOVEMENT SCALES TO ADDRESS SPATIAL AWARENESS AFTER BRAIN INJURY

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Abstract

This single-participant quasi-experimental thesis study was an investigation of the implementation of Rudolf Laban's dimensional and diagonal movement scales in individual dance/movement therapy sessions with an adult female recovering from brain injury. The main research question was "How will the implementation of Laban's movement scales affect the participant's general awareness of space?"

The Santa Barbara Sense of Direction Scale was used as a pre-test and post-test to record the participant's self-reports of her spatial awareness. Eleven sessions were video-recorded and the participant's movement during the scales was observed and notated by the primary researcher and a hired analyst using Laban Movement Analysis. Since the participant had limited movement capacity, the observation parameters were focused on her eye movements; she was scored as successful or unsuccessful in seeing each point in space. Mean calculations of the scores assigned for each point revealed that the participant improved overall by 16% in her execution of the scales, which could indicate an increase in spatial awareness. Her score on the post-test indicated an improvement of 3% in her self-reports of her spatial awareness.

The hypothesis developed from this research is that Laban's movement scales may augment recovery from brain injury in a beneficial manner because the client's spatial awareness may improve when the scales are executed regularly. This research provides evidence that dance/movement therapy interventions building on Laban's theory of Movement Harmony are valid techniques to address spatial awareness. Additional outcomes of the study include the proposal of study protocols for use in further research studies of this type.

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CHAPTER ONE

Introduction

As a professional dancer working as a choreographer, teacher, and performing artist for over a decade, I have developed a necessary hyper-awareness of my spatial environment. This has occurred over a lifetime of cultivating skills. I have always inherently understood that attention to my environment helps me to know my location, to move through space, and to maintain and develop spatial relationship to the other people moving with me. This natural ability is not exclusive to me; I did not become a better dancer because I had superpowers. Everyone has these basic and instinctual skills.

I probably did not pay attention to how I was processing my surroundings when I was a child learning to dance. I just danced. I trusted my brain to execute processes I not only did not know how to control, but also was not aware were happening. In the same way that my blood coursed through my veins without my instruction, my brain registered my environment and informed my nervous system and muscles for the purposes of navigation. I may have taken note of useful landmarks, such as where the door was located, but I did not have to tell myself repeatedly where the front of the room was or where the teacher was standing. I just knew.

The normal-functioning brain typically takes an inventory of the environment unbeknownst to the conscious self (Townsend, et al., 1999; Etienne and Jeffery, 2004; Bremmer, 2005; Cheng and Newcombe, 2005). One may sometimes purposefully decide to pay attention to landmarks in space, perhaps to better remember a route in order to return home again, but many neurological processes take place behind the scenes to ensure organized movement in the intentional body. When I danced, I eventually learned how to more actively engage with and improve my spatial processes when the demands of the movement became more complicated.

The unconscious, automatic processes may have remained out of my volitional control, but it is likely that they advanced because they supported movement tasks I was seeking to improve and commanded with purpose.

As I became more skilled as a dancer, I began to recognize that I may have developed exceptional spatial processing skills over time. This could be attributed to the practice of noticing the space around me to achieve more complex movement through space and in reference to specific spatial points. I was in college when I first became particularly interested in how spatial awareness is developed, maintained, and improved. Spatial tasks became increasingly complex and difficult as I advanced through school and then into the professional world. Challenges posed by instructors and choreographers still require me to investigate how I move through space, i.e. being aware of the bodies around me so that I do not hit someone in my own movement or impede someone's path. Perhaps the goal is to purposefully intersect with someone at precisely the right moment, so I have to measure my movement through space and time. Additionally, I can easily transpose a phrase of movement to have a different frontal facing. For example, I can perform the movement while facing one wall, and then rotate to face a different wall and begin the same dance from there. In this endeavor, the entire phrase of movement stays consistent to the spatial directions intrinsic to the phrase, which means that the points in space to which I refer will all rotate the same amount that the initial facing rotated.

I was always intrigued by the fact that some people could easily solve these spatial puzzles, while others struggled and became frustrated. I began to wonder how I accomplished these tasks. Did I receive better training for this sort of activity? Did I have an over-developed area of my brain that was tuned to respond to these spatial changes the way a BMW easily hugs the curves of the Autobahn? Was it my hardware (my brain) or my software (what I had

learned) that gave me these abilities? Could the two be extrapolated from each other, or were they intricately entwined? I have since rejected notions of the human body as a machine, embracing instead a more organic paradigm of the living form that could never hold the perspective of the body as a series of parts that work in mechanical fashion. I now approach and investigate every mystery of the body from a holistic point of view, with the understanding that the mind, body, and spirit are one and the same. Changes cannot be made to one without affecting the others. If we include the actual physical brain within the realm of the notion of body, then the body/mind connection becomes more understandable while at once deepening the mystery.

I was also curious if one could lose spatial ability if one did not engage in these sorts of spatial challenges, in the same way that muscles atrophy following an injury or a long vacation. When I was not dancing, I noticed a overall decrease in spatial awareness, and I noticed that when I regularly attended class and performed, I honed my skills in solving movement-based spatial challenges. I felt there must be a spatial module somewhere within the neurological system that could weaken or be made stronger, depending on how frequently it was utilized.

At Columbia College Chicago, I chose to study Laban Movement Analysis (LMA) in conjunction with the Master of Arts in Dance/Movement Therapy and Counseling. The Graduate Certificate in Laban Movement Analysis (GLCMA) program at Columbia defines LMA as the following:

> "The analytical framework developed by Laban facilitates acuity in observing and assessing movement patterns. The comprehensive nature of the framework allows movement issues to be addressed from multiple perspectives; clinically and in performance. Beyond this, holistic paradigms of harmony and balance in Laban theory

suggest further ways in which movement can enhance the regenerative processes and expression of the body/mind" ("Graduate Laban Certificate", n.d., para 3).

LMA, particularly Rudolf Laban's series of movement scales, provided a context for my naïve musings about spatial awareness. These scales are ordered sequences of movement in which the mover refers to specific points in space as defined by the forms of the Platonic solids such as the octahedron, cube, and icosahedron (Laban & Ullmann, 1966; Moore, 2009). In learning and performing Laban's movement scales, I felt more connected to and more aware of my spatial environment. I learned to be intentional in moving toward the specific points in space that Laban had identified and named in the development of his theory of Movement Harmony. I also began to understand the causal relationship between moving this way and feeling a deeper sense of "harmony"; I felt calmer and generally more organized in my body/mind, as well as more in tune with my immediate surroundings, after I performed the scales.

In making the link between the physical body and the laws of the universe, Rudolf Laban (1879-1958) was part of an echelon of scholars across many fields (mathematics, science, and philosophy, to name a few) who postulated that all living matter (and even non-living matter, such as crystals) is connected through structural and energetic forces. When a layman reads these words, the reaction is generally one of dismissal and some disdain. These theories seem like an intangible hodge-podge of mystical musings that have no bearing on the mundane reality of everyday life. Laban grounded these ideas in the most immediate reality available to everyone: the body.

Since Laban first began to theorize about notions of "harmony" in movement, there have been many developments from his original ideas. He referred to "choreutics," (later called "space harmony" by Laban scholars) and "eukinetics," which included ideas about the shifts in

dynamic qualities that occur during movement (also known as "effort/shape") (Laban & Ullmann, 1966). When I learned about this seemingly ephemeral connection to the universe that begins in the individual body, moves into one's immediate surroundings, and concentrically progresses out into the cosmos, it was called "Space Harmony".

Carol-Lynne Moore, Laban scholar, has further developed the theories of Space Harmony as she has delved more deeply into the unpublished writings housed in the Laban archives in England. She has set forth the evolved term of "Movement Harmony" to signify that Laban's theories integrated all elements of human movement, and to hearken back to Laban's original ideas that the areas of analytical taxonomy he developed are interconnected. "Space Harmony" is generally categorized with the larger category of "Space" in LMA, wherein concepts of movement scales and symmetry operations are grouped. Yet, one cannot move through space without shifts in Effort (the dynamic qualities of movement), without attention to the mechanism of movements that occur in the Body, or without reason and/or stimulus to do so (a category known as Shape). Thus, Moore refers to "Movement Harmony" to encompass all cohesive elements of Laban's theories about movement.

I soon realized that in following the path blazed by these esteemed dance scholars I was beginning to scratch at the surface of a broad field that has been researched for decades and is beginning to yield useful information for dancers, psychologists, and medical researchers alike: neuroscience. I eventually began to understand, by following my curiosity and continuing to ask more questions on a movement level, that the essence of my questions was rooted in the mysteries of the brain and the neurological system. Cognitive neuroscientists use tasks similar to the ones I encountered as a dancer to determine a research participant's level of spatial skills (i.e. Hegarty, et al., 2008). This field of research focuses on quantitative measurement of spatial

awareness, using highly advanced technology to investigate the relationship of movement and brain activity.

I knew that I would not be able to pursue in-depth spatial awareness research using advanced technology for my Master's thesis at Columbia College Chicago since the school does not own the equipment. Nevertheless, I believed that I could provide solid information to, and support for, the field of dance/movement therapy if I embarked upon research that used Laban's theories to address spatial awareness. One of the goals of dance/movement therapy (DMT) is to increase one's awareness of self in relationship to his/her environment (Chace, 1953). I was already making connections between Laban's work – the scales and symmetry operations, specifically – and the spatial awareness research. Additionally, I considered the possibility that my technical and creative skills as an advanced dancer/mover are part of my unique abilities as a therapist. I could use my own kinesthetic knowledge of spatial processing in guiding others to improve their spatial awareness. It was even more exciting to consider that I am not the only one who is making the transition from the professional dance world to the therapeutic milieu; thus, a cadre of "dancers-as-therapists" may contribute significantly to clinical treatment.

In my second year of the Masters program, with my Graduate Certificate in Laban Movement Analysis in hand, I became a DMT intern at a non-profit day rehabilitation program for adults recovering from brain injury. My questions about the potential loss, continued maintenance, and further development of spatial awareness came to the surface of my pondering with renewed relevance and importance. Engaging with these questions often provided a specific lens for my movement observations and subsequent interventions. I was intrigued and dismayed by the clients' apparent lack of spatial awareness. I began to wonder how this deficit affected other areas of their recovery processes.

Each brain injury is a unique phenomenon, with symptoms that can vary as widely as the individuals who sustain the injuries. Every year in the United States, approximately 1.4 million people survive various types of brain injuries, including traumatic brain injury, acquired brain injury, stroke, and aneurysm (Faul, et al., 2010; Lloyd-Jones, et al., 2010; "Brain aneurysm statistics", 2009). Some of these people undoubtedly experience diminished spatial awareness, since spatial processing occurs in specific areas of the brain that could sustain damage. We can easily identify the people who are having trouble with processing spatial information by testing them in the first stage of treatment. Most hospitals can include these spatial functioning tests in overall assessments at regular intervals and upon discharge.

However, only a few rehabilitation programs - the typical next step of recovery - have the resources to focus on spatial awareness in rehabilitation (Haggard and Cockburn, 1998). Treatment plans may include activities that utilize components of increasing spatial awareness, but rarely is it a concentrated area of attention. Improved spatial awareness is a by-product of other interventions. If the program has the resources to provide spatial training, it is included in the cognitive re-education portions of the program, which may include working on visual-spatial perception and motor skills separately. Often the visual-spatial activities are computer programs and/or paper and pencil worksheets; the motor skills are addressed through physical and occupational therapies.

Dance/movement therapy is also the perfect setting in which spatial awareness rehabilitation can occur. Treatment plan goals of DMT in rehabilitation include, but are not limited to: 1) Increase intrapersonal awareness on physical, emotional, cognitive, and behavioral levels, 2) Increase interpersonal and environmental awareness, thus establishing and maintaining appropriate physical and psychological boundaries in relationships, 3) Increase self-expression

through verbal and non-verbal means, and 4) Increase motor performance, including improvement of balance, coordination, and rhythm (Chace, 1953, 1964; Levy, 1988). In working towards these goals, dance/movement therapists often incorporate spatial directions into interventions, asking the clients to be specific about how they aim their limbs in space, directing them to move together as a group, and/or requesting that they interact with each other with respectful spatial boundaries and eye contact. The pursuit of increased spatial awareness supports the goal of increasing awareness of self (intrapersonal), other (interpersonal), and the environment. Yet, even if a program incorporates dance/movement therapy into the curriculum, it would still be rare to see time in the daily schedule dedicated to actively working on the specific task of improving spatial awareness.

When I noticed the deficit in spatial awareness for people who have brain injuries and learned about the lack of resources for spatial activities within many clinical settings, I found the seeds of my thesis project. I realized I could combine visual-spatial perception and motor skills re-training by using Laban's movement scales in a dance/movement therapy context. I decided to implement the dimensional and diagonal scales in individual dance/movement therapy sessions with an adult female recovering from brain injury, postulating that these specific interventions would augment her recovery in a beneficial manner. A secondary purpose of the research was to develop a hypothesis regarding the effects of this research.

The main research question of this thesis project is "How will the implementation of Laban's movement scales affect the participant's general awareness of space?" This question raised many larger questions that could not possibly be addressed in one research project, but to which this research may contribute, including: Can the neurological pathways destroyed by the brain injury actually be rebuilt using the movement of the scales? How are cognition, expression

of emotion, memory, and other important recovery components affected by the regular practice of the scales? Can treatment programs incorporate the movement scales as interventions with ease and regularity, and how would this treatment affect other areas of recovery? What modifications would be necessary for a person with a brain injury to engage with the scales? A thorough development of further research questions is presented in the Discussion section of this thesis.

Theoretical Framework

During my internship, I learned that adults recovering from brain injury benefit significantly from structured interventions that also encourage their creativity (Berrol, 2009). This thesis project was framed by the tenets of dance/movement therapy (DMT) with Laban Movement Analysis (LMA) providing the structure for observation and intervention. The application of LMA in these particular research procedures also falls within the paradigm of the Cognitive-Behavioral Therapy (CBT) approach.

Dance/movement therapy is the psychotherapeutic use of movement to promote emotional, cognitive, physical, and social integration of individuals ("What is dance/movement therapy," 2009). Dance/movement therapists use a holistic approach to treatment, subscribing to the belief that health is promoted through the treatment of the whole person by attending to the integration and interdependence of the related parts that comprise the whole, i.e. body, mind, and spirit.

Dance/movement therapists focus on the client's movement behavior, with the understanding that the body will reveal clues to the client's inner landscape of thought and emotion. The therapist then makes interventions, movement or otherwise, which develop the client's functioning, expressivity, and communication through movement. Additionally, the

client is educated on these components of treatment and recovery. In this way, the holistic model of health is upheld (Goodill, 2005).

My assessments and interventions are usually based on what I observe in a client's body. Laban Movement Analysis provides a specific language for describing, notating, and assessing those observations. For example, I may note that a client "used indirect space and decreasing pressure while moving her pencil in slow time across the paper. This resulted in a light marking that did not resemble the 'A' she was attempting to write. I asked the client to increase her pressure and direct her pencil up and to the right, which produced a clearer letter." As a therapist using LMA as an observational tool and recording method, I clearly communicated that the client was not able to write legibly, and I described specifically how I guided her. I noted her Effort (one of the main categories in LMA) when I remarked on her use of space, weight, and time, indicating that she was using a "float" action drive by indirecting, decreasing pressure, and decelerating. My intervention modulated her to a "press" action drive (directing, increasing pressure, decelerating) and incorporated a specific spatial direction, which brought in another category of LMA (Space). Although the language seems specialized, LMA employs common words that have the same definition in the system that they do in everyday language (press, direct, decelerate, etc.), providing a clearer picture of how the movement occurred.

Cognitive-Behavioral Therapy (CBT) is primarily focused on a client's observable behavior and how he or she responds to the various occurrences in his or her life, be it interpersonal or intrapersonal. When the client notices her unfavorable habits, she can begin to make changes to her behavior as necessary, according to challenges or dissatisfactions she may be experiencing. The originator of CBT, B.F. Skinner, suggested that "humans can have the closest approximation to 'freedom' through recognizing that they can control and shape behavior

in their culture and families if they choose" (Skinner, 1953, 1969, as cited by Ivey et al., 2007, p. 183). This concentration on change and choice is central to the theoretical framework of CBT. The therapist hopes to empower the client to take responsibility for her own change through acknowledgement of her role in her own processes and progress.

Laban and Skinner were similar in their theories about change and choice in behavior and movement. Laban's (1950) theoretical constructs of man's ability to change movement included the concept of "humane effort". He suggested that humans were superior in the animal kingdom in the ability to change movements to suit specific needs and situations. For example, a cat can only move with inherent cat-like qualities, but a human being can move like any animal if he desires. An animal changes its movement in instinctual response to necessity, not with the conscious selectivity of humans. Laban (1950) asserted that man:

> "…can establish complicated networks of changing effort qualities, representing manifold ways of releasing inherent nervous energy. Man has the capacity to comprehend the nature of the qualities, and to recognize the rhythms and the structures of their sequences. He has the possibility and the advantage of conscious training, which allows him to change and enrich his effort habits even in unfavourable external conditions" (p. 14).

Dance/movement therapists often use Laban's movement scales in treatment plans to nurture a transformation in movement. The scales are a concrete example of an intervention tool that facilitates change both cognitively and behaviorally, as the client and therapist can use the movement sequences to assess and improve the ineffective patterns of movement which may have developed. This thesis project may provide evidence that the scales could be particularly valuable after a brain injury, a time when movement patterns are often adversely affected.

All therapists are concerned with establishing and maintaining a therapeutic relationship that follows and meets the needs of the client, no matter what theories provide the framework for intervention. This holds true for Cognitive-Behavioral Therapy. The therapist is continually reflecting how the client is making changes, and also guiding the client in how she can improve her behavior to manifest the desired changes. This is done through empathy and mirroring, as in many psychological frameworks, and also through more direct methods such as cuing, modeling, and encouraging the client to practice the new behavior (Ivey, et al., 2007). The change implemented through the direct cues will more likely take place if the relationship between the therapist and the client is supported by the mutual trust that develops through empathy and mirroring.

In dance/movement therapy, the CBT principles of mirroring and empathy-building occur through the therapeutic movement relationship (Chace, 1953, 1964). The dance/movement therapist observes the client's movement patterns and overall movement qualities, and then attunes to the client by embodying those qualities and/or repeating the movement or a related movement. For instance, if a client claps softly during a dance/movement therapy session, the therapist might mirror the client by softly tapping a finger on her knee. The client then feels the therapist's empathic connection because this mirroring indicates the therapist sees him and is attuning through movement. If the dance/movement therapist and client were working together in a CBT framework, and change on some level was a treatment goal, then the therapist may begin to alter the movement in some way (accelerate, increase pressure, move it around the room) and cue the client to follow her. This ability to change on a physical level could then be transposed to cognitive, emotional, or behavioral treatment goals; the inter-connectivity is

another example of the body/mind connection upheld in the holistic model of dance/movement therapy.

This research demanded a highly structured plan of intervention, as I sought to quantitatively measure change in the participant's spatial abilities through my observations of her movement. Prescribed treatment plans such as this study may be perceived as impersonal, program agenda-based, or otherwise inappropriate for client-centered treatment that is necessary in brain injury recovery. Conversely, I found that the structured framework of the scales provided fertile ground for our therapeutic relationship to grow and deepen in unique ways. I was obligated to continue to develop the procedures with her treatment needs in mind, since I was bound by responsibilities as her therapist before I took on the role of researcher. Thus, while adhering to a specific structure that potentially improved one component of her recovery (spatial awareness), I also remained sensitive and responsive to the changes that occurred for her in other areas (especially physical movement) and made adjustments as necessary. This illustrates the blend of CBT, DMT and LMA.

To my knowledge, this particular research has not been done in the field of dance/movement therapy. The movement scales have not been linked specifically to the spatial processes of the brain, and there are limited research findings published on dance/movement therapy treatment for adults recovering from brain injury (Berrol, 1990, 2009). However, the extensive research in spatial awareness, including research conducted with participants who have brain injuries, can be related to dance/movement therapy and Laban Movement Analysis. I sought to establish this relationship and support it with quantitative analysis of my observations of my participant's movement.

CHAPTER TWO

Literature Review

People who are diagnosed with brain injury (acquired, traumatic, stroke, and/or aneurysm) often experience great disharmony in their lives. Sequelae of brain injuries include, but are not limited to, motor deficits and a decrease in ambulatory movement. Motor control and movement through space require an understanding of the environment in which the person is moving. Thus damage to the neurological system may affect both how the survivor moves and how the brain creates and maintains a general awareness of space. Rehabilitative treatment for brain injury lasts for indeterminable lengths of time and includes various therapies that directly address these motor and spatial processing functions in order to help the survivor recover to the fullest potential of movement (Holmberg & Lindmark, 2008; Keren, et al., 2001). Such therapies can include occupational, physical, and even vocational. Many settings also incorporate creative arts therapies such as dance/movement therapy (DMT).

DMT and Laban Movement Analysis (LMA) share two fundamental principles: movement is a form of communication, and humans move to satisfy a need (Chace, 1953; Laban, 1950, 1966). This commonality is one reason that many dance/movement therapists utilize movement interventions based in LMA. Laban integrated principles of human movement with ancient and intrinsic concepts of physical laws, and he proposed that one can derive a fuller sense of well-being through harmony with those laws. One way to cultivate that harmony is the execution of his movement scales which refer to specific points in space and are analogous to harmonic tones in Western music (Laban & Ullmann, 1966). Laban's dimensional and diagonal scales, specifically, are examples of movement interventions used by dance/movement therapists

to reinforce movement experiences of stability and mobility (Prospero, 2008), which are two concepts important to motor control recovery in brain injury rehabilitation.

This literature review contains a summary of chosen research in three main areas: spatial awareness, the effects of brain injury on spatial function, and Laban's theory of Movement Harmony. In consideration of the research study participant's possible physical limitations, this review also includes literature on how eye movement relative to spatial processing is affected after stroke. While the author recognizes that there are many brain functions which contribute to the execution of movement, the focus is on the consideration of spatial function, i.e. the physiological and neurological processes which create and maintain spatial awareness, orientation, intention, and navigation. The role of the central nervous system in motor behavior is a vast area of research only briefly discussed in this review. Research findings containing information about the effects of brain injury on spatial function, and addressing the effects of movement therapies on recovery from brain injury, are incorporated. The concepts of Movement Harmony as set forth by Rudolf Laban and esteemed Laban scholars, including Laban's movement scales, are explored. The concurrent investigation of the three main subjects of this literature review may illustrate that the use of movement scales as interventions in dance/movement therapy in the treatment of clients with brain injury could possibly affect the clients' spatial awareness.

Physiological/Neurological Functions in Spatial Awareness and Navigation

Processing Environmental Information

Daniel Siegel (1999) emphasized that the ability to create internal representations from external stimuli, and then plan for and carry out the responsive action in space and time, is the basis for survival. If one can imagine all of the dangers present in everyday life that demand our

attention and reaction, this statement becomes quite clear. The human brain is equipped with complex systems that contribute to the processing of environmental information which then leads to the movement of the body within that environment. These structures include the vestibular system, the visual module, and many other regions within the brain.

Vestibular ocular reflex. The vestibular system contains neurons that respond to rotation around any axis, and therefore they are receiving information about head rotation and orientation in many dimensions (Yakushin et al., 2006). The eyes work with the vestibular system, sending spatiotemporal information to the brain about where the head is in space, in a function known as the vestibular ocular reflex (Cohen, 1998; Yakushin et al., 2006). In addition to the eyes and the vestibular system, the brain receives information from tactile and auditory receptive fields to enhance the general representation of location.

The cerebellum and parietal cortex functions. The many areas of the brain which process this information sent by the sensory modalities include the cerebellum, the thalamus, the cerebral cortex, the parietal cortex, and the hippocampus (Townsend et al., 1999). (See Appendix F for a general diagram of the human brain.) The cerebellum, once thought to only control motor behavior, has now been shown as a central computing and relay center which tracks sensory information in space and communicates to other brain systems its predictions that guide optimal attentional responses (Townsend et al., 1999). Basically, the cerebellum prepares other internal systems for upcoming events.

Researchers speculate that another synthesizing and computing area could be the parietal cortex. Studies show that single cells in the parietal cortex of monkeys respond to signals from visual, somatosensory, and auditory cortices (Bremmer, 2005). This is how the monkey creates a coherent representation of the outside world.

Creating Spatial Representation for Navigating through Space

While the cerebellum and the parietal cortex may be integrating and disseminating large amounts of divergent information, other areas more precisely process detailed stimuli from the external world. Siegel (1999) asserted that the modules of the brain each have specific duties in the processing of specific information. They rely on specific kinds of representations, created by patterns of neuronal firing in response to external stimuli, to solve particular kinds of problems. These modules then interact with each other to form one's subjective experiences.

Hippocampus function. Etienne and Jeffery (2004) provide a summary which cited previous research to describe the neural structures which underlie spatial representation in mammals – place cells and head direction cells in the hippocampus. These cells form an internal map and compass, respectively. This process is known as path integration. It is offered as an explanation of how mammals maintain a continuous record of the direction in which they are moving, as well as maintain the ability to return to the starting point of a journey without making use of familiar position cues, or landmarks. This record is created by constantly noting and encoding movement-related cues. As with the cerebellum and the parietal cortex, the hippocampus cells integrate environmental and movement-detection systems, including visual, vestibular, and proprioceptive, with preference given to the most reliable or salient source. However, the hippocampus may have a more specialized task of creating the internal map and compass.

Ventral intraparietal function. Bremmer (2005) argued that the ventral intraparietal cortex (VIP) is also responsible for creating a map of the environment. His studies showed that the VIP carries signals relevant to localizing targets in space. It uses a combination of eye-centered and head/body centered coordinates to construct the representation of the targets and

everything in the pathway that would need to be avoided if one were moving toward the targets. His explanations are very detailed; they describe the tendency for cells in the VIP to respond directionally to self motion and external object motion. The VIP actually encodes self-motion using signals from the vestibular organ, derived from real rotational movement and unaffected by the reflexive, compensatory eye movements that occur in motion. Additionally, Bremmer found that the vast majority of neurons in the VIP are side-preferential, i.e. specialized, individual cells are activated when the body moves to the right, or if an external object moves in the area to the right, of the perceiver. If movement occurs on the left side, a different set of neurons responds. The neurons that respond to the right-side movement will not respond to left-side movement, and vice versa.

Geometric module. While the brain uses information generated from the actual movement of the body to tell the body where it is located, Cheng and Newcombe (2005) proposed that vertebrate animals also use the geometry of the surrounding environment to locate places. They stated, "Geometric and featural information, once processed at input, are always put together in the same representation, to be used for reorientation, and quite probably, other spatial tasks, as well" (p. 17). Featural information (those elements of the environment that we may refer to as landmarks) may not be used if there is reason to believe it is less reliable than geometric information, and the use of environmental features to create the internal map differs across species and gender.

More research needed. Cheng and Newcombe (2005) cited the necessity for more research to bridge the gap between the modularity of input and the integration of output in the creation of the internal map. Path integration could be one explanation of what happens between the reception of varied information from different modules and the output of acting upon the

proposed cognitive map created by the hippocampus. Unfortunately, there is still no answer to how the nervous system combines its distance and direction signals to produce the path integration signal (Etienne and Jeffery, 2004), so there are discrepancies in that theory, as well. It is certainly logical to assert that route learning and cognitive map-making do play integral roles in how we perceive and navigate through space, but the truth is that we still do not know exactly how they fit into the larger theory of spatial navigation and representation.

Other processes. There are still more structures to be named as players in the spatial awareness game of the brain. There are two predictive processes discovered in the chosen research which provoke much contemplation on animal survival. Etienne and Jeffery (2004) explained that cells in the anterior thalamus predict which direction a mammal will go within 40 milliseconds prior to movement in that direction. This suggests that this structure may serve to organize and/or transfer motion-related information. Townsend et al. (1999) also stated that "single cell recordings in alert monkeys have demonstrated that activity in parietal cortex precedes an intended eye movement to predict the location of expected visual input" (p. 5641). Siegel's (1999) assertion that spatial awareness is essential to survival could include the element of anticipation and reflex as explained solidly by these pre-movement neuronal activities.

Effects of Brain Injury on Spatial Functions

For the purposes of this study, "brain injury" refers to all types of insult to the brain, including acquired brain injury and its sub-category of traumatic brain injury, stroke, tumor, and aneurysm. Survivors of these events are often treated together in rehabilitation programs, and treatment protocols are often transferrable to each of these populations. "Lesion" is a broad term used to refer to any type of abnormal tissue in the body resulting from disease or injury, including tissue damage resulting from brain injury ("Definition of Lesion", 2001, para 1).

Parietal Lobe Lesions Lead to Spatial Neglect

If spatial awareness is essential to survival, then people with brain injuries require special consideration and treatment which address deficits in spatial perception and navigation. Karnath (1997) asserted that parietal lobe lesions lead to disturbances of spatial perception and of motor behavior in space. The importance of the parietal lobe has been established above, particularly in the creation of an internal representation of the spatial environment. Creating this map requires exploration of that space with the eyes and the body; people with brain injury often exhibit a deficient response to those external stimuli in the brain. This symptom is called spatial neglect. Karnath found that the neglect generally occurs in reference to stimuli which are located contralaterally to the parietal lobe lesion. This failure to explore the contralesional area of space with eye or limb movements occurs in patients with inferior parietal lobe lesions, predominantly on the right side. Another result of these lesions is that the patients perceived their bodies as being oriented toward the ipsilesional side, in rotation around the vertical axis. This suggests an altered representation of space.

Occipital Lobe Lesions Lead to Visual Field Deficits

Brain injury survivors who sustain lesions in the visual cortex (located in the occipital lobe) usually exhibit a visual field deficit on the side opposite of the lesion (Nelles, et al., 2007). A visual field deficit exhibits similarly to a spatial neglect (as described in the Karnath study) although it is an affectation of a different part of the brain and a discrete neurological process. For example, a client may report that she cannot see objects, people, and/or the general area on her right side. She may repeatedly bump into doorways on that side, not read words on that side of a page, and not use her peripheral vision to see a person standing beside her on the right side. This is typical of a visual field deficit resulting from lesions on the left side of the visual cortex.

Nelles, et al. (2009) reported that exploratory eye movement training may combat these deficits (and lead to improvement in daily living activities) because specific eye movements could induce plasticity in the neuronal pathways of the brain.

Cerebellar Lesions Lead to Delay in Spatial Orienting

The importance of the cerebellum in coordinating information about the spatial environment also has been discussed in the chosen research. Townsend et al. (1999) presented evidence that patients with cerebellar damage acquired from tumor or stroke presented with slowed covert orienting of visuospatial attention. In the control participants of this study, attention was oriented within 100 milliseconds of the stimuli; those participants with cerebellar damage took eight to twelve times longer to orient their attention. It is possible that the eye movements alone are the disrupted function in people with brain injury, but this study also shows that the damage may also disrupt both the spatial encoding and the subsequent gaze shift.

This finding reiterates the complex process involved in orienting oneself in space. It is not simply that the eyes see and relay the information to the brain; there is actually a recursive loop occurring in which the brain perceives and tells the eyes where to go, then the eyes report back to the brain. According to Townsend, et al. (1999), it is possible that the first step of this loop occurs deep within the cerebellum within the nuclei that control cerebral-cerebellar communication. Some studies have suggested that constant overshoot of the attentional target could be attributed to this cerebellar-dependent faulty perception of the target location. This is the function which occurs before the decision to execute the eye movement. Townsend et al. (1999) emphasized the complex pathways of the neural connections throughout the brain, asserting that damage to the cerebellum disrupts many circuits between the thalamus and the

cortices, and between the ocular nerve and the cortices. This could be why both motor and non-motor aspects of spatial orienting are affected in patients with brain injury.

Impaired Movement as Related to Spatial Processing Disturbances

Balance and coordination deficits are present in 39% of individuals with brain injury (Dault & Dugas, 2002). Many studies contribute to the development of treatment protocols that address motor function after brain injury (Homberg & Lindmark, 2008; Safaz, et al., 2008; McCrea, et al., 2002; Keren, et al., 2001; Haggard & Cockburn, 1998), and spatial processing plays an important role in how one performs physical movement. Postural control and the spatial coordination of limbs are affected by the damage to the neuronal pathways that process visual, vestibular, and proprioceptive information. It has also been shown that patients with lesions to the parahippocampal areas show deficits in route learning (Cheng & Newcombe, 2005). Thus the brain injury can affect not only the perception of space, but also movement of the body within space and navigation through it.

As this review demonstrates, a lesion in almost any area of the brain could lead to some sort of deficit in spatial awareness and functioning. Clinicians treating survivors of brain injury must take into consideration the inextricable nature of these discrete neurological processes, as it is often difficult to pinpoint the exact location of an injury and how it affects the individual. The development of treatment plans can be increasingly difficult and as mysterious as the inner workings of the brain, itself. Clinicians who focus on movement, such as dance/movement therapists, are particularly challenged to address the issues from a holistic perspective that takes into consideration not only the intertwined nature of the brain functions, but also the complex and inter-connected workings of the mind/body.

Cynthia Berrol's (2009) research findings provide support for the use of dance/movement therapy in brain injury rehabilitation. She outlines basic principles of DMT treatment that help to demystify the treatment planning process for dance/movement therapists. These principles include beginning at the individual's current level of function, building on what is familiar to the client, motivating the client with meaningful stimuli, encouraging active participation, and developing a structured format that includes consistency and repetition, with some variation to avoid "habituation" (p. 203).

Specific movement-based interventions building on Laban's theories and practices, such as the scales, may be supported by the research presented in this review. Although Karnath's (1997) study showed that there is severe bias of ocular space exploration in the participants with right-brain-damage, he stated that goal-directed arm movements to single targets in near-reach space are not affected (p. 1412). He implied that exploratory behavior (used in his study) and intentional movement (toward a specific point in space and employing visuo-motor processes) do not share the same neural control mechanism. Thus it is possible that clients with lesions in the parietal lobe could rebuild spatial awareness through goal-directed movement if they do not have lesions in the visual cortex. Additionally, Nelles, et al. (2009) asserted that even simple eye movement training, which could be performed by clients who cannot execute full-bodied movement, may be beneficial to brain injury rehabilitation and could provide a measurable component of recovery. Dault and Dugas (2002) also demonstrated the efficacy of a program that focuses on intentional movement in their studies, which will be further discussed.

Laban's movement scales are examples of intentional, goal-directed movement, since the mover must reach to the single targets of the specific points in space. The use of the scales as DMT interventions also allows the therapist/researcher to address many of Berrol's (2009)

specific "primary areas of function for DMT intervention for individuals with [acquired brain injury]." The areas of function are as follows: body image, self concept, social skills, affect/self-regulation, movement dynamics, range of motion, balance, motor planning, motor sequencing, spatial awareness, spatial judgment, rhythmic discrimination, memory (short and/or long-term), attention/concentration, and communication skills (p. 203). Laban's theories, principles, and practices encompass and address all of these functions.

Movement Harmony

Evolution of Terms

"Movement Harmony" is the most current term set forth by Moore that refers to Laban's theories of the synthesis of elements in movement. It encompasses all previous definitions of "choreutics," "eukinetics," "effort/shape" and "space harmony." According to Moore (2004) Movement Harmony is "dynamic symmetry based upon proportional ratios that bring about consonance between every part and the whole" (p. 19).

Integrative Movement

Moore (2004) stated that Laban's theories are "equally concerned with movement *synthesis*; that is, with how time, space, and energy cohere in meaningful human acts" (p. 4). This is what Laban called harmony; the scales demonstrate his theories through movement. When the body moves in harmony with its environment, it is possible for greater health to be achieved. Laban (1966) stated in his posthumously published movement tome, *Choreutics*, that "the integrating power of movement is perhaps the most important value for the individual" (p. 112). Before the advanced research in neurology, he spoke to the integration of physical movement and the thought processes that occur with movement. Laban also emphasized the importance of moving, rather than simply analyzing movement, stating, "…spatial, bodily, and

psychological analysis cannot replace the integration which takes place during movement" (p. 114).

Laban (1966) named general elements which may lead to integration, including 1.) Orientation in space, using the cardinal planes, dimensions, and the diagonals of the cube as guides, 2.) The use of natural sequences in the kinesphere, deriving from natural movements that follow the anatomical restrictions/abilities of the body, 3.) Awareness of bodily perspective that helps to discriminate between spatial understanding and spontaneous movement of limbs. These elements are remarkably similar to the previously outlined DMT principles cited by Berrol (2009) and practiced by dance/movement therapists in various treatment settings.

External Systems of Spatial Orientation - Cross of Axes

Durr and Farnell (1981) identified three different systems of spatial referents used in Laban Movement Analysis. The first is the standard cross of axes, which uses the law of gravity as a base. The vertical axis in this system uses "down" as towards the earth, in correspondence to the law of gravity; "up" is towards the sky, or simply opposite of down. The horizontal axis is then determined as perpendicular to the vertical axis. The second system of spatial reference is the body cross of axes. This system uses the self as reference for vertical and horizontal, with the head as "up" and the feet as "down." This system changes the orientation of the cross of axes as the body moves in space; if one is lying on the ground, the mover's notion of "up" would actually be parallel with the horizontal axis in the standard system of reference. The third system of reference is the constant cross of axes, which uses the environment to determine up and down. If one were in a room, the ceiling would be "up" and the floor would be "down".

Platonic Solids and Movement Scales

Laban (1966) related bodily movement to crystalline forms, which Plato set forth as the Platonic solids. These forms are the tetrahedron, the cube, the octahedron, the dodecahedron, and the icosahedron. The constant cross of axes corresponds to Laban's use of the cube as the basis for spatial orientation. While he noted that the actual trace-forms of harmonious movement of living creatures are closer to spherical in structure, he used the cube to simplify the observation and notation of movement. This makes sense if one thinks of how humans tend to imagine a room around them in order to orient in space, with the imaginary "front" and corresponding "back" and "sides" often present in the imagination when the actual structure is not there.

Laban's connection to the Platonic solids is present in the movements of his scales. Two examples of this relationship are the dimensional and diagonal scales, which correspond to the octahedron and the cube, respectively, and also illustrate the prototypes for stability and mobility. In the dimensional scale, one moves by referring to the endpoints of the dimensions through the center of the kinesphere; the cardinal dimensions create the inner scaffolding of the octahedron. The dimensional scale provides a pathway for movement that is perpendicular or parallel to the plumb line of gravity, thus lending a sense of stabilization to the movement (p. 90). The diagonal scale moves through the center of the kinesphere along the diagonals; the diagonals create the inner scaffolding of the cube. The three equal spatial pulls of the diagonals take the mover off the plumb line of gravity and therefore into mobility (p. 90). The mover may quickly stabilize herself by reaching into the opposing diagonal, for "movements with axial counter-tensions are generally stable" (p. 94).

Laban (1966) stated that the "two contrasting fundamentals on which all choreutic harmony is based are the dimensional and the diagonal tension" (p. 44). The interplay of stability and mobility within and between the dimensional and diagonal scales is indicative of the continuum of polarities at play in human movement and in nature at large. Human movement is a mixture of both equilibrium and disequilibrium, and all of Laban's scales reflect these natural tendencies. Laban explained that equilibrium is attained through dimensional movement, while disequilibrium occurs in any movement deflected from the dimension, one type of which is movement along the diagonals.

Other movement scales demonstrate the more complex movement of the human body; Laban (1966) used the icosahedron to develop these scales. The icosahedron is the Platonic solid that is closest in shape to a sphere and thus better represents the human kinesphere. The cardinal planes (horizontal, vertical, and sagittal) create the inner scaffolding of the icosahedron. Its angles correspond with the angles which the limbs are capable of describing, as determined by the structure of the joints. The icosahedron angles are half, equal or double that of the various angles of human limb capability.

Moore (2004) called both the primary scales (which move along the superficial edges of the icosahedron) and the A and B scales (which traverse the internal space of the icosahedron at fifth intervals) "highly mobile" and stated that they "challenge balance by remaining off the vertical axes and shifting constantly between planes" (p. 34). This movement between the planes and negotiation of balance in the vertical dimension is an ideal challenge of spatial awareness for clients recovering from brain injury, if it is compared to movement tasks tested by other researchers such as Dault and Dugas (2002). The scales enlist the entire neurological system which creates the internal map and moves the body through the space represented by the map.

Symmetry and Kinesthetic Understanding of Spatial Qualities

Laban (1966) was ahead of his time when he foreshadowed the advanced discoveries of neurology today, stating "With the growing understanding of our kinaesthetic sense we may recognize that our nerves have the capacity for genuine perception of spatial qualities" (p. 89). He also may have been ahead of his time in the use of mathematical language of symmetry to relate human movement to the greater laws of the universe. He asserted that we understand symmetry through the structure of the physical body (right-left symmetry) and further through movement in his scales that have multi-dimensional symmetrical relationships (p. 160).

There may now be evidence that there is a neurological basis for our perception and comprehension of symmetry. Gin McCollom, PhD, a theoretical neurobiologist at Legacy Research, Legacy Health in Portland, Oregon, uses mathematics to explain the organization of sensorimotor neurobiology. McCollum (2007) also set forth the use of symmetry groups as related to physical laws to explain spatial orientation. She declared that the neural organization of human beings has an intrinsic structure related to physical laws (especially the conservation of angular and linear momentum and of energy) and this structure provides guidelines in which to frame active movement. This occurs through the synaptic projection patterns of the vestibular system, which provide the discrete skeletons of spatial forms. The semicircular canals within the vestibular system are shaped and placed in a manner which facilitates the registration of angular motions of the head in physical space. Then the pathway from the vestibular nuclei to the cerebellum gives the canals the symmetry group of a square, thus communicating the notion of a continuous plane to the mover.

Since this arrangement does not relay information about the geometry of the environment to the central nervous system (which is, as aforementioned, very important), we also possess the

organization of the pathways that carry canal activity to the spinal cord. The pathways from the canals to the neck motor neurons are organized with the symmetry group of a cube, thus allowing for a three-dimensional coordinate system by which to orient in space.

McCollum (2007) postulated that the mathematical language of symmetry groups provides a means to determine, express, and analyze the intrinsic logic of biological systems. She emphasized that we understand intrinsically the logical properties of physical space, and how to move in that space, because those fundamentals are embedded in the structure our nervous system. This physical evidence could provide advanced support for Laban's use of the cube as the basis for spatial orientation, and his use of the icosahedron (which has the inner scaffolding of the cardinal planes) as a prototype for the human kinesphere.

Durr and Farnell (1981) also wrote about this notion of embedded knowledge of physical laws, but in intellectual and physical contexts. Durr and Farnell stated, "Not only is the notion of opposition essential to the study of movement, the fact must be recognized that these structures are *interacting* dualisms" (p. 231). Laban (1966) asserted that human beings understand polarities of movement, which interact with each other and exist as a result of each other, because the human body offers notions of finite limitations. While these concepts help us to make sense of the physical world around us, we do not attribute their existence to the calculations of humankind, although their expression as "laws" is indeed very human.

McCollum (2007) further explained that the symmetry groups frame coordinates in space and provide guidelines for optimizing movement. This certainly corresponds to Laban's theories, and brings the emphasis back to active movement, rather than simply how we think about space. Laban stated that "it is possible to follow and understand the continuous creation of spatial impressions through the experience of movement" (p. 4). The emphasis on active

movement is also inherent to the tenets of dance/movement therapy, and serves as further indication of the benefits of using LMA in the DMT setting.

Dance/Movement Therapy and the Mind/Body Connection in Brain Injury

Many dance/movement therapists look to Laban for inspiration and education in search of support for the holistic model of treatment. The "mind/body connection" is essential to Laban's theories, which integrate concepts from many different fields, and to DMT, a practice which employs movement in the pursuit of integrated physical, mental, and spiritual health.

Inner Volition and Imagination

The concept of "volitional movement" is widely researched in motor behavior and psychology. It can be defined as purposeful, goal-directed, coordinated movement that originates in the central nervous system and occurs because the mover "wills" it (Critchley, 1954; Schwartz, 1994). This aligns with Laban's theories, since Laban and his followers do not subscribe to the idea that movement simply occurs from an arbitrary arrangement of limbs in space, but requires self investment and the imagination. Moore (2004) also referenced the necessity for the engagement of the imagination, and challenged the mover to access his or her own creativity in bringing the harmonic movement sequences to life. One of her most emphatic assertions is that in order to become fulfilling experiences, the spatial forms must be embodied. The "exercise of movement imagination is a critical dimension of the experience of harmony" (p. 39).

Laban (1966) also spoke of an "inner volition" from which man's movement arises, a phenomenon that cannot occur without the active engagement of one's imagination. He acknowledged that movement through space is inseparable from, and quite possibly generated by, the dynamic effort elements of movement. How a mover attends to the motion factors of

flow, space, weight, and time in his movement may reflect upon, and provide insight to, the mover's intention born in the imagination. Laban explained this in the following passage:

> "The will or decision to move springs from the depth of our being. We not only alter the positions of our bodies and change the environment by our activity, but bring an additional colour or mood to our movements from our psyche. We speak of feeling, or thought which precedes or accompanies movement" (p. 48).

Cynthia Berrol is also well-known for her efforts to support the theories of DMT with the recent discoveries of neuroscience; she referred to this volitional movement as an anchor for the value of DMT. Volition arises from intention, and intention reflects inner state. We seek to change one by working with the other in a "mind/body connection" paradigm. Berrol (1990) supported her arguments with neurological research current to the end of the twentieth century, and cited neuroanatomical constructs as the primary reason that volitional movement is important to DMT (p. 264). In a later article, she built upon the known positive neurological effects of an exercise regimen and named dance as an activity similar to exercise. She remarked, "Extending the parameters of physical exercise as a biogenic regulator, dance, a close correlate, can similarly be postulated a modality that mediates mental states via neurotransmitters" (Berrol, 1992, p. 24).

Laban's ideas about volitional movement are theories and beliefs he developed from years of intensive research in the fields of dance, art, music, philosophy, psychology, mathematics and physics. As Laban Movement Analysts practicing in dance/movement therapy, we may subscribe to his theories and put them into practice, but we also may be biased in believing them to be true. While we may have a history of experience that the methods are effective, it is difficult to substantiate the work with unbiased evidence. There is a significant

absence of research that supports Laban theory. Berrol's work is important to the field of DMT because she is one of few published researchers who seek to illuminate the solid neurological basis for DMT, and she integrates theories from different fields of sound research in her reports. She does not, however, directly cite Laban as a source for, or influence of, her theories, even though she works with similar ideas. Thus, while her work is compelling, it does not provide direct evidence for the efficacy of implementing Laban's theories and practices in dance/movement therapy.

Testing Volitional Movement and Creativity

Dance has the added benefit of creativity, imagination, and decision-making that is not inherent in the execution of rote, prescribed exercises. The research of Dault and Dugas (2002) demonstrated the effectiveness of movement that employs these skills with the comparative testing of a traditional muscle training program and a program that used techniques which could be considered close to dance (Step™ Aerobics, Slide ™ Aerobics, and aerobic dance). The participants in their research all had some form of brain injury. They sought to demonstrate that traditional rehabilitation programs for these clients do not provide full recovery of balance and coordination because the programs do not stimulate the cortical reorganization necessary after brain injury. They mention dance therapy, touting it as an integrative modality that provides the physical, psychomotor, cognitive, and emotional treatment components that lead to great probability of return to the lifestyle before the trauma.

In this study of ten people with brain injury, the five clients who were assigned to the non-traditional program showed significant improvement in temporal coordination of arms and legs. Dault and Dugas (2002) attributed this improvement to the various rhythmic movements. In this study, specific motor function improvements were attributed to each specific component

of the program. The Step™ exercises provided directional change and weight-shift challenges, while the Slide™ exercises required an increase in postural control to maintain balance since the surface on which the mover slides is very slippery. Almost no changes occurred in the group assigned to traditional muscle training.

Movement Scales as Therapeutic Intervention

If volitional movement is defined as goal-directed and intentional, then Karnath (1997) and Dault and Dugas (2002) established in their respective studies that volitional movement could repair the deficits in neural control that lead to issues with spatial awareness, mobility, balance, and other physical manifestations of brain injury. Laban's movement scales are structured tasks that must be executed with intention and volition, activated first in the imagination of the mover. The scales activate the body in specific movements in space, thereby utilizing the functions of the brain which perceive and navigate space. Laban's movement scales also require the mover to access all of the movement components discussed in the previous studies: creativity and choice in the modulation of effort elements, directional change, weight-shift, balance maintenance, shifts in eye focus, and rhythmic changes.

Downey (2004) asked "How does the idea of prescriptive movement fit into the practice of dance/movement therapists who value spontaneity and creativity?" (p. 91). It is important to refrain from taking this question out of context in order to prove this author's own theories, as Downey may have been concerned that the therapeutic process would be inhibited by the more structured task of movement scales. However, she did assert that Space Harmony (now referred to as Movement Harmony) could be used as an alternative to medication prescriptions or as a preventative measure to increase neuroplasticity in the brain.

Downey's research charted the brain wave activity present in the execution of Laban's fifth interval movement scales. She found that after doing these complex scales there was a strong presence of high beta and gamma waves in the occipital and parietal lobes. She postulated that those areas of the brain are more highly activated with a strong mind/body connection or stronger state of relaxation (p. 87). She also cited the possibility of neck muscle tension affecting the brain waves. If the research of this review is taken into consideration, it is possible that the parietal lobe activity may be a reflection of the spatial awareness mechanisms employed by the brain when executing the scales.

Siegel (1999) pondered not only the roles and activation of specific areas of the brain, but also the plasticity of the brain, or the ability to continue to grow and change in response to traumatic events or in further normal development that may occur through novelty of experience. Siegel noted that while it is unknown how much the brain is able to rebuild after a stroke, there is evidence that the brain is capable to some degree of responding to "changes in experience with further development of brain structure and function" (p. 194). He referred to drastic alterations of experience that result in the restructuring of representational regions in the brain, such as learning to accommodate the loss of the limb. Perhaps plasticity in the brain could be stimulated through a more manageable and less traumatic change in experience such as the learning and execution of a movement scale.

Improved Sense of Self Related to Embodiment and Spatial Awareness

Berrol's (1990) case study of a 35-year-old male patient with brain injury who underwent 4.5 months of DMT cited the use of explorations using eye focus and shifting tempos. Her interventions included walking in time with music, first looking straight ahead, then at specific objects in the room, and eventually including speed changes, direction changes, and more shifts

in eye focus. It is clear from more recent research in neuroscience, as cited previously, that the eyes play a huge role in the mover's spatial awareness. Berrol's client reported at the end of the study that he was better able to see things around him when he walked down the street. His therapists noticed his increased sense of confidence and improved interpersonal relationships within the program.

Autonoetic consciousness. The integrating power of DMT is supported by Siegel's (1999) explanations of how autonoetic consciousness happens in the brain. This function is, in essence, the "sense of self" that therapists work to help clients develop, and its presence requires the integration of representations of self in time and space. Siegel proposed that this is fundamental to the narrative mode of cognition; basically, these representations are necessary to the ongoing story we create about ourselves that tells us we exist. If this is so, then this author theorizes that awareness of one's spatial environment contributes to coherence, well-being, confidence, the very notion of "I am".

The right hemisphere functions. Siegel (1999) asserted that "how the mind creates representations and places value on them is inextricably linked with emotional process" (p. 173). Our emotional landscape is created by the brain, and is affected by how we perceive the environment and others. His explanations of how these representations are created focus on the right hemisphere function, which is supported by other research this author has reviewed. Two of the studies uncovered the importance of the right hemisphere because the participants had injuries in that area (Naito, 2004; Cheng & Newcombe, 2005). Siegel explained that the dorsal stream of information, dominant in the right hemisphere of the brain, relays information about spatial and contextual representations. This stream incorporates information from the body, particularly from autonomic activity, in order to evaluate external stimuli for their significance to

internal states. This autonomic information, which is directly from the body and the internal states, combined with the self in environment, allows the right hemisphere to appraise situations and control the degree of bodily arousal. Thus, the creation of primary emotions begins with bodily arousal and is closely tied to how an individual perceives herself in her environment.

Arzy, et al. (2006) elaborate on the neurological functions that occur in the process of environment/self perception, localizing the event in the right posterior brain region. They refer to the concept of "embodiment" as "the sense of being localized within one's physical body" (p. 8074) and also cite this phenomenon as a fundamental aspect of self. Hence they make the connection between self location as related to embodiment and embodiment as a primary component of awareness of self (Arzy, et al., 2006).

The pursuit of increased embodiment is a fundamental principle of dance/movement therapy (Goodill, 2005) and can be one of the most difficult concepts to understand, especially for clients who have brain injuries. The areas that create a sense of embodiment may be damaged or destroyed, and motor deficits contribute to the inability to explore movement. This hindrance has exponential and multi-layered effects; for example, the self and the location of one's body in space are the starting point for any spatial reference and/or relationship. Therefore, a decrease in embodiment results in many different types of issues that affect various aspects of recovery from brain injury.

The overall perception of how the body is moving may also occur in the right hemisphere. A study by Naito et al. (2004) provided evidence for right hemisphere dominance of perception of limb movement. This study (an analysis of fMRI data with participants who did not have lesions) showed that the perception of limb movement engages a right-sided network of frontal and parietal areas as well as motor areas and the cerebellum. Cheng and Newcombe

(2005) found that the right hemisphere processes both geometric and featural information about the environment. Therefore the right hemisphere generates one's sense of self, the understanding of the environment in which the self is moving, and the perception of how the self is moving in the environment. These are key components in both dance/movement therapy and Laban's theory Movement Harmony.

Relationships. Durr and Farnell (1981) also emphasized the importance of relationship in the systems of spatial referents, particularly in the body frame of reference (which could be a direct correlation to sense of self). They stated, "These positional expressions are always relative to something else and because of this, it is important to remember that in descriptions of the spatial aspects of human movements of action systems, it is *relationships* that are being described" (p. 227). One's perception of oneself in space is literally the beginning of interpersonal dynamics, and one of the fundamental components of any type of therapy is to improve relationships through the exploration of the intrapersonal and interpersonal.

Marian Chace, the foremost pioneer of dance/movement therapy, also stressed the importance of relationship to client rehabilitation, as realized through the alliance between the therapist and the client. This fundamental principle of Chace's approach to DMT is known as the "therapeutic movement relationship" (Chace, 1953, 1964). Chace's development of her approach to the therapeutic movement relationship was rooted in her studies with Harry Stack Sullivan, an interpersonal psychiatrist who laid groundwork for understanding relationships in reference to the self (Schmais, 2004).

Sullivan was also influenced by George Herbert Mead, whose writings Schmais (2004) cited as important to understanding the therapeutic relationship within the dance/movement therapy milieu. Mead (1934, as cited by Schmais, 2004) conceptualized the self as interplay

between the two elements of "I" and "me." The "I" is the "authentic" self and comprises the psycho-physical aspects of the self which include freedom, creativity, and subjectivity. The "me" is the "social" self and seeks to limit, control, and socialize the "I." In dance/movement therapy, the therapist pays attention to both aspects of self in the client; the therapist uses movement to empathically reflect the "me." This reflection signals validation and acceptance on the part of the therapist, which in turn helps the client to accept his "me". This leads to the integration and exploration of the creative, uninhibited, and more authentic "I." Thus the therapeutic relationship strengthens the client's "sense of self."

Downey (2004) integrated the varied concepts of relationship in her master's thesis as she declared, "[Dance/movement therapists] explore the relationship of mind and body, part to whole, inner world to outer world, movement and cognition and emotion, and through all of this self to other" (p. 90). She championed Laban's theory that the structure of these relationships indicates the existence of some type of organization and harmony.

Conclusion

There are numerous researchers seeking to discover exactly how the human brain makes sense of an individual's environment and then endeavors to move the human body through it; this review only summarizes a fraction of them. As dance/movement therapists with our Laban tools at hand, we are poised to make great contributions to this research. Clients with brain injuries are particularly affected in their awareness and navigation of space; dance/movement therapists are equipped to treat this symptom, particularly if they use the movement scales as specific interventions to address the DMT goals of increasing awareness of self, other, and environment. How would the execution of movement scales affect the damaged brain? Can the neurological pathways destroyed by the brain injury actually be rebuilt using the movement of

the scales? Would these clients be able to learn and execute the scales? Could performance of the scales using only eye movement be just as effective for those clients who are not able to do full-bodied movement? Would memory deficits caused by brain injury affect success or failure? Would following a leader who modeled the scales have the same effect as performing the scales by one's own volition? How would cognition, expression of emotion, memory, and other components important in brain injury recovery be affected? Could the scales be used as a starting point for deeper research, perhaps involving a creative process which could engage more directly the other aspects of recovery?

These are only some of the questions that arise from this literature review, and they will be discussed further and developed in Chapter Five of this thesis. The author is certainly biased in making the connections between the three areas, as the interest in the topics first arose from a personal belief that increased spatial awareness is beneficial to overall functioning. There is much more research to be completed in order to gain a fuller understanding of the role of the brain in human movement, as well as the effect of movement on the brain. There is also much to learn about the effects of brain injury, and this knowledge is undoubtedly attainable in existing research. Overall, it cannot be denied that Laban's theory of Movement Harmony, applied within the context of dance/movement therapy, may be supported by the ever-increasing discoveries of neuroscience. While these connections have been pointed out before, it appears that the direct use of the scales with people who have brain injuries has not been tested under controlled research measures. This could be an important step in affirming the integrative theories of dance/movement therapy, as well as the use of Laban Movement Analysis as a basis for creating interventions.

CHAPTER THREE

Methodology and Procedures

Methodology

Experimental Design

The project design was a single-participant quasi-experimental study (Cruz & Goodill, 2004) conducted at my internship site, a day rehabilitation program for adults recovering from brain injury. During individual dance/movement therapy sessions that occurred approximately once a week for eleven weeks, I introduced two variables: Laban's dimensional scale and diagonal scale. I also utilized preparatory practice exercises derived from said scales throughout the study. Several external factors influenced the frequency and regularity of the research sessions, including the participant's unexpected schedule changes and an unforeseen family vacation that occurred in the fourth and fifth weeks of the research period. Additionally, I determined that regular practice of the scales at home (ideally on a daily basis) would contribute to the participant's benefit from the treatment. Although the participant initially agreed to engage in this practice as much as possible, after the third week of the study she reported that she did not engage with the scales outside of the research sessions.

This design allowed me to observe the effects of the variables as compared to baseline activities observed in the treatment program at large during dance/movement therapy groups. It aligned with the structure and clinical framework of the rehabilitation program, as well as the overall treatment goals of dance/movement therapy (particularly the goals to increase awareness of self, other, environment. See page 8 in the Introduction). This study did not produce results that can be generalized to large groups of people; however, it did result in the refinement of research procedures that could be used in further studies of similar interventions. Risk of harm

due to the removal of the variables was low, as the participant was still active in dance/movement therapy groups, exercise, and individual counseling on a regular basis after the study was completed.

Dimensional Scale and Diagonal Scale as Variables

Laban (1966) stated that the "two contrasting fundamentals on which all Choreutic harmony is based are the dimensional and the diagonal tension" (p. 44). One of the overall treatment goals for the participant was to improve her overall functioning of physical movement, a pursuit that could relate to Laban's theories of movement "harmony" and aligns with dance/movement therapy goals. In the dimensional scale, one moves along the vertical, horizontal, and sagittal dimensions and following the pathway from one perceived endpoint to the next through the center of the kinesphere. These cardinal dimensions provide a pathway for movement that is perpendicular or parallel to the line of gravity, thus providing a sense of stabilization for the mover. The diagonal scale connects the opposite corners of the cube, moving through the center of the kinesphere along the cubic diagonals; the three equal spatial pulls in each dimension (i.e. forward/sagittal, right/horizontal, and high/vertical) take the mover off the plumb and therefore into mobility. Thus, the dimensional and diagonal scales can be viewed as prototypes for stability and mobility, two very important components of the participant's recovery.

I also chose these particular scales as variables because they are the simplest of Laban's scales with regard to the arrangement of the sequence of points. Additionally, the dimensional and diagonal scales are the first ones the student learns in the tradition of Laban's scales and theories. Oral tradition has been the main reason for this pattern of learning, yet there may be neurological evidence that underlies Laban's reasons for this method. Laban scholar Jeffrey

Longstaff proposes a "Choreutic Prototype/Deflection Hypothesis" wherein he uses research in spatial schemas to provide reasons for how and why we teach the scales in this order. He stated that when a mover is learning movement, the brain creates spatial schemas based on prototypes, and then processes other differing movements as variations on the prototype (Bartlett, 1932, as quoted by Longstaff, 2010).

According to Longstaff (2010), the dimensional and diagonal scales are examples of a prototype and variation on a spatial schema. The dimensional scale is a schematic prototype because the brain most easily recognizes ninety degree angles in the recall of sequences in movement or visual processing of scenes. The diagonals are then variations on the prototype of the dimensions, as they deflect from the ninety degree angle at a forty-five degree angle. To the human brain, this is the next most recognizable angle. Additionally, the diagonals then provide prototypes for further variations of movement; in Laban's taxonomy, the fifth interval scales can be viewed as deflections from the diagonal (Moore, 2009).

The dimensional and diagonal scales are comprised of points in space that are already in the standard environmental lexicon of the average adult if we apply this basis of dimensions and diagonals as typical spatial schemas. Concepts such as "up", "down", "right", "left", "forward", and "back" are imprinted in our neurological systems at an early age, as they correspond to our notions of symmetry in the body and the cardinal dimensions (Moore, 2009; McCollom, 2007; Laban & Ullmann, 1966). In choosing the dimensional and diagonal scales, I assumed (and subsequently established) that these directions of movement would be familiar to the participant, and thus it would be easier for her to learn sequences of movement made up of these points in space.

Since the participant was limited in movement (see Research Participant, p. 45), I decided to begin with asking the participant to simply look at the points in space. During the eighth session, the participant progressed to referring to the points in space with the left arm (the side not affected by hemiparesis) with my assistance. The details of the scales and how they were used in this study are explained in the Procedure section of this chapter and Appendix E.

Sequence of dimensional and diagonal scales. At the beginning of the study, I focused on the dimensional scale. The points and verbal cues for this scale are outlined in Table 1. The numbers indicate the order of the sequence, and the illustration provides a visual reference for the scale.

Verbal cue	**LMA Taxonomy of Point in Space**
1 Up	Place high
2 Down	Place deep
3 Right	Right middle
4 Left	Left middle
5 Forward	Forward middle
6 Back	Back middle

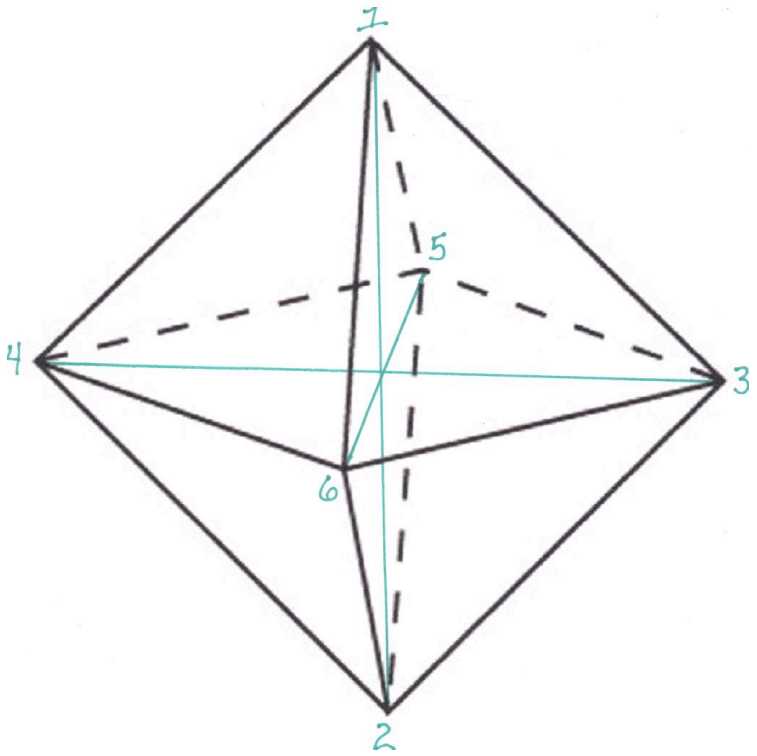

Figure 1. Sequence of dimensional scale (Fluty, 2010, based on Laban 1966).

The sequence in Figure 1 would be considered an execution of the dimensional scale on the right side, as it refers to the right side first. If the mover were gesturing with the arm (as opposed to simply looking to the point) she would use her right arm. If the mover were to use

the left arm, she would refer to the left side first. Since the participant was executing the scale with her eye movement, the movements that corresponded to forward and back were to bulge and close the eyes.

During the fifth session, I introduced the diagonal scale and the sessions thereafter included both scales. The points and verbal cues are the same for the diagonal scale and are outlined in Figure 2. The numbers indicate the order of the sequence, and the illustration provides a visual reference for the scale.

Laban Taxonomy of Diagonals	**Verbal Cue and LMA Taxonomy of Point in Space are the same**	
P1 diagonal	1 Forward -right-high	2 Back-left-deep
P2 diagonal	3 Forward -left-high	4 Back-right-deep
P3 diagonal	5 Back-left high	6 Forward -right-deep
P4 diagonal	7 Back-right-high	8 Forward -left deep

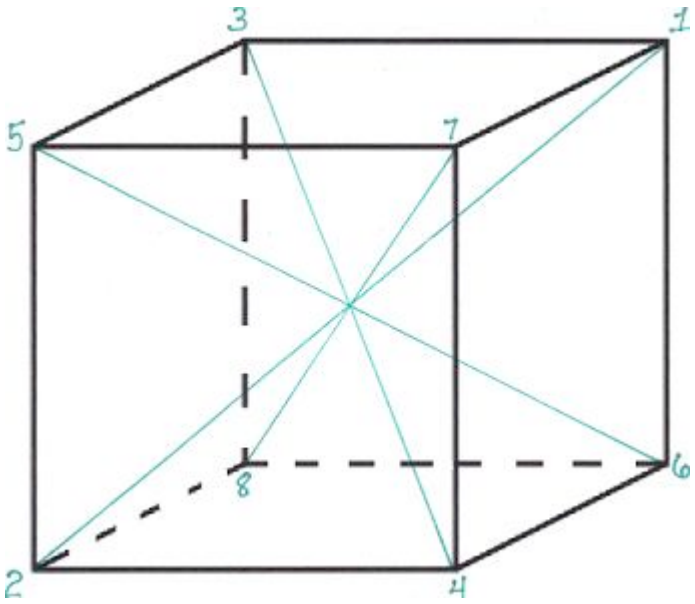

Figure 2. Sequence of diagonal scale (Fluty, 2010, based on Laban 1966).

In LMA, the diagonals are often referred to as "P1," "P2," "P3," and "P4," in reference to which "Primary Scale" moves around the diagonal (see Appendix A for detail). The sequence of the diagonal scale in Table 2 is performed when the mover begins with the right side first, using

the right arm as the predominant gesture/referring arm. If the mover begins with the left side first, the sequence would be as follows: P2, P1, P4, P3.

Research Participant

The participant is a fifty-year-old Caucasian female selected by the director of the rehabilitation program because her individual treatment needs coincided with the potential benefits of the research study. The participant's medical history and treatment records reveal that in November of 2006, she survived a series of strokes in the right frontal, bilateral parietal, and left occipital areas of the brain; she was eventually diagnosed with Cerebral Vasoconstriction Syndrome, also known as Call-Fleming Syndrome. This resulted in right-side hemiparesis and right-side hemianopsia (visual field deficit), which contributed to decreased balance and coordination. She also continues to experience short term memory loss as well as depression and a decrease in concentration.

The participant's course of treatment after the strokes was complicated by many factors. She remained in a coma for approximately two weeks after the initial surgical procedures (endovascular coiling for the occipital aneurism and a craniotomy to repair the right frontal subarachnoid hemorrhage). She was hospitalized for approximately two months, during which time she sustained a perforation of her colon that may have occurred during the insertion of her feeding tube. This injury resulted in a hematoma that required surgical removal and a colostomy that was reversed seven months later.

Upon discharge from the hospital, the participant transitioned to an inpatient rehabilitation program where she remained for another month. At this location she participated in at least three hours of treatment per day, which included physical therapy, speech therapy, and occupational therapy. At the end of this inpatient rehabilitation period, she was transferred to a

nursing home to continue her intensive treatment. She remained there for six months, and then moved to an apartment where a live-in personal assistant helped her with daily living needs (toileting, bathing, dressing, walking, preparing and eating meals, etc.) and further rehabilitation.

The participant entered the day rehabilitation program where this study took place in February of 2009, and attended five days per week for approximately one year. Her personal assistant attended the program with her since she still required assistance with personal needs that could arise during program time, such as eating, toileting, and walking. Daily activities in the program included several weekly therapy groups of varied focus (including dance/movement therapy), daily individual rehabilitation activities (cognitive, attention, memory), exercise, and weekly leisure outings designed to facilitate community re-integration.

The participant's treatment goals in the day rehabilitation program focused on objectives that could increase her independence in daily functioning. At the time of the study, she was unable to toilet independently or write legibly; both of these deficits were partially attributed to her inability to understand spatial cues for directed arm movement and execute the desired movement, particularly in attempts to cross her mid-line (gesture across the body laterally) with her left arm. Additionally, the hemianopsia prevented her from seeing the area to her right, and therefore she rarely moved her eyes in that direction. Prior to the study, as an intern working with her individually, I introduced many interventions based on enhancing spatial awareness and increasing direct spatial intention, particularly as applied to handwriting. These improvisational interventions largely contributed to my initial interest in the potential for utilizing spatial-cue-based treatment in the rehabilitation of brain injury, i.e. Laban's Movement Scales.

The Institutional Review Boards of Columbia College Chicago and the agency at which the study occurred approved this study. The participant and her legal guardian gave written consent for participation (see Appendix B).

Ethical Concerns

While the implementation of these interventions using the movement scales has not been well-documented as research in the field of dance/movement therapy, Laban's theories and methods are widely applied and accepted as beneficial and ethical clinical treatment modalities in dance/movement therapy. The research participant was fully aware of the benefits and potential risks involved in the research as outlined in the consent forms. Potential benefits were numerous, including increased spatial awareness, improved cognitive and emotional processing, improved balance and coordination, improved physical mobility, and increased physical stability. She understood that this research could possibly lay the groundwork for further research in this area, and may provide evidence of the efficacy of this particular treatment for adults recovering from brain injury and other populations. There was no compensation of any kind, and no additional time commitment outside of the regular rehabilitation program hours was required. The aforementioned supplementary practice of the activities to occur outside of the study was voluntary.

There were minimal risks involved in this study, none of which were beyond the scope of the usual dance/movement therapy treatment that the participant already received in the rehabilitation program. In addition to the possibility that physical, emotional, cognitive, and/or behavioral improvements could result from the treatment and continue beyond the termination of the research period, the participant understood that she could also experience disappointment upon the removal of the treatment. Any improvements made during treatment would possibly

decelerate or disappear without the treatment. Therefore, at the onset of the study, I agreed to consult with the participant and the director of the rehabilitation program when the study ended to assess if follow-up treatment would be necessary. We determined that no continuation was required since the ongoing rehabilitation program met the continued needs of the participant and even occasionally incorporated elements of the research in regular dance/movement therapy groups.

The participant exited the day rehabilitation program four months after the study concluded when she and her family independently determined that the program was no longer serving her needs and she was no longer showing improvement. This decision was inconsistent with staff reports and my observations, and also caused concern regarding the ethical considerations of the research study. During the study, the participant showed significant improvement in all areas of rehabilitation, including cognitive, behavioral, social, emotional, and motor control, as evidenced by staff observations during the regular program activities. She also exhibited less frequent emotional disturbances and reported that she felt she was improving significantly. Immediately following completion of the study, the participant was frequently unable to manage her frustration in regular activities during the program hours; nevertheless, she did eventually continue to improve and/or maintain the improvements she experienced during the study. The completion of the study unfortunately coincided with a change in the participant's personal assistants, the finalization of her divorce, and other external relational factors that may have contributed to her frustrations and resulted in the decrease in improvement. The staff members of the program postulated that there were too many variables present to attribute the decrease in overall improvement to the termination of the study, thus the initial ethical determinations remained intact.

Procedure

Session Environment

I met with the participant approximately once a week for twenty to forty minute intervals in a private conference room in the program building. Occasionally the participant's personal assistant was also present. The room was approximately 200 square feet and contained tables and chairs that were pushed aside to make room for the participant to sit in a chair in the middle of an open space of about 40 square feet. The characteristics of the room were initially insignificant to the study, and the room was chosen because it was the only available private space at the rehabilitation program. However, as the study evolved the characteristics of the room and the objects in the room became significant to the procedure since they were used as visual markers to help the participant see the points in space. The participant sat in a chair facing a video camera and windows, while I moved around in the space as needed to initiate cues.

Modifications to Ensure Ethical Practice

The initial proposal of this study included the following steps:

1) Baseline information collection over three regular program days
2) Test of spatial awareness and questionnaire on sense of direction to provide pre-test data (SEE APPENDIX D).
3) Eight weeks of twice-weekly forty-five minute sessions during which the participant would practice and then perform ten uninterrupted and unguided executions of Laban's dimensional and/or diagonal scales
4) Additional creative exploration of the scales, i.e. improvisational reference to points in space included in the scales

5) Repeated administration of spatial awareness test and sense of direction questionnaire as a post-test
6) Observation of participant over three regular program days to collect data to compare to baseline information

The participant and I agreed that the scales could be modified in consideration of the participant's physical limitations. For example, I could ask her to simply refer to specific points in space with her eyes or one hand, instead of doing the standard practice of gesturing with the arm and stepping toward the point in space. I could make subsequent assessments and adjustments according to her progress as the research continued. As an ethically and professionally responsible clinical intern, I determined that the participant's clinical treatment goals would always take precedence over the planned procedures of the research study.

I continually adopted modifications to guide the participant to see the points in space. This practice also grounded me in my responsibilities as the participant's therapist since the adjustments allowed for the continued attention to the participant's recovery needs. Before working with the participant, the planned procedure only allowed for verbal prompts to look to the points. It was clear after the first session that the participant would need to work up to this level of performance. Often I made procedural changes in the moment of directing the scales in response to the immediate needs of the participant; details of how these modifications unfolded in the process are included in Appendix E, as well as expounded upon in the Discussion section. An important example of modification is that the participant found the point in space most readily when she followed my face as I moved to the point in space. The implications of this development are discussed later. Some procedural modifications arose because of limitations in

coordinating the schedule of the participant, the changing daily activities of the rehabilitation program, and my scheduled days working at the program.

Procedure for Data Collection

Baseline information. In order to collect baseline information before beginning the research study, I observed the participant in a dance/movement therapy group in regular programming at the day rehabilitation program. Using Laban Movement Analysis and a specialized Movement Assessment Coding Sheet, or MACS (see Appendix C), I made notations to record which points in space the participant referred to with any part of the body (including the eyes). The method of notation was a simple tally using "hash marks" in the appropriate boxes. I was not able to observe her for the other two planned events because of the aforementioned scheduling difficulties.

Pre-test. During the first meeting of the study, the participant verbally responded to a questionnaire called the Santa Barbara Sense of Direction Scale (Hegarty, et al, 2002) to provide pre-test data. This test was chosen because it is related to tasks that require an update of spatial orientation in an actual environment, rather than estimating distances or drawing maps. The use of direct experience instead of maps, videos, or virtual environments is more relevant to this study that is dependent upon real-time and real-space awareness and navigation. In addition to this highly validated test, I conducted my own improvised exploration by asking the participant to name the points in space at which I gestured. This was not to collect data, but rather to gain a sense of how to proceed in the study and the participant's recovery process. Detailed procedures for each research session are included in Appendix E, and are indicative of the variations in the order of events and questions posed to the participant. Only a general explanation of the data collection procedures is outlined in the present chapter.

Introduction of variables. During the research study procedures I met with the participant on twelve separate occasions. Each session was video-recorded, and I made notations of observations using Laban Movement Analysis on a specialized Movement Assessment Coding Sheet (MACS) (see Appendix C for a sample of the MACS).

I began each session by guiding the participant in learning and practicing the movement scales, at first utilizing only eye/head movement. I eventually progressed to assisting the participant with arm movement using both proximal and distal holds. As mentioned previously, brightly colored objects located at the points in space in the room (telephone, fire alarm, tennis ball, etc.) provided visual landmarks to aid the participant in seeing the points clearly.

When the participant was ready to perform sequential executions of the movement scales, during which time she would refer to the points continuously without stopping and without receiving help, she would segue from practice time to execution/observation time. I would simply ask the participant if she was ready to try the scales on her own. I determined the number of executions by one of two ways: I would decide on an amount (based on my assessment and observation of the practice movements) and ask the participant if it was reasonable, or I would ask the participant how many executions she wanted to try. She ranged from one to ten executions of each scale.

During this stage of the session, I simultaneously observed and notated the participant's movement. If the participant saw the point, I placed a checkmark in the box for the corresponding point in space; if the participant was not successful in seeing the cued point, I would include a text notation of what point she saw; if the participant responded to the prompt by moving a body part other than the eyes, I would include a text notation of which body part she moved.

When the executions were completed, I would ask the participant how easy the scales were for her (using a rating scale of 0 to 10, with 0 being extremely difficult and 10 being extremely easy), which points were easiest/hardest to see, and how the scale felt in comparison to previous sessions. I asked these questions in a conversational mode, and the participant's answers were recorded in the "Notes" section of the MACS.

Immediately following each session, I recorded key impressions, statements, and/or events in a session report, at which time reference would be made to the notes on the MACS. This practice gave me the opportunity to capture data I may have been unable to record during the execution/observation time, such as the procedural modifications, the participant's verbal responses to my interventions, external elements/events that may have influenced the session, and my thoughts and responses during the session.

Additionally, I viewed the video of the session to notate how the participant performed the scales, how the participant was moving in general, and how I guided the participant. I recorded these video observations in writing; appendix E contains all written records of the sessions. As I viewed videos, I occasionally observed details I had missed in the session. I anticipated that the data gleaned from the videos and the session reports would be important for many reasons. For example, I reviewed these details during the study to evaluate the need for additional supportive research as questions or issues arose. I sometimes made procedural changes based on my video observations and/or session reflections. This supportive data also enriched the data analysis, results, and discussion of the research.

Post-test. At the conclusion of the study, I administered the Santa Barbara Sense of Direction Scale again as a post test. Additionally, I asked the participant another improvised set of questions during which she attempted to name the points in space at which I gestured. As in the

pre-test, this improvisation was not an official set of data, but gave me an overall impression of how the participant may have improved during the study.

Post-study data collection. I was unable to collect comparative post-study data in the program milieu because of scheduling difficulties. I did, however, engage in more data collection processes using the videos. I collected two additional data sets at the conclusion of the study. I viewed all videos a second time to ensure accuracy of observation. Viewing only the execution portions of the videos, I made notations on separate MACS as to whether the participant was successfully referring to the points in space. This allowed me to observe and record as an outside observer instead of as a participant-observer, theoretically diminishing the distraction that occurred from engaging in the task of prompting the scales. I also employed another analyst who holds a Graduate Certificate in Laban Movement Analysis (GLCMA) to perform this same method of data collection. This third set of data provided an objective outside perspective on the research, as I was aware of the potential for my notations to reflect my possible bias as the participant's therapist.

Data Analysis

Pre and post test questionnaire scoring. Likert scales such as the Santa Barbara Sense of Direction Scale used in this study are scored by simply adding the numeric answers to each question to return a final score for the test. This scale had a potential overall total of "105," if every question were answered "7" for "strongly disagree." A higher score on this scale would indicate that the participant rated herself very low in spatial abilities, since the negative answer was placed at the higher number (many scales use the opposite rating system, with the negative answer being placed at the bottom of the scale and thus receiving a score of "1"). I also compared the answers to the individual questions for content analysis.

MACS scoring. At the conclusion of the research sessions, the data consisted of MACS on which I had recorded my observations during the sessions. The first step in the first phase of the data analysis was to translate the checkmarks to quantifiable data. Since I structured the MACS scoring so that the participant either saw the point or did not see the point, I was working with a "yes" or "no" result. (I anticipated that this would simplify the data analysis process because it would allow for the use of means and binomial distribution.) I assigned scores of "1" to the checkmarks that indicated she saw the point, and scores of "0" to blank boxes that indicated she did not see the point or made other movements. Each attempt to see the point received a score; i.e., if she attempted to see "forward-right-high" ten times she received ten scores of either "1" or "0."

The second step in the first phase of analysis was to watch all of the videos from the session and repeat the above process with the MACS from those observations. The final step in the first phase of data analysis was to hire an outside analyst to view the videos and then repeat the above process with her MACS. Thus, at the conclusion of the first phase, I had three sets of data from three sets of MACS. I determined that the most reliable set of data were the MACS from my video observations, as this was derived from a more focused observation than the sessions and there was consistency between the hired analyst's observations and my own observations. The few differences between my observations and the hired analyst's observations were attributed to rater error, therefore my video observations were the data analyzed for the study.

The second stage of data analysis was to obtain a comparison analysis of the participant's performance at the beginning and end of the study. The first and last day scores from each point in space were extricated and inserted into separate Microsoft Excel worksheets. I then obtained

the mean (*M*=mean) for the total attempts to see each point during each session. I plotted the mean score for each point in space from the first day and last day on a line graph. This allowed for a visual inspection of the increment of change ("increment of change" encompasses improvement, no change, and decline) from the first day to the last day.

Thus, at the end of this second stage of data analysis, I had a set of data for each point in space that included a table of scores (See table 1) from the first and last days that showed the mean, accompanied by a line graph that illustrated the change from the first day to the last day. From these individual point tables and graphs, I created compound line graphs for the dimensional scale and the diagonal scale (see figures 4 and 6).

For the third stage of analysis, I subtracted the last day score from the first day score to determine the increment of change (ΔP) from the beginning of the study to the end of the study {$\Delta P = M_1 - M_2$; M_1 = the average score from the first day; M_2 = the average score from the last day}. I also obtained means of groupings of the points, such as the average increment of change in the dimensional scale, the diagonal scale, and each hemisphere.

Statistical significance. The fourth and final stage of analysis was to determine if these results were statistically significant and not occurring by chance. An outside statistics consultant performed a test of significance on all points in space to calculate p-values. To reflect that each event of success or failure had equal probability, we used the value of 0.5 for the probability of success. The statistician calculated the p-values to determine statistical significance of the data, using a cumulative binomial distribution function.

$$B(x; n, p) = \sum_{y=0}^{x} b(y; n, p)$$

Figure 3. Cumulative binomial distribution function.

P-values less than 0.1 provide evidence against the null hypothesis that the participant had no control (the level of control indicates if the participant's movements occurred randomly or with volition); the smaller the value, the stronger the evidence. Thus, if the p-values are closer to 1, it supports the null hypothesis that the participant had no control. If the p-values are closer to zero, it illustrates that she did have control, and thus provides evidence against the null hypothesis. If the values are closer to 1 at the beginning of the study and closer to zero at the end of the study, this provides evidence that the participant gained control from the beginning to the end.

CHAPTER FOUR

Results

The main goal of this study was to research how the participant's spatial awareness was affected by learning and practicing Laban's dimensional and diagonal scales. Three hypotheses developed over the course of the study. The first hypothesis was that at the end of the study the participant would be more spatially aware as evidenced by observable improvement in the clarity of her eye movements in the execution of the scales. The second hypothesis that emerged from the first one was that she would gain more control of her eye and arm movements as the study progressed; this relates to the null hypothesis used in the calculation of p-values that the participant had no control over her movements. These two hypotheses have an assumed causal relationship: if she is gaining clarity in her movements, then she has more control over her movements. Finally, I proposed that the regular implementation of Laban's movement scales in the rehabilitation treatment of brain injury could augment recovery in a beneficial manner, regardless of the specific (or even unknown) effects of engaging with the scales.

The main data collection tool was the video observation and notation of the participant's movements while she performed the scales with cuing and guidance from me. I based my hypotheses on my careful observations of her movements and her reports of her experience in the movements. The results of the data analysis are presented in tables, line graphs and bar graphs. The data are categorized by grouping the points in space in various configurations, i.e. dimensional scale, diagonal scale, and each hemisphere (forward, back, right, and left). These figures support or refute the hypotheses regarding the participant's progress in the study. Additionally, p-values are shown in the tables and on the graphs beside the points. These numbers inform the hypothesis regarding the participant's level of control over her movements.

If she supposedly did not have control over her movements, the p-value is closer to one. If she supposedly did have control, the p-value is closer to zero.

Dimensional Scale

In the execution of the dimensional scale, the participant showed an overall average improvement of 30%. This supports the hypothesis that the participant would improve her execution of the scale from the beginning of the study to the end of the study. However, all individual points and/or dimensions did not improve. The results for the one point that declined, "forward middle," could be attributed to any number of extenuating circumstances, since on earlier days in the study she achieved scores of 100%. Additionally, at the beginning of the study her natural gaze was usually forward in a fixed line of focus, so "forward-middle" was the only point that she saw clearly during every execution of the scale. By the end of the study, she was looking around more easily in general, and showed significant improvement in seeing the other points in space. While the data analysis of the points that remained the same does not provide support for the hypothesis, it is evidence that the treatment is not harmful.

Table 1 and figure 4 contain the average scores the participant received during her attempts to see the points in space in the dimensional scale on the first day and the last day of her attempts. Points in space are displayed in the sequence of the dimensional scale on the right side from beginning to end.

Table 1

Data Set – Dimensional Scale

Point in space	Date	Scores	Average Score (*M*)	p-value
Place High	7/23	0 0 0 0 1	20%	0.8125
	9/30	0 0 0 0 1	20%	0.8125
Place Deep	7/23	0 0 1 0 1	40%	0.5
	9/30	1 1 1 0 1	80%	0.0313
Right Middle	7/23	0 0 0 0 1	20%	0.8125
	9/30	1 1 1 1 1	100%	0
Left Middle	7/23	0 0 0 0 0	0%	0.9688
	9/30	1 0 1 1 1	80%	0.0313
Forward Middle	7/23	1 1 1 1 1	100%	0
	9/30	1 0 1 1 1	80%	0.0313
Back Middle	7/23	0 0 1 0 1	40%	0.5
	9/30	1 0 1 0 0	40%	0.5

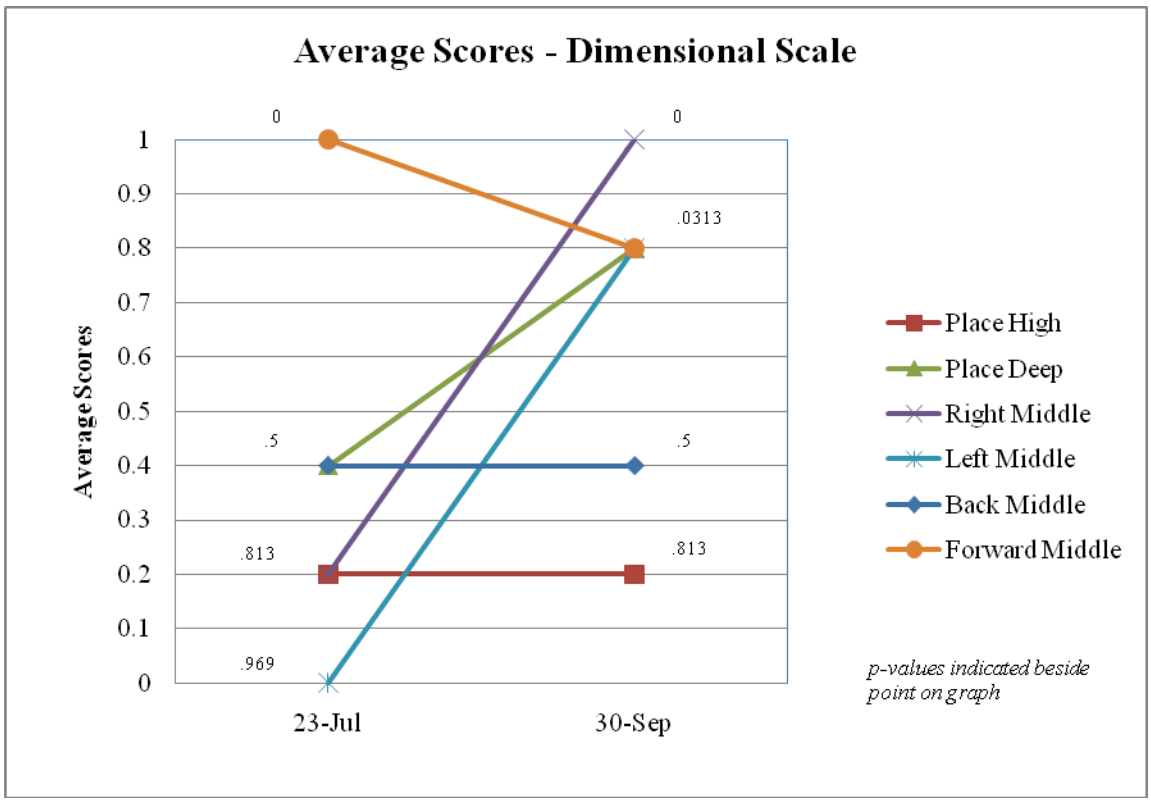

Figure 4. Average scores of the dimensional scale on first day and last day.

Table 2 and figure 5 show the participant's average increment of change (including improvement, no change, and decline) in the dimensional scale from the beginning of the study to the end of the study. Points in space are displayed in the sequence of the dimensional scale on the right side from beginning to end.

Table 2

Average increment of change in each dimension from first day to last day

Point in space	ΔP	M
Place High	0	
Place Deep	40	
Average increment of change for vertical dimension		20
Right Middle	80	
Left Middle	80	
Average increment of change for horizontal dimension		80
Forward Middle	-20	
Back Middle	0	
Average increment of change for sagittal dimension		**-10**
Overall average increment of change for dimensional scale		30

Note. "Increment of change" is a general term that encompasses improvement, no change, and decline. Red = decline; green = improvement; gray = no change. ΔP = increment of change, or $\{\Delta P = M_1 - M_2;\ M_1$ = the average score from the first day, M_2 = the average score from the last day, ΔP = increment of change$\}$. M = average increment of change, or $\{M=(\Delta P_1 + \Delta P_2)/2\}$ and $\{M=(\Delta P_1 + \Delta P_2 + \Delta P_3)/3\}$.

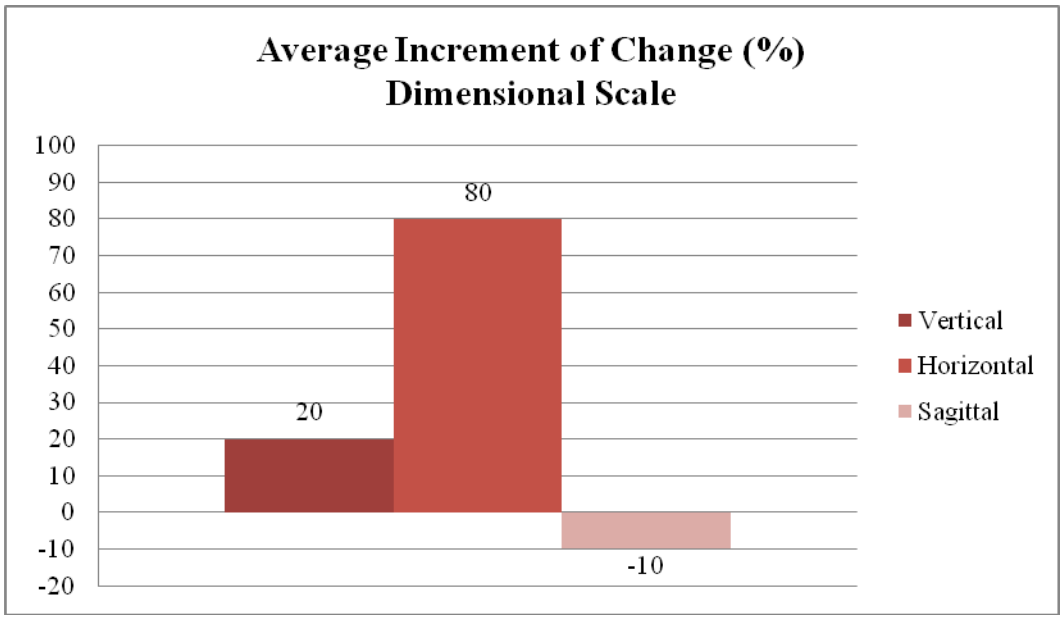

Figure 5. Average increment of change in each dimension from first day to last day.

Diagonal Scale

In the execution of the diagonal scale, the participant showed an overall average improvement of 5.9%. This supports the hypothesis that the participant would improve her execution of the scale from the beginning of the study to the end of the study. However, all individual points and/or diagonals did not improve. The results for the two points that declined, BRH or "back-right-high" and FLH or "forward-left-high" could be attributed to any number of extenuating circumstances, since on earlier days in the study she achieved scores of 100%. The decline in FLH was only by 1%. BRH was the point in space that the participant always confirmed was the most difficult for her to see, and this corresponds to the combination of her right side visual field deficit with her habitual gaze forward and tight neck muscles that inhibit her from looking behind her. While the data analysis of the points that remained the same does not provide support for the hypothesis, it is evidence that the treatment is not harmful.

Table 3 and figure 6 contain the average scores the participant received during her attempts to see the points in space of the diagonal scale on the first day and the last day of her attempts.

Table 3

Data Set – Diagonal Scale

Point in space	Date	Scores	Average Score	p-value
FRH	8/17	1 1 1 1 0 1 1 0	75%	0.0352
	9/30	1 1 1 1 1 1 1 1	100%	0
BLD	9/10	1 0 1 1	75%	0.0625
	9/30	1 1 0 1	75%	0.0625
FLH	8/17	1 1 1 1 1 0 1 1 1	89%	0.0020
	9/30	1 1 0 1 1 1 1 1	88%	0.0039
BRD	9/10	1 0 0 0	25%	0.5000
	9/30	0 0 0 0 1 1 0 1	38%	0.6367
BLH	9/10	1 1 0 0	50%	0.3125
	9/30	1 1 1 0 1 0 0 1	63%	0.1445
FRD	8/17	1 1 1 1 1 1 1 0 1	89%	0.0020
	9/30	1 1 1 1 1 1 1 1	100%	0
BRH	9/10	0 1 0 1	50%	0.3125
	9/30	1 0 0 0 1 0 1 0	38%	0.6367
FLD	8/17	1 1 1 1 1 1 1 1	100%	0
	9/30	1 1 1 1 1 1 1 1	100%	0

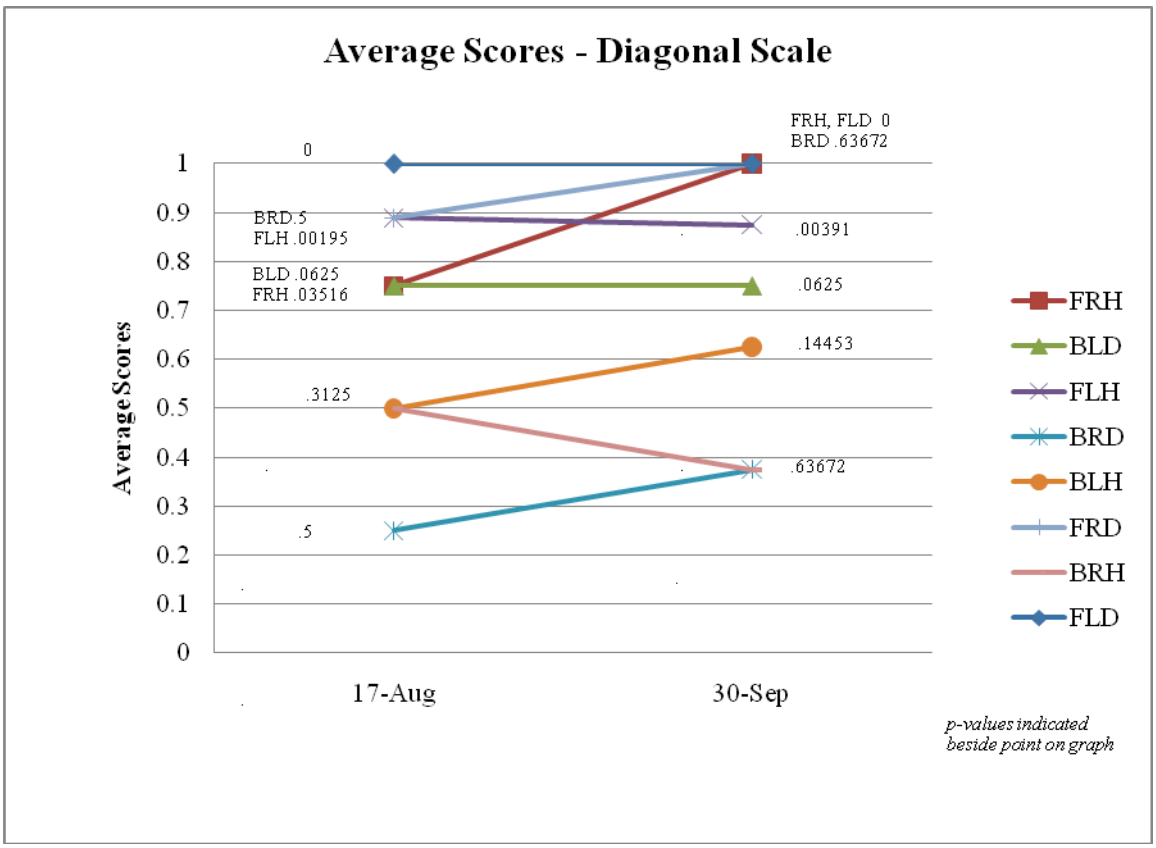

Figure 6. Average scores in diagonal scale on first day and last day.

Table 4 and figure 7 show her average increment of change in the diagonal scale from the beginning of the study to the end of the study. Points in space are displayed in the sequence of the diagonal scale from beginning to end on the right side.

Table 4

Average increment of change in each diagonal from first day to last day

Point in space	ΔP	M
FRH	25	
BLD	0	
Average increment of change for P1 diagonal		12.5
FLH	-1.3	
BRD	12	
Average increment of change for P2 diagonal		5.35
BLH	12	
FRD	12	
Average increment of change for P3 diagonal		0
BRH	-12.5	
FLD	0	
Average increment of change for P4 diagonal		-6.25
Overall average increment of change for diagonal scale		5.9

Note. Red = decline; green = improvement; gray = no change. ΔP = increment of change, or $\{\Delta P = M_1 - M_2;\ M_1$ = the average score from the first day, M_2 = the average score from the last day, ΔP = increment of change$\}$. M = average increment of change, or $\{M=(\Delta P_1 + \Delta P_2)/2\}$ and $\{M=(\Delta P_1 + \Delta P_2 + \Delta P_3 + \Delta P_{43})/4\}$.

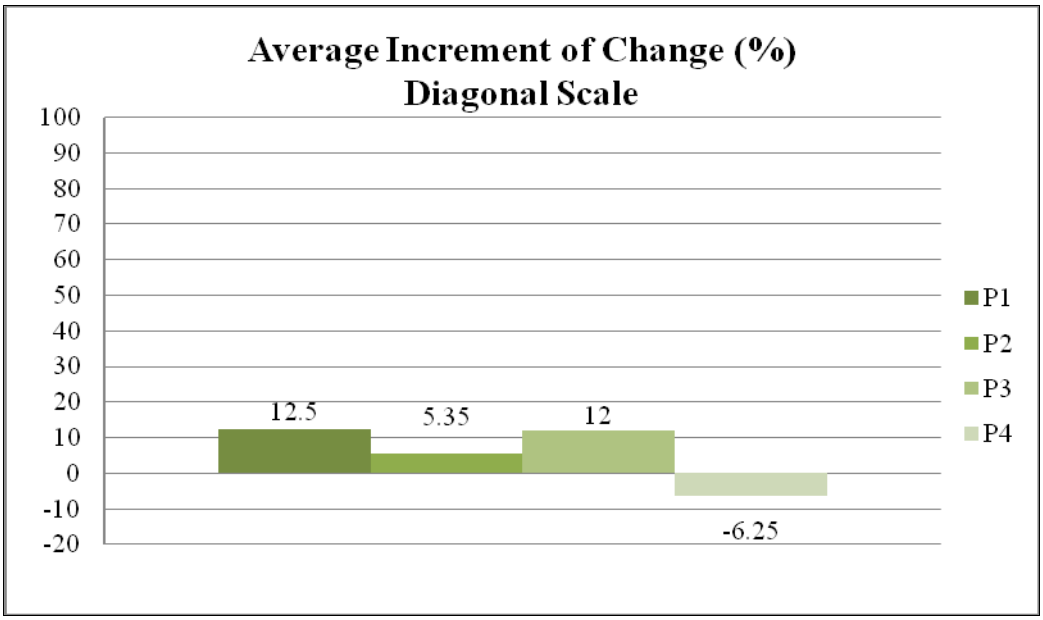

Figure 7. Average increment of change in each diagonal from first day to last day

Hemispheres

Because the participant has a right side hemianopsia and right side hemiparesis, and also stated that she was not aware of the space behind her, I wanted to analyze the data by grouping the points by which spatial hemispheres the points are located in, i.e. the points on her right side, the points on her left side, the points in front of her, and the points behind her. This categorization returned results that indicated she improved in all hemispheres. Figures 10, 11, 12, and 13 show the average scores the participant received during her attempts to see the points in each hemisphere on the first day and the last day of her attempts.

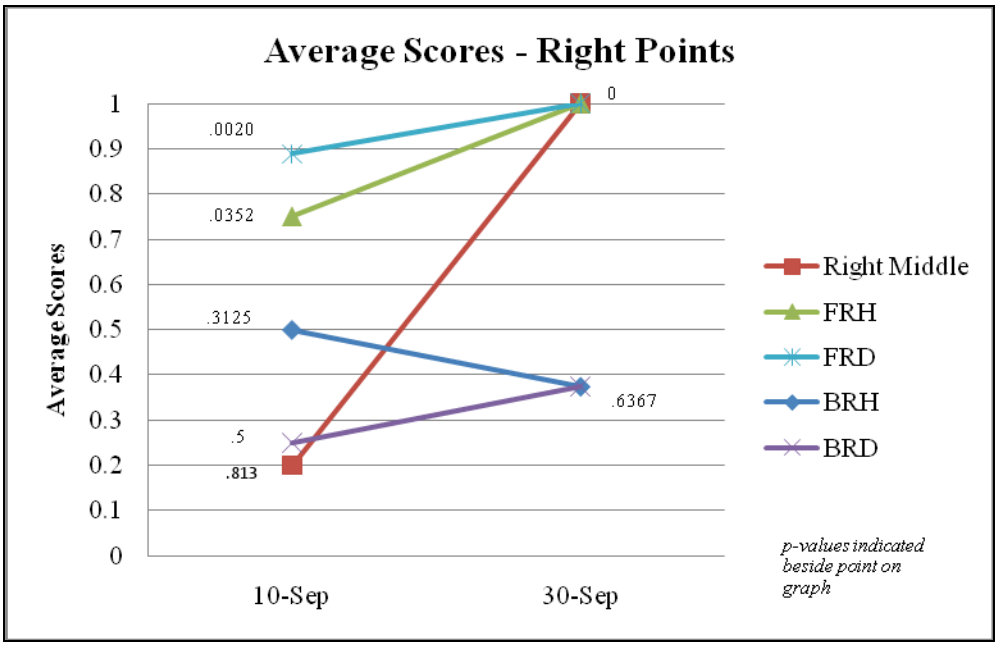

Figure 8. Average scores in right hemisphere on first day and last day

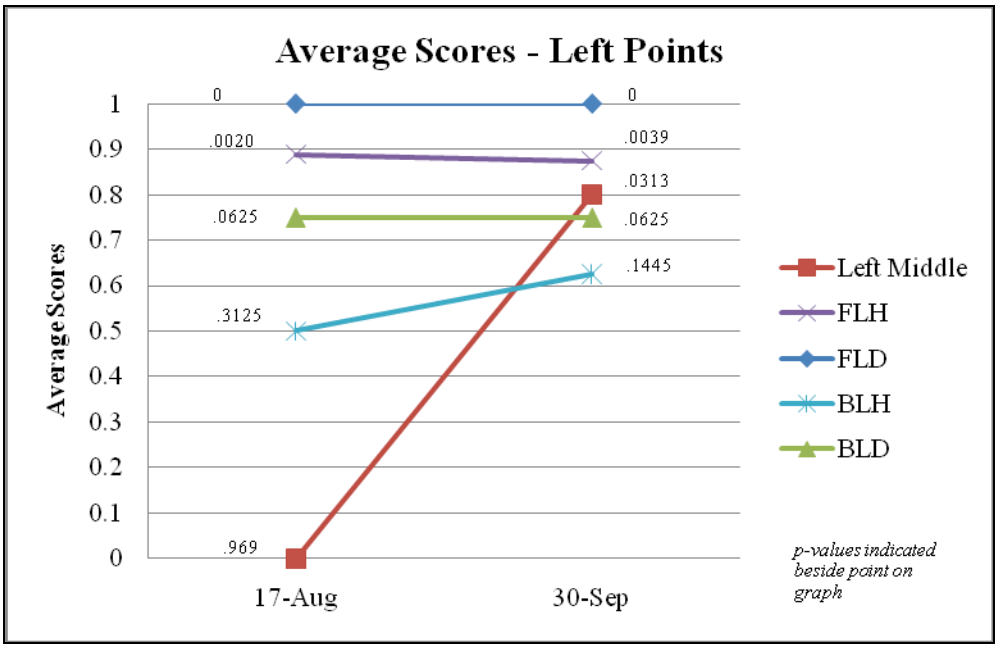

Figure 9. Average scores in left hemisphere on first day and last day

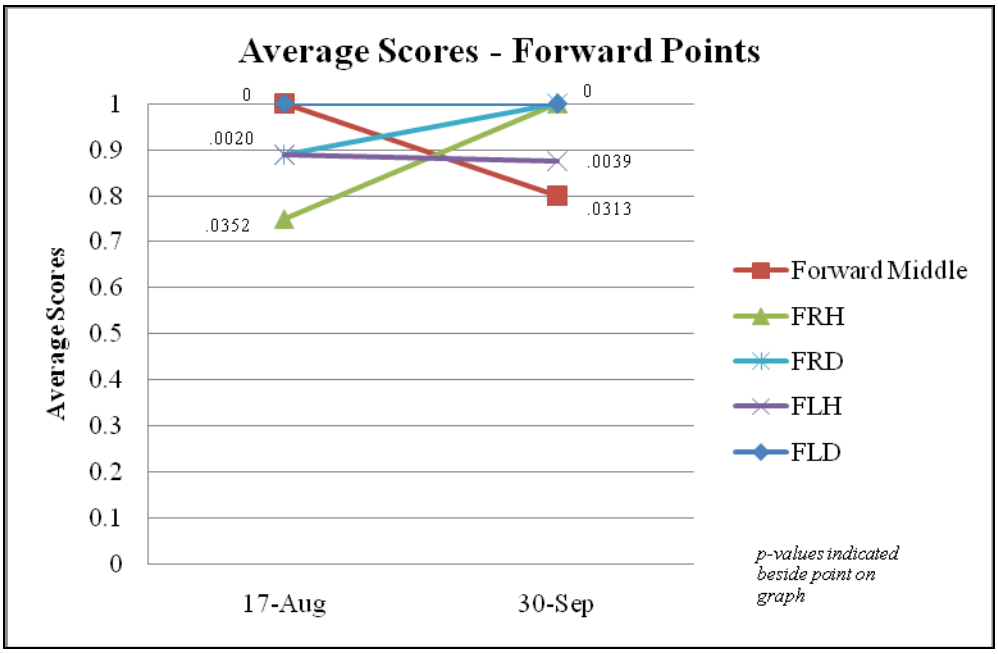

Figure 10. Average scores in front hemisphere on first day and last day

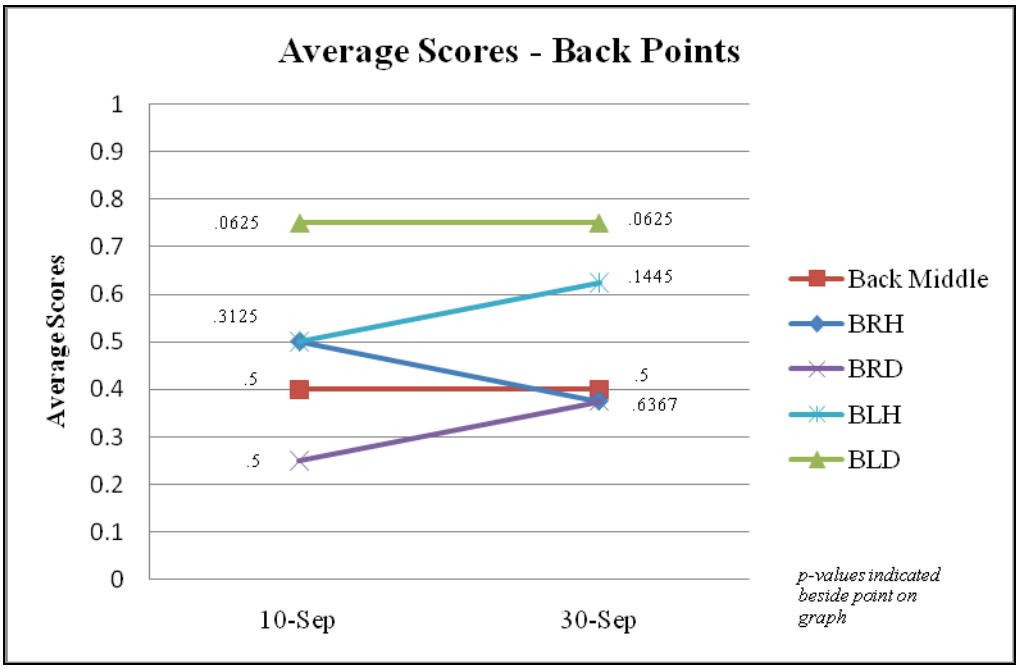

Figure 11. Average scores in back hemisphere on first day and last day

Table 5 and figure 12 show the average increment of change in the hemispheres from the beginning of the study to the end of the study. I did not calculate the overall average increment of change for all hemispheres because the result would have been skewed by the fact that many of the points in space are calculated in more than one hemisphere. For example, BRH is included in the calculations for both the right hemisphere and the back hemisphere.

Table 5

Average increment of change in each hemisphere from first day to last day

Point in Space	ΔP	M
RM	80	
FRH	25	
FRD	12	
BRH	-12.5	
BRD	12	
Average increment of change right points		23.3
LM	80	
FLH	-1.3	
FLD	0	0
BLH	12	
BLD	0	
Average increment of change left points		18.14
FM	-20	

FRH	25	
FRD	12	
FLH	-1.3	
FLD	0	
Average increment of change forward points		3.14
BM	0	
BRH	-12.5	
BRD	12	
BLH	12	
BLD	0	
Average increment of change back points		2.3

Note. Red = decline; green = improvement; gray = no change. ΔP = increment of change, or $\{\Delta P = M_1 - M_2;\ M_1$ = the average score from the first day, M_2 = the average score from the last day, ΔP = increment of change$\}$. M = average increment of change, or $\{M=(\Delta P_1 + \Delta P_2 + \Delta P_3 + \Delta P_4 + + \Delta P_5)/5\}$.

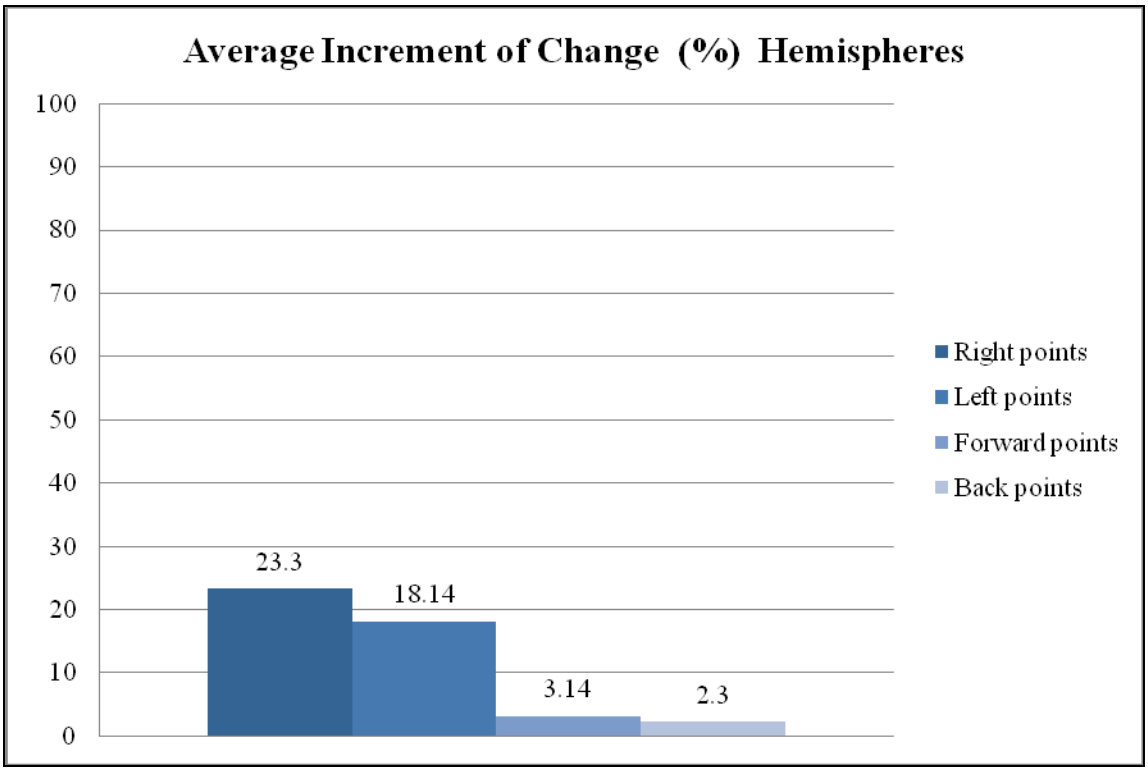

Figure 12. Average increment of change in each hemisphere from first day to last day

In conclusion, table 6 outlines the overall increments of change for all of the points in space. The average decline and the average improvement are shown, as well as the result that the participant exhibited an overall average improvement of 16%. Figure 15 shows the average scores for all of the points in space on the first day and the last day. It exhibits the general upward trend of improvement.

Table 6

Average increment of change for all points in space from first day to last day

Point in Space	ΔP	M
FM	-20	
FLH	-1.3	
BRH	-12.5	
Average decline		-11.27
PH	0	
BM	0	
FLD	0	
BLD	0	
No change		0
PD	40	
RM	80	
LM	80	
FRH	25	
FRD	12	
BRD	12	
BLH	12	
Average improvement		37.23
Overall average increment of change		16.23

Note. Red = decline; green = improvement; gray = no change. ΔP = increment of change, or {$\Delta P = M_1 – M_2$; M_1 = the average score from the first day, M_2 = the average score from the last day, ΔP = increment of change}. M = average increment of change, i.e. {$M=(\Delta P_1 + \Delta P_2 + \Delta P_3 + \Delta P_4 + + \Delta P_5)/5$}.

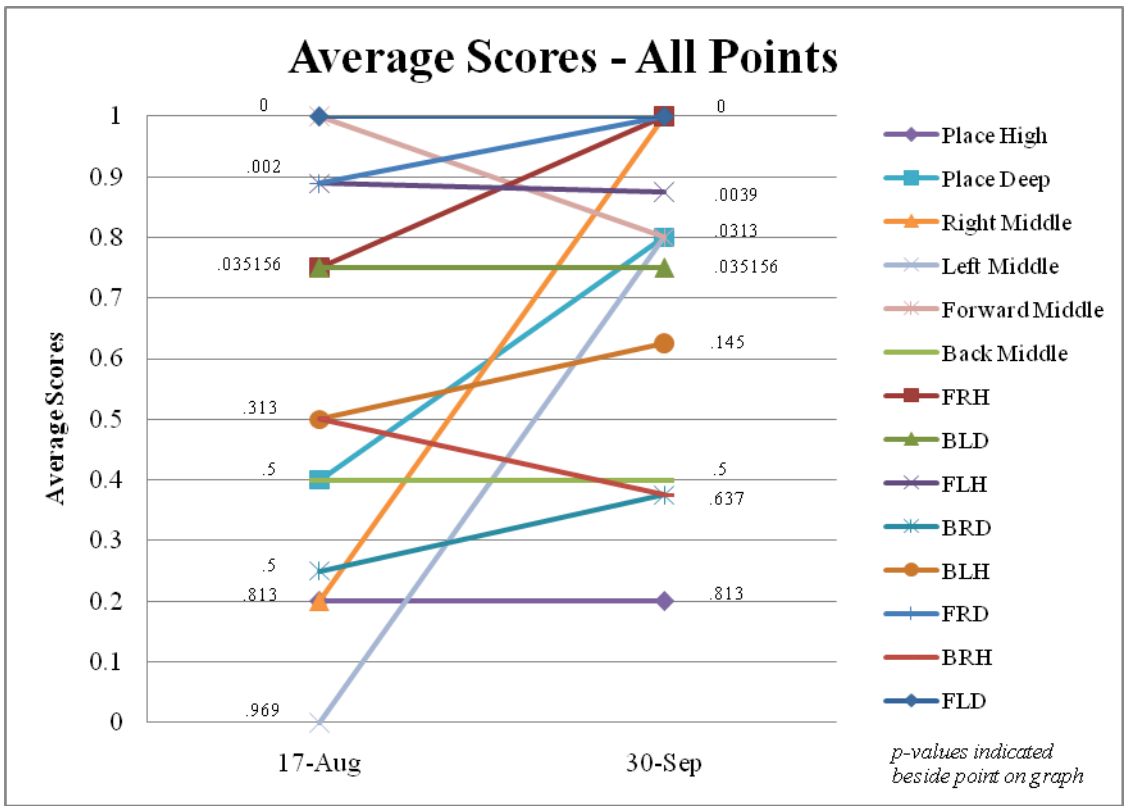

Figure 13. Average scores for all points in space on first day and last day.

Pre and post test comparison

The participant's composite score on the Santa Barbara Sense of Direction Scale on July 16 before the study began was "87" out of "105." This indicated that she rated herself low on spatial abilities, as the highest answer ("7") to each question correlated to "strongly disagree". After the end of the study on October 5, she scored an "84." The complete results are presented in Table 7. Questions scored in reverse from the answer are indicated by bold typeface.

The participant rated herself higher on six questions. These items addressed her ability to give directions, her memory of where she left objects, her ability at judging distances, her ability to find her way in a new city, her ability to understand directions, and her ability to remember routes as a passenger in a car. She rated herself lower on three questions, which addressed her overall "sense of direction," her enjoyment of giving directions, and how important it is to her

that she knows her location. She stayed the same (rating herself very poor) on six questions. These consistent low ratings occurred in the areas of her tendency to think in cardinal directions, her enjoyment of reading maps, her ability to read maps, her allowance of others to navigate, her ability to remember a route after having traversed it only once, and her impression of her "mental map".

Table 7

Pre and post test questionnaire data

Question	*Pre-test*	*Post-test*	*Interpretation*
1. I am very good at giving directions.	7	3	Improved
2. I have a poor memory for where I left things.	7	5	Improved
3. I am very good at judging distances.	7	4	Improved
4. My "sense of direction" is very good.	1	3	Declined
5. I tend to think of my environment in terms of cardinal directions (N, S, E, W).	7	7	No change
6. I very easily get lost in a new city.	7	4	Improved
7. I enjoy reading maps.	7	7	No change
8. **I have trouble understanding**	7	3	Improved

directions.			
9. I am very good at reading maps.	7	7	No change
10. **I don't remember routes very well while riding as a passenger in a car.**	7	6	Improved
11. **I don't enjoy giving directions.**	1	7	Declined
12. **It's not important to me to know where I am.**	1	4	Declined
13. **I usually let someone else do the navigational planning for long trips.**	7	7	No change
14. I can usually remember a new route after I have traveled it only once.	7	7	No change
15. **I don't have a very good "mental map" of my environment.**	7	7	No change
Composite score	87	84	Improved

CHAPTER FIVE

Discussion

Study Results

The results of this study support the three hypotheses. First, the participant exhibited observable improvement in the clarity of her eye movements in the execution of the scales at the end of the study, so it could be suggested that she was more spatially aware as evidenced by this criterion. Second, she appeared to gain more control of her eye and arm movements as the study progressed, because she executed the scales better at the end of the study than she did at the beginning of the study. The data show that the participant improved by 16% in her overall execution of the scales. Her average scores decreased for only three of the individual points and she remained the same for four points. She showed improvement in the remaining seven points in space, or half of the total points attempted.

I also hypothesized that the regular implementation of Laban's movement scales in the rehabilitation treatment of brain injury could augment recovery in a beneficial manner, regardless of the specific (or even unknown) effects of engaging with the scales. This third hypothesis is supported by these results, since she improved or stayed the same in seeing eleven out of fourteen points. For a client recovering from brain injury who lacked control over her movements, an improvement in executing a learned sequence could indicate an increase in control and thus a positive effect of treatment (Ohyama, et al., 2006). The study results are also supported by Berrol's (2009) research on the use of dance/movement therapy in brain injury rehabilitation. This study met all of the criteria she presents as standard DMT principles (see page 22 in the Literature Review).

The declines the participant exhibited are not significant enough to denote harm from the treatment, as many factors could have contributed to these results. First, for "forward-left-high" she only declined by 1%, not a significant loss. The 12% decline for "back-right-high" may not be statistically significant. The p-values for the first and last day scores of "back-right-high" indicate that she most likely could not control seeing this point, as it was one of only two points for which the p-values were closer to 1 at the end than they were at the beginning. The p-value for "back-right-deep" (directly below "back-right-high" and thus in her deficit area) also indicated this decline in control over her movements, although the scores for "back-right-deep" indicated an improvement. The fact that she had more control at the beginning than she had at the end could indicate that she was seeing those points by chance, since she improved or stayed the same in all other points. This would align with her right side visual field deficit and her reports of her experience that she had the most difficulty seeing those points.

Regarding the decline in seeing "forward middle," the overall change in her movement from the beginning of the study to the end of the study is pertinent. When she began, she mostly looked at this point even when asked to look other places, so it was not a surprise that she scored 100% on seeing this point. At the end of the study she was able to look around the space with clear focus and see many points, and she actually appeared distracted on the execution in which she did not see "forward-middle." Additionally, in that particular execution of the scale, she saw only two of six points.

This data only shows the quantitative analysis of the participant's movements on two days of the study. For extensive movement analysis and descriptions of how her overall movement changed from the beginning of the study to the end of the study, see Appendix E.

Pre-test and Post-test Results

The pre-test and post-test results provide valuable insight into how the participant's cognitive and emotional changes may have occurred parallel to her physiological improvements. At the beginning of the study the reality of the participant's physical and mental abilities may not have aligned with her impression of herself. In fact, she may not have been able to accurately define where her deficits lay. For instance, if she woke up in the morning and could not remember where she left her shoes the night before, she might have just become frustrated at what she thought was memory loss or her lack of ability to concentrate. She often berated herself for these shortcomings, and her shame and embarrassment frequently exhibited as emotional outbursts in the rehabilitation program. She did not realize that a problem such as forgetting the location of an object or not remembering her way from the car to the program could actually be a spatial processing deficit.

At the beginning of the study the participant's answers to the questions on the Santa Barbara Sense of Direction Scale reflected her lack of self-esteem as well as her lack of insight, and perhaps even confusion about what was being asked of her. An example of her confusion could be that she expressed strong negative feelings about her spatial processing skills, yet also stated that she had a good "sense of direction." She revealed her harsh impression of herself when she responded with only the strongest positive or strongest negative answer; furthermore, the positive answers related to negative statements (i.e. she strongly agreed that she had a poor memory for where she left things).

At the end of the study, her answers were more varied, and moreover indicated that she thought more poorly of herself in some areas than she had at the beginning. However, she may have been answering the questions on the Santa Barbara Sense of Direction Scale more

accurately because that time she better understood what her problems were and how to deal with them. Her self-awareness had increased and her general understanding of what we were doing in the study increased. Her "vocabulary" improved and she learned how to describe herself. Also, her self-confidence improved because she could identify the affects of the stroke rather than just become overwhelmed by an overall feeling of inadequacy. As she began to improve in her movement and spatial awareness, she also learned more about her condition. Thus, while some of her answers may have indicated that when the study concluded she felt she did "worse" in a particular area of spatial processing, she simply might have been reporting more accurately than she had at the beginning.

There is another dance/movement therapy perspective with which we can consider the data from the pre-test and post-test. As stated before, the answers to the questions on the pre-test all fall at the polar opposites of the scale: "strongly agree" or "strongly disagree". The participant seemingly saw everything in "black and white," saying an absolute "yes" or "no" to everything and apparently disregarding the "middle ground." She never gave a "neutral" response to any of the questions. In contrast, at the end of the study more of her answers were at the middle of the scale rather than at the polarized ends. She was more in the "gray area," which is more truthful to real life, more accurate regarding her situation, more insightful of her inner self, and wiser in her interpretations. Could this be an indication of further integration of material and understanding of self?

Dance/movement therapists may see and treat this progression with movement interventions. Hackney (2004) thoroughly explains the patterns of movement connectivity that develop from birth to locomotion. In this development, the pattern of "body-half" ideally occurs before "cross-lateral". Body half is related to polarity as it begins the definition of each side of

the body and across the mid-line of the spine. Babies who crawl on their stomach before they creep on their knees show the body-half connectivity as one side of the body pushes against the other in an opposing flexion/extension of the limbs on each side of the body to move forward. "Cross-lateral" is the next and final stage of development, and integrates all previous stages as the opposite quadrants of the body begin to connect more fluidly and clearly. A simple example of cross-lateral movement is biped walking: the right arm swings forward as the left leg takes the step, connecting the right high quadrant of the body to the left low quadrant in an integrated pathway through the core of the body.

The participant had very little access to her cross-lateral connectivity before this study began. In fact, all of her patterns of connectivity (breath, core-distal, head-tail, and upper-lower are the others; see Appendix A for full definition of the patterns of connectivity) had been undermined by her strokes. Her overall movement profile showed a prevalence of body-half movements paradoxically destabilized by inefficiency in the body-half connectivity. Her hemiparesis caused this juxtaposition. As we moved from one-dimensional polarities in the dimensional scale to three-dimensional polarities in the diagonal scale in this study, the participant was called upon to use her cross-lateral connectivity in new ways. She progressed from staring straight forward, to looking from side to side, then to reaching with her left arm across her midline along the diagonals. Could her answers to the post-test reflect her physiological integration on a cognitive level? If so, we have evidence for the "mind/body connection" that is important to the tenets of dance/movement therapy.

Further Questions about Spatial Awareness and Movement

Since I did not use specialized equipment to measure spatial processing in the brain, there is no way of knowing if the participant's spatial awareness actually improved on a neurological

level. Downey's (2004) study provided evidence that the parietal lobe of the brain is activated when performing movement scales. Bremmer (2005) and Karnath (1997) are among the numerous researchers who have shown that this region is significant in spatial processing. Downey postulated that her findings could indicate support for the supposed "mind/body connection." Since spatial processing requires cognitive and motor control areas working together, she may have been right. The findings of my study could be supported by the findings of Downey's study, and vice versa.

I also developed many questions around spatial awareness and how improved movement may or may not indicate improved brain function. Before I began my study I theorized that clarity of spatial intention, i.e. moving directly towards a point in space by gesture or locomotion, represented an advanced sense of spatial awareness. Using the scales to investigate whether a client could engage in direct spatial intention could provide evidence that the client was or was not spatially aware, and successfully performing the scales could translate to an increase in spatial awareness.

As I worked with my participant I wondered if the scales perhaps did not address how the participant perceived space at all, but only improved how she directed her movements to points in space. I began to understand as my study progressed that I could have been making a connection between functions that were related but not the same. The participant often reported that she could "sense" the areas around her, but she still could not move toward and/or within those areas. In other reports she would state that she never really thought about certain areas at all, such as the space behind her. Perhaps gesturing to the point in space does not necessarily indicate increased spatial awareness. Can one maintain awareness of the space around oneself even if unable to gesture to the area? How does the brain encode the information about the

environment if one cannot move around and explore it? Other researchers in psychology, motor learning and control, and rehabilitation are exploring these questions. I have only touched on a very small portion of it in this thesis. Further studies proposing Laban's scales to address any movement concern would be bettered by the inclusion and contextualization of more of that research.

The further exploration of these questions could provide a tremendous amount of information to practitioners in the rehabilitation of brain injury, since so many people who have survived trauma to the brain are often paralyzed or partially paralyzed. Perhaps the damage to the brain has occurred in a spatial processing area, so the information from the environment reaches the brain but it does not undergo any sort of processing. Thus the person has limited intentional movement. Maybe the eyesight is affected in such a way that the brain may not receive the information from the eyes. If the brain injury survivor has an injury that results in a limitation of movement, such as paralysis or spasticity, there may be a deficit in another primary receptor from which the brain receives information about the environment: the proprioceptive system (Etienne and Jeffery, 2004).

I found some resolution in these movement-based dilemmas by simply measuring the eye movements, a decision which guided the study in a specific direction. For this participant who had a visual field deficit, there was no doubt that any engagement with the eyes would be beneficial. It was highly likely that her spatial awareness was affected by her eyesight issues. By the end of my study, the participant reported that her perception of the area around her increased, even if she was not always able to directly see it. This was a positive report in regard to her recovery, yet it left me at a loss as a researcher using eye movements as a measurable indication of spatial awareness. Some questions that arose were as follows: "From an

observation point of view, how do I know what she perceives if I cannot see/observe her doing the eye movement that refers to the points?" and "How am I going to measure her 'perception' without advanced technology?"

I was fortunate that I was able to engage my participant with questions such as these, as most of her cognitive processing related to reasoning, problem solving, and abstract thought was intact. We were able to clarify that for her, seeing the area around her and simply being aware of the area around her felt like different processes. I also observed that there were many times when she reported that she could not see the point, but she was moving her eyes to the point. It is possible that this could be a starting point for the process of re-patterning her spatial awareness. For the purpose of this discussion, I will go forward with the theory that clarity of movement and line of sight to specific points in space could signify intact spatial awareness.

I have also engaged with these questions as a dancer for many years. In the current movement research of my dance company, we discuss this from the perspective of how we experience and engage with the audience members when our back is turned to them. We cannot see them, but we know they are there. We have found that our own awareness and engagement with these questions is crucial to how the witness perceives our movement. It does, in fact, change how we execute the movement. Another level of coincidence between my research parameters and my creative process was the use of spatial intention with the eyes. In my own dancing I have been pursuing more choices about how I am focusing and using my eyes; ergo, did I have a desire to guide this cultivation of spatial intent for my client because I experience it so acutely in my own execution of movement?

Therapeutic Relationship and Sense of Self

I also find that my spatial clarity with my eyes and my gestures is keener in performance than in rehearsal or personal exploration. This indicates the importance of being witnessed in any personal process (Adler, 2002) and demonstrates the importance of the therapeutic relationship in the study. The concept of being witnessed in movement can translate to the validation of being witnessed by a caregiver and the importance of relationship in overall development as a healthy human being.

Much of the improvement the participant exhibited could also be attributed to the benefits she gained from the strong therapeutic relationship that developed during the study. I constantly provided structure, feedback, and validation in our process, through verbal and non-verbal empathy and mirroring. Schoenberger, et al. (2006), in their study of therapeutic alliance and brain injury rehabilitation, stated, "…good emotional bond between client and therapist may lead to a feeling of being accepted in the clients, fostering clients' own acceptance of their changed identity and life circumstances" (p. 8). As explained in the Literature Review (p. 34), the therapeutic relationship is essential to strengthening the client's sense of self. In dance/movement therapy, the fundamental principle of creating a therapeutic movement relationship between therapist and client, as well as between clients, was set forth by DMT pioneer, Marian Chace (1953, 1964). It is difficult to cultivate a therapeutic relationship, and thus nearly impossible to engage in therapeutic processes, if the client does not have a basic understanding of spatial relationships.

This study addressed sense of self in the therapeutic movement relationship developed specifically in the context of spatial awareness. The self and the location of one's body in space are the starting point for any spatial reference and/or relationship. If self location is processed on

a neurological level in the right hemisphere of the brain (Arzy, et al., 2006), it is possible that the ability to establish self location is affected by damage to this area of the brain. I continually asked my participant to begin the scales by seeing her own body first, using the verbal cue of "self". She usually responded by closing her eyes and reported that she did not understand the direction to "begin at self". If self location is related to embodiment and embodiment is a primary component of awareness of self (Arzy, et al., 2008; Goodill, 2005), then the participant's overall deficits in self-regulation, self-awareness, and independence could be attributed to this basic inability to perceive herself in space. She improved in the task of "starting at self" as the study progressed. It is possible that the learning and execution of the scales helped her to better understand her location in space, thus becoming more embodied and more self-aware.

Daniel Siegel (1999) addresses this re-patterning concept on an interpersonal relationship/human development level. He combines theories of Alan Sroufe and Susan Harter to define "self" as an "internally organized cluster of attitudes, expectations, meanings, and feelings" whose development depends upon the context of relationship experiences with caregivers (p. 173). This definition suits the purposes of this study because it contextualizes "self" in a developmental lens and thus allows for the possibility that re-patterning of self can occur through the therapeutic relationship and/or awareness of environment through spatial processing. If a concept of "self" exists partially in relation to "other," then awareness of environment (in this study, spatial awareness) is a first step toward healthy self-concept.

There are also strong implications of relationship in how I guided her in the execution of the scales. The strongest visual guide for her to see the points in space was to follow my face as I moved to the points in space. This could relate to attachment theory, which proposes that babies seek out caregivers (faces, smells, touch, etc.) to learn how to self-regulate. If the face is

demonstrating appropriate response and affirmative expression for the baby, the baby begins to understand how to internalize the idea that she will survive; she carries the image of the caregiver with her and feels secure when she recalls it. This has been postulated as a neurological process, wherein the brain literally builds neurological pathways based on relationships with another human being (Bowlby, 1969; Ainsworth, 1978; and Sroufe, 1996, as cited by Siegel, 1999). This is why the relationship with the primary caregiver is so important.

Object Relations Theory and Self Psychology have also provided theoretical frameworks for therapists to use concepts of "self" and "other" to address emotional regulation deficits (St. Clair & Wigren, 2003). As the therapist/researcher in this study, I was the "other" to the participant's "self". Within a highly structured plan of intervention, it is possible that I helped her to re-pattern not only her movement but also her attachment. The stroke survivor's damaged brain could be compared to a baby's new brain if re-patterning and repair are similar to initial patterning of neurological pathways. In this study, we may have created new neural pathways through spatial intention and relationship.

Using the Scales to Foster Plasticity in TBI Rehabilitation

Although this study did not provide the direct evidence of neurological rebuilding that advanced equipment would provide, there is no doubt that the participant did learn the scales, and she executed them better at the end than she did at the beginning. This proves that she could still learn new things, which indicates that her brain maintained plasticity after her strokes (Ohyama, et al., 2006). Perhaps we were "re-wiring" new pathways in her brain and neurological system that had been destroyed by the strokes.

The average person's brain decreases in plasticity in the natural process of aging (Berrol, 2009; Colcombe, et al., 2004). The participant would have exhibited normal decline at some

point simply due to aging if she had not suffered the strokes. Immediately following the strokes she would have shown improvement up to a point, but eventually she would reach a plateau in her progress. She would then eventually begin to decline. If treatment could prevent or slow down that process (even if she stayed at the same level) then the treatment would be beneficial for her (Holmberg & Lindmark, 2008). I propose that Laban's movement scales provide that avenue for improvement or maintenance.

Spatial Awareness Affects Cognitive and Motor Processes

Spatial awareness is usually only addressed specifically when the client may not be able to perform certain motor tasks, such as reaching for a glass of water or pulling up a pair of pants. Sometimes a client needs to be more spatially aware in simple walking, so an occupational or physical therapist may direct him to try to see more clearly where he is going, or tell him to head in a specific direction. Yet, it is rare that this type of issue is addressed through the lens of spatial awareness; more often therapists address these deficits through exercises that focus on motor control (McCrea, et al., 2008, Reznick & Groswasser, 2001; Haggard & Cockburn, 1998).

It has been shown, however, that a decline in spatial processing may affect other areas of rehabilitation. Haggard and Cockburn (1998) found that cognitive processes are negatively affected by deficits in spatial processing after brain injury. This may be because motor control is less automatic and therefore requires an increase in cognitive functioning. The increase in the cognitive functioning required for motor control could result in interference in other cognitive processes. Additionally, some cognitive processes rely on spatial schemas for understanding abstract thought (Gattis, 2001). For instance, the concepts of "down the hall" or "up the street" cannot be understood if one is unable to process spatial location and relationship. The understanding of these schemas could be reinforced by spatial tasks such as the scales.

This evidence of the interrelated nature of motor control, cognitive processing, and spatial abilities may illustrate the possibility of unexpected beneficial effects of using the scales for spatial awareness training. The ability to engage in a personal relationship with a group or another individual may improve because spatial relationship with other people is better understood. The ability to travel throughout the community independently may improve because the individual comprehends maps and rebuilds the ability to create cognitive maps and maintain a sense of direction.

Transference of Skills

In pondering the various benefits of the scales, many questions arise. How do we qualitatively assess the transference of these skills gained in learning the scales to everyday life? The participant in my study did very well in other areas of treatment and her daily living skills improved. She reported that she could see more of her surroundings when she was out for a walk, noticing the flowers and the people she passed. This is similar to the participant in Berrol's (1990) study who reported he could see more around him as he walked down the street.

The participant in my study also made connections between her improvement in spatial intention and feeling more intentional in her personal goals. At the beginning of the study she expressed dismay over her lack of personal intention. During the study she reported that her outlook was broader and she felt more hopeful about her recovery. She stated that since starting the study she felt more desire to improve herself, to stop fighting the process, and especially to stop fighting with her mother. I translated her metaphor for her: we were working on spatial awareness and widening her literal perspective in a visual and sensorial way, and she was feeling the effects psychologically. I propose that engagement with the scales in individual treatment provided a clear avenue for addressing her many treatment goals outside of the treatment. The

scales are simple, straightforward and structured, and yet the work translates to many other complex (perhaps even abstract) concepts of everyday life and relationships.

This still does not answer the question of how we can measure the changes that occur in daily living skills. In my study the participant's personal assistant often provided a unique and important perspective when we discussed how the work with the scales may have been helping the participant in other areas. Could we develop a test that measures the transference of the skills we are teaching when we work with the scales? This could lend validation to our work as Laban Movement Analysts and dance/movement therapists, strengthening the overall therapeutic modality, as well as the specific intervention methods, in the context of rehabilitation from brain injury.

Movement Scales as Assessment and Measurement Tool

Holmberg and Lindmark (2008) cite the need in brain injury rehabilitation for more comprehensive assessment tools that address overall functionality in daily living skills and provide validated results. Spatial testing, one area that is often measured in the assessment of daily living skills, is generally administered via complex equipment that tracks eye movement, motor control, and/or brain function. The rehabilitation program where my study took place does not have this equipment; if it is determined by the treatment team that spatial abilities should be formally assessed, a series of spatial task worksheets is used. Unfortunately, many of the clients are not able to engage with these worksheets that require the ability to read (vision is often an issue) and write (paralysis and paresis affect many brain injury survivors).

Laban Movement Analysts possess the skills to administer and measure tests based on the scales that clients could engage with at their own levels of ability. Since the analyst uses only her keen observational skills, this type of tool would require no special technology and would be

comparatively inexpensive for a treatment program to implement. In this study my observations and the hired analyst's observations yielded similar results, so there is a starting place for potential validation. A further research study could address this question of validation in assessment using LMA. Another study based on my study could measure the efficacy of the scales as treatment.

In general, Laban Movement Analysis provides taxonomy for movement research in the context of dance/movement therapy, and this thesis study demonstrated that components of that taxonomy (the scales) can be quantified. The scales provide a specific method to observe, collect, and measure data. Thus, the context of LMA could lend efficacy and validity to the studies of dance/movement therapists who wish to pursue quantitative research. Clinical research in this field is usually qualitative, because it is difficult to control variables and movement is difficult to measure. While all questions about spatial awareness and neurological re-patterning cannot be answered with the simple engagement with the scales, the researcher can still use the observational skills based in LMA to assess the participant's performance. The data and results from such studies could even provide substantial evidence to funders, family members, and even skeptical clients that Laban-based interventions used in dance/movement therapy are part of an effective treatment plan.

Procedural Revisions for Future Studies

As previously stated, I maintained flexibility in my procedures as the study progressed in order to remain sensitive to my client's needs and in respect of my responsibilities as her therapist. While I went into the study with a clear plan of action, I quickly realized that in clinical research adaptability is necessary. I kept thorough notes of the changes I made, as well as reasons for making them. For example, if the participant was not able to turn her head to see a

point and named tight neck muscles as the reason for the inability, I offered suggestions for stretches that could be performed in the session and at home. If the participant was not responding to a verbal cue, or perhaps stated that she could not see the area at all, I placed an object that served as a visual landmark at the point. I eventually discovered that when I moved to the point in space and asked the participant to follow my face, eyes, and/or voice, the participant followed me along the pathway easily and saw the points more clearly. All notes of specific changes are included in detail in Appendix E.

If further research is to be conducted in a similar manner, I have outlined what I believe to be the most efficient procedures based on my discoveries as I improvised my way through this study. The following is a clearer design for a study of this sort if other researchers are interested in repeating this research. These procedures could also be a framework for a treatment plan using the movement scales.

Baseline information and post-study data collection. It is important that baseline information is collected over three events and while observing the participant in a "natural" setting instead of a facilitated dance/movement therapy group. Additionally, it is important to observe the participant in the same way after the study concludes. Unfortunately, in this study I was only able to collect baseline information once and did not return to the rehabilitation program to collect post-study data. I did not use the baseline information that I collected in this study because of this deficiency in procedural validity that was ultimately beyond my control as a researcher.

Pre-and post-test. Ideally, the researcher would have access to a spatial testing laboratory in order to test the participant with validated tests and appropriate equipment/technology. If this is not available, or in addition to the spatial lab testing, the researcher could devise a simple test

that requires the participant to see the points in space that would be included in the study. I have several ideas for these tests that arose from what I discovered in this study. Perhaps the pre and post test occurred in a natural setting (such as a living room or a shopping mall) where the participant had to identify specific things at specific places that corresponded to the points in space included in the scale. Theoretically, at the end she would be able to see those things in those places more clearly when cued. For example, when the therapist said, "The window is in front of you, to the right of you, and above you," the participant would look immediately to "forward-right-high" at the end of the study because she had learned and practiced that pathway. This test would relate to a generalization of the scales training into activities of daily living.

The following tests could occur in a controlled setting. The points in space that comprise the scales could be assigned a random order of sequence that remained the same for the pre-test and the post-test. The test should be timed. The researcher should provide only verbal cues. Another variation of this concept could be a test where objects are placed at the points and the participant is asked to find and see the objects, again in a random order that remained the same for both pre-test and post-test. This test would also occur within a specific amount of time.

Study procedures. Several aspects of the procedures evolved over the course of the study, and I also became savvier in my administration of the study as it progressed. There were also many details of the environment that were out of my control; this led me to devise some recommendations of ideal situations in which the study could occur. The room should be as free of distractions as possible, i.e. plain walls, good lighting, comfortable temperature, etc. Ideally, the study sessions would occur in the same room every time. The brightly colored objects should be carefully selected and placed consistently in the same places for every session. The objects in this study that proved to be easily found and seen clearly were a toy lobster, a tennis

ball, and a tomato. It would be ideal if each object was at least as big as a basketball, one bright color distinctive from all other objects, and characteristically unique (for instance, I possessed a toy lobster and a toy crab that appeared quite similar to each other so I never used them on the same day). In keeping with client-centered therapy and in the setting of clinical research, it may be beneficial for the participant to choose the objects herself and decide where they are placed.

Time and length of session and procedures. Preferably, the sessions would occur at the same time on the same days of the week and would last the same amount of time (forty-five minutes to an hour worked well for my study). Additionally, the segments of the study would be timed in the same manner in each session, i.e. ten minutes of greeting/settling/check-in, ten minutes of practice activities, fifteen minutes of execution of scales, and ten minutes of conclusion/discussion. It would be best if the client spends a specific amount of time learning the scales, and then the data is collected in a specific time frame in a strict procedure of executions with no practice.

Verbal, visual, and tactile cue consistency. Beginning on the first day of the study, the researcher would use both the verbal and the visual cues of following the researcher's voice and face to the point in space. The proximal and distal holds as tactile cues while guiding would also be used consistently. Examples of these tactile cues could be as follows: For the proximal hold, the researcher stands or crouches directly beside the participant at the left side and places her right hand between the participant's scapula. The researcher then takes the left arm with her own left arm, making as much contact as possible along the length of the arm, and guides the participant's left arm to the points in space. For the distal hold, the researcher grasps the participant's left hand with both hands and walks around the participant to the points in space; this guides the participant to reach to the outer edges of her kinesphere.

As my study progressed it became increasingly apparent that these changes would have yielded more valid results. It is difficult to control the settings of any clinical research study; my hope is that my experimentations can provide a substantial starting point for similar studies.

Summary

This study established that Laban's movement scales could serve as beneficial treatment in brain injury rehabilitation, as they support and further treatment principles of dance/movement therapy. Other research supports this theory, as similar studies have proven to be beneficial. Other questions that arise from my research are numerous. The main research question for this study was "How will the implementation of Laban's movement scales affect the participant's general awareness of space?" I found that doing the scales increased her spatial awareness according to the criteria used for evaluation in this study. She improved by 16% overall in her execution of the scales as indicated by clarity of her eye movements in seeing the points in space. According to my observations, she also exhibited improvement in gesturing to the points with her left arm. Her self-reports indicated that she felt more aware of her surroundings on a daily basis.

There were other questions I developed at the beginning of the study, some of which were partially answered and others that could be addressed in further studies. Can the neurological pathways destroyed by the brain injury actually be rebuilt using the movement of the scales? This study did not employ the equipment necessary to evaluate neurological growth in the brain of the participant. Many studies address this issue in other contexts (Nelles, et al, 2007, 2009; Holmberg & Lindmark, 2008; McCrea, et al, 2002; Reznick & Groswasser, 2001; Haggard & Cockburn, 1998); the important component of this question for our purposes as dance/movement therapists is the use of the scales. If the improvement of motor skills relies on

the rebuilding of neurological pathways and is subsequently imperative to brain injury rehabilitation (Reznick & Groswasser, 2001; Haggard & Cockburn, 1998), can Laban's movement scales provide the means for neurological re-growth? Further studies could directly address this issue, perhaps with the utilization of spatial testing equipment to provide quantitative measurement of outcomes.

I also pondered how cognition, expression of emotion, memory, and other important recovery components may be affected by the regular practice of the scales. In this study, my participant began to express herself more freely in our sessions. Her answers to the pre- and post-test could reflect her physiological integration on a cognitive level. If I had conducted other cognitive tests at the beginning and the end of the study, would I have noticed further integration of material and understanding of self?

Many of these changes that I observed throughout the study may have been a benefit of individual therapy, in general, rather than a result of the specific treatment. Regardless, the scales provided a context for change. This study showed that what is not immediately available to a client can be "trained" and developed through intention and awareness. Additionally, when I found that the participant followed my face and voice more easily than any other cue, I considered the wealth of pertinent discoveries in attachment theory. Within a highly structured plan of intervention, is it possible that I helped her to re-pattern not only her movement but also her attachment? Did we create new neural pathways through spatial intention and relationship? I wondered if her inability to begin a movement by seeing herself before seeing her environment was related to her deficits in self-regulation, self-awareness, and independence. She improved in this task as the study progressed.

Although we may consider many of my participant's improvements more likely the benefits of the therapeutic relationship, we can still ask how Laban's movement scales affect an individual's overall well-being. Downey (2004) began to address this in her study, and I affirmed in my study that the scales can be beneficial in treatment for brain injury. Studies with numerous participants could provide further evidence for the efficacy of the scales as treatment. Further studies across populations could provide evidence of generalization of this study. Outside the realm of research, can treatment programs incorporate the movement scales as interventions with ease and regularity, and how would this treatment affect other areas of recovery? This would be another area to explore.

I did not know at the beginning of my study that one of the most important questions would be "What modifications would be necessary for a person with a brain injury to engage with the scales?" I understood that I would be improvising to make adjustments as the study progressed in order to most thoroughly engage with the participant; I did not realize that I would conclude the study with such advanced clarity about how the procedures could be designed. This could be one of the most useful results of my study, since a researcher going forward to address any of these questions could pick up directly where I ended and use my proposed design for another study. It is imperative that any researcher keep in mind that modifications will always be necessary, as each brain injury and every individual are unique.

Related to the questions about how the scales may fit into treatment programs are the issues of how the scales translate to everyday life. How do we qualitatively assess the transference of these skills gained in learning the scales? Could we develop a test that measures the transference of the skills we are teaching when we work with the scales? Perhaps the development of a treatment component includes tools that serve as pre-test, post-test, and re-

integration measures. As the scales are both an abstraction and a simplification of everyday movement, we must somehow help the clients/participants understand how they can apply what they have learned. They will potentially experience the benefits without knowing that the improvement is related to the work with the scales, in the same way that the participant found herself seeing more of the flowers and people in her neighborhood when she went for walks. We can also direct them to capable and intentional application.

Laban Movement Analysis has provided a context for interventions in dance/movement therapy since the mid-twentieth century. This is one of few studies that provide quantitative evidence for Laban's theory of Movement Harmony. There is no question that this study demonstrated that Laban's dimensional and diagonal scales were beneficial to the participant. I also established that she improved her "spatial awareness" if the main criterion for evaluation is how she saw her environment. Thus, it could be concluded that Laban's movement scales could be used to improve spatial awareness after brain injury.

Many questions are still unanswered, and many will continue to arise. It is my hope that I have brought attention to a component of recovery that is often not directly addressed in a structured manner, and provided a clear plan of movement intervention that could be transferred to other survivors of brain injury and perhaps even other populations. Millions of individuals (and their families and loved ones) are affected by brain injury, and the numbers continue to increase. It is imperative that we, as dance/movement therapists, persist in finding new ways of treating these individuals. In the process of exploration, we can contribute to the further development of Laban's theory of Movement Harmony by making strong connections to ongoing discoveries in neuroscience.

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Appendix A

GLOSSARY

Laban Movement Analysis Terms

Bartenieff, Irmgard

Irmgard Bartenieff was a dancer, physical therapist, and educator credited with bringing Laban Movement Analysis to the United States in the mid-twentieth century. A student of Laban, she is known for advancing his theories of movement on a physical level, addressing ways to move efficiently and expressively through her framework of "Basic Six" fundamental exercises. The Basic Six address the main body action principles of lying, sitting, crawling, kneeling, standing, and locomotion, as well as the integration and progression through these activities. (Moore, 2010)

Choreutics

Laban (1966) used this term to describe the practical study of the various forms of harmonized movement. Moore (2009) further defines the term as relating to the spatial domain of Laban's philosophical and spiritual values inherent in music and dance. Simply put, it is the "study of movement from place to place". It is also referred to as "space harmony" in English-speaking countries.

Fundamental Patterns of Total Body Connectivity

This framework is also referred to as "body connectivities," "developmental patterns of connectivity," and "developmental movement patterns," among others. Human movement develops along a progression of neuromuscular patterns that begins in utero and continues

through locomotion. Laban's movement studies required a healthy connection to and utilization of these patterns, and his legacy yielded diverse branches of exploration in this specific area of the pursuit of efficient movement. (See Bartenieff, Irmgard.) Peggy Hackney, a student of Bartenieff, defined six "Patterns of Total Body Connectivity" (based on the developmental stages of neurological patterns) as "breath," "core-distal," "head-tail," "upper-lower," "body-half," and "cross-lateral." Beginning with core-distal, this nomenclature could be aligned with the terms "navel radiation," "spinal movement," "homologous movement," "homo-lateral movement," and "contra-lateral movement" in Bonnie Bainbridge Cohen's system of Body-Mind Centering. These terms are derived from Western medicine and are also used in other rehabilitation modalities such as physical therapy and occupational therapy. Cohen also studied with Bartenieff. In dance/movement therapy, these concepts are used to guide clients to movement re-patterning, strengthening, and awareness. (Hackney, 1998; Cohen, 1993)

Eukinetics

This term refers to the study of movement from "mood to mood," later renamed "effort." Laban called this domain the "how" of movement, or the dynamic structure of movement. In current Laban taxonomy, "effort" refers to how the mover conveys his attitudes toward flow, space, weight, and time in his movement. (Laban & Ullmann, 1966; Moore, 2009).

Kinesphere

In movement terms, the kinesphere is the space around the body that can be reached by easily extended limbs without stepping away from that place which is the point of support (Laban & Ullmann, 1966). The kinesphere moves with the mover as she moves through space. In this

study, the point of support for the participant was the chair in which she was sitting, so her kinesphere did not move while she executed the scales. She was encouraged to reach to the edges of her kinesphere.

Kinesthetic

The word kinesthetic is used to refer to the sensory experience derived from the receptors located in muscles, tendons, and joints and stimulated by bodily movements and tensions (Webster, 2010).

Laban Movement Analysis (LMA)

This analytical framework developed by Rudolf Laban "facilitates acuity in observing and assessing movement patterns. The comprehensive nature of the framework allows movement issues to be addressed from multiple perspectives; clinically and in performance. Beyond this, holistic paradigms of harmony and balance in Laban theory suggest further ways in which movement can enhance the regenerative processes and expression of the body/mind" ("Graduate Laban Certificate", n.d., para 3).

Laban, Rudolf

Rudolf Laban (1879-1958) was born in Austro-Hungary and became one of the founders of European Modern Dance. He was a dancer, a choreographer and a dance/movement theoretician influenced by his studies in visual art, science, mathematics, theater, philosophy, and psychology. He created a system of dance analysis and theory known as Laban Movement

Analysis, as well as a system of notating movement called Labanotation (Bartenieff & Lewis, 1980; Hodgson and Preston-Dunlop, 1990; Moore, 2009).

Movement Harmony

As of this writing, this is the most current term set forth by Moore that refers to Laban's theories of the synthesis of elements in movement. It encompasses all previous definitions of "choreutics," "eukinetics," "Effort/Shape" and "space harmony." She stated that Movement Harmony is "dynamic symmetry based upon proportional ratios that bring about consonance between every part and the whole" (Moore, 2004, p. 19). Moore (2009) established that Laban aimed to describe the deep structure of movement, "elucidating the means through which distinctively different elements of movement cohere in meaningful actions" (p. 5).

Movement Scales, or *Scales*

In LMA, scales are ordered sequences of movement in which the mover refers to specific points in space as defined by the shapes of the Platonic solids such as the octahedron, cube, and icosahedron (Laban & Ullmann, 1966, Moore, 2009). Movement scales can be compared to scales in music, as they have similar harmonic structures based on symmetry operations and intervals in the same way that tones establish harmony in sound.

Space Harmony

See "choreutics."

Platonic Solid

A Platonic Solid is a three-dimensional geometric solid with equilateral flat faces and straight edges. There are exactly five such solids that take their names from the number of faces they each contain: the tetrahedron (four faces), cube (six faces), octahedron (eight faces), dodecahedron (twelve faces), and icosahedron (twenty faces). This was proved by Euclid in the last proposition of the *Elements*. They are named after philosopher/mathematician, Plato, as he is credited by some as the first to identify and name these forms (Weisstein, 2010). Laban also referred to them as the "crystalline forms" and created his movement scales using these shapes as prototypes for movement pathways.

Primary Scale

In LMA, each cubic diagonal is named after the primary scale that surrounds it (i.e. "P1"). Also known as the "standard scale", of which there are four, each primary scale is oriented around one of the cubic diagonals and traces the edges of the icosahedron, creating soft curvilinear trace-forms and touching each of the corners of the cardinal planes before returning to the point of origin. Laban designed the primary scale as an analog model of the chromatic scale in music. It establishes a set of ordered spatial relationships from which additional harmonic trace-forms may be constructed, similar to how the chromatic scale provides a tonal basis for additional scales and chords in music (Laban & Ullmann, 1966; Moore, 2009).

Symmetry operations

The theme of symmetry in geometry was established before the time of Euclid, as it is merely a description of naturally occurring phenomena. Carol-Lynne Moore uses this term to refer to

repeating patterns of shapes and to describe Laban's use of symmetry in movement, particularly the scales. The four symmetry operations are reflection (the shape is mirrored across an axis, i.e. human limbs), rotation (the shape is rotated around an axis, i.e. flower petals), translation (the shape is repeated in succession, i.e. trees in the forest), and glide reflection (the shape is translated and reflected, i.e. dancers facing opposite directions and performing the same steps). (Moore, 2009)

Effort/Shape

"Effort/Shape" is a term coined by Laban in unpublished writings (Moore, 2009) and refers to theories further developed with and by Warren Lamb (1979). It refers to the fundamental correlation between efforts and shapes in movement, or the alignment of the dynamic intention of the mover with the shape of the spatial trace-forms created by the mover. An example is "rising (shape) with decreasing pressure (effort)." Congruent movement combinations are referred to as "affinities." We may refer to incongruent movement combinations, such as rising with increasing pressure, as "disaffinity."

Trace forms

Laban's term for the movement pathways that trace shapes in space around the mover (Laban & Ullmann, 1966). Warren Lamb (1979) relates this term to the trails of vapor left by jets as they fly across the sky.

Brain Injury Terms

Note: for the purposes of this study, "brain injury" refers to all types of insult to the brain, including acquired brain injury and its sub-category of traumatic brain injury, stroke, and aneurysm. Survivors of these events are often treated together in rehabilitation programs, and treatment protocols are often transferrable to each of these populations.

Acquired Brain Injury

An acquired brain injury is an injury to the brain, which is not hereditary, congenital, degenerative, or induced by birth trauma. It has occurred after birth ("Living with Brain Injury," 1997, para 8).

Brain Aneurysm

A brain aneurysm, sometimes referred to as a cerebral or intracranial aneurysm, is a weak bulging spot on the wall of a brain artery, formed from continuous wear and tear on the arterial walls over an extended period of time. This constant stress to the artery wall can sometimes, but not always, lead to hemorrhage causing severe damage or death. ("What is a Brain Aneurysm?", 2009)

Traumatic Brain Injury

The Brain Injury Association of America defines traumatic brain injury as "an insult to the brain, not of a degenerative or congenital nature but caused by an external physical force, that may produce a diminished or altered state of consciousness, which results in an impairment of

cognitive abilities or physical functioning. It can also result in the disturbance of behavioral or emotional functioning." ("Living with Brain Injury," 1986, para 6).

Call-Fleming Syndrome

Call–Fleming syndrome is "a reversible segmental vasoconstriction [or narrowing] of cerebral arteries manifested by a 'thunderclap' headache and focal neurologic symptoms" (Noskin, et al, 2006). It is also referred to as "series of strokes" in the study participant's medical records.

Hemianopsia

Hemianopsia (also known as hemianopia) is a visual field deficit on one side caused by occipital lesions. It results in mild to severe disability in daily living activities, as the client does not see objects, people and places on the affected side. This causes them to experience deficits in spatial processing, stumbling, and running into doorways, wall, people, and furniture (Nelles, et al, 2008).

Hemiparesis

Hemiparesis is weakness on one side of the body.

Stroke

The American Stroke Association stated "a stroke occurs when a blood vessel that carries oxygen and nutrients to the brain is either blocked by a clot or bursts. When that happens, part of the brain cannot get the blood (and oxygen) it needs, so it starts to die" ("What is stroke?", 2010).

Psychology Terms

Self

Daniel Siegel (1999) combines theories of Alan Sroufe and Susan Harter to define "self" as an "internally organized cluster of attitudes, expectations, meanings, and feelings" whose development depends upon the context of relationship experiences with caregivers (p. 173). A caregiver is any individual who is taking of the infant in this crucial developmental stage.

Self-awareness

For the purposes of this study, "self-awareness" refers to the integrated and reality-based concept of how one is functioning on emotional, cognitive, relational, and physical levels (and how these components integrate to create a cohesive whole self). This study addresses re-patterning of movement; change can only occur when the individual is aware of her behavior and thus employs her ability to make choices that enact the change. Thus, she has increased her self-awareness.

Self-regulation

Siegel (1999) defines self-regulation as the way the mind organizes its own functioning. It is primarily related to the modulation of emotion, or the ability to recognize how one is emotionally responding to a situation or event and then suitably adapting his response.

Spatial abilities/Spatial skills

When a psychologist, neurologist, or physiotherapist refers to a client's spatial abilities or spatial skills, he is generally referencing the client's level of spatial awareness and spatial processing. He may administer tests to measure spatial abilities (see "Spatial Tasks).

Spatial awareness

For the purposes of this study, spatial awareness refers to the overarching ability to perceive, process, and navigate through the environment. It requires an awareness of the body in space and how it relates in location to the objects and other beings in the space.

Spatial intention

Supported by spatial awareness and its implications, spatial intention refers to the ability to move with intention, particularly as one aims directly to a point in space with a gesture or through locomotion.

Spatial processing

This term is used in this study to refer to the actual neurological processes that the brain uses to compute the information about the environment and the location of the body and other objects/beings in space.

Spatial schema

If a schema is a model or pattern created by the mind/brain to aid in the explanation of a complex phenomenon in reality (Siegel, 1999), then a spatial schema as referred to in this study is a

cognitive model that helps an individual to make sense of his or her environment. Often we are unaware of the schemas we possess and interact with on an unconscious level (Townsend, et al., 1999; Etienne and Jeffery, 2004; Bremmer, 2005; Cheng and Newcombe, 2005).

Spatial tasks

Spatial tasks are the specific actions a client may or may not perform adequately that indicate his level of spatial awareness. These tasks may include drawing a map, pointing to a specific point in space, or correctly identifying a three-dimensional object that has been rotated and looks slightly different from the new perspective.

Volitional movement

The concept of "volitional movement" is widely researched in motor behavior and psychology. It can be defined as purposeful, goal-directed, coordinated movement that originates in the central nervous system and occurs because the mover "wills" it (Critchley, 1954; Schwartz, 1994).

Appendix B

Columbia COLLEGE CHICAGO

Informed Consent Form

Consent Form for Participation in a Research Study

Title of Research Project: Spatial Awareness, Space Harmony, and Traumatic Brain Injury
Principal Investigator: Kristina Fluty
Faculty Advisor: Susan Imus
Chair of Thesis Committee: Lenore Hervey, 312-369-8548

INTRODUCTION

People who are diagnosed with traumatic brain injury often experience great disharmony in their lives, particularly in physical movement. The injury may destroy or damage the parts of the brain responsible for creating and maintaining a general awareness of space. Rudolf Laban's theory of Space Harmony combines movement and scientific concepts. He proposed that one may experience a fuller sense of well-being by performing his movement scales which refer to specific points in space.

You are invited to participate in a research study to investigate the use of Laban's movement scales in the treatment of adults recovering from traumatic brain injury. This consent form will give you the information you will need to understand why this study is being done and why you are being invited to participate. It will also describe what you will need to do to participate and any known risks, inconveniences or discomforts that you may have while participating. You are encouraged to take some time to think this over. You are also encouraged to ask questions now and at any time. If you decide to participate, you will be asked to sign this form and it will be a record of your agreement to participate. This process is called 'informed consent.' You will receive a copy of this form for your records.

You are being asked to participate because the staff and director of the New Focus Rehabilitation Program have determined that you may benefit from the procedures used in this research.

PURPOSE OF THE STUDY

The purpose of this research study is to see how spatial awareness may be affected by doing Laban's movement scales. These scales are performed by pointing to specific points in space while maintaining balance and coordination.

PROCEDURES

- Before the research begins, you will be observed in your regular treatment programming by the researcher for two weeks to observe your movement patterns.
- Then you will be given two simple and general spatial awareness written tests.
- You will then learn the movement scales for eight weeks during individual dance/movement therapy sessions with the researcher.
- You may also use the movement scales to create your own dances.
- You will be asked questions about your dance/movement therapy experiences during the eight weeks. Your answers to the questions may be published with your permission.
- You will be recorded on video during your sessions. Other researchers, therapists, or movement analysts will view these videos with your permission.
- You will be observed and guided by the researcher during the sessions.
- At the end of the eight weeks, you will again take the original spatial awareness written tests.
- All research will be conducted at [NAME OF REHABILITATION PROGRAM] at [ADDRESS] during the regular program hours of 8:30am-2:15pm. Sessions will last for approximately forty-five minutes each, twice a week, for about eight weeks.

POSSIBLE RISKS OR DISCOMFORTS

Risks of participating in this study are minimal, and no greater than participating in the other dance/movement therapy sessions that are a part of your program.

POSSIBLE BENEFITS

Benefits may include increased spatial awareness, improved cognitive and emotional processing, improved balance and coordination, improved physical mobility, and increased physical stability. This research will possibly lay the groundwork for further research in this area, and your contribution may help develop this particular treatment for adults recovering from brain injury and other populations.

There will be no compensation of any kind, and no additional time commitment outside of the regular rehabilitation program hours will be needed. Participation in this study may result in less participation in other treatments of the program; however, the sessions will be scheduled during regular individual dance/movement therapy or exercise times.

CONFIDENTIALITY

The following will protect the confidentiality of the information gathered about you:

1. The researcher will keep all study records (including any identifying information) locked in the [PROGRAM NAME] supervisor's desk, accessible only by the principle investigator and the supervisor.
2. The audio and videotapes will be destroyed after two years.
3. All electronic files containing identifiable information will be password protected. Any computer holding such files will also have password protection to prevent access by unauthorized users. Only the members of the research staff will have access to the passwords.
4. Data that will be shared with others will be anonymous to help protect your identity.

5. At the conclusion of this study, the researcher may publish her findings. Information will be presented in general and you will not be identified in any publications or presentations.

RIGHTS

Being a research participant in this study is voluntary. You may choose to withdraw from the study at any time without penalty. You may also refuse to participate at any time without penalty. Your dance/movement therapy will continue as part of the treatment plan established by the New Focus staff. It will be determined by the site supervisor, the principle researcher, and you if it is appropriate to continue the individual sessions with the principle researcher or another therapist on site. If you have any questions about the study or your rights as a research participant, you may contact the researcher or the faculty advisor listed above.

Who do I contact if I have questions about the study?

Take as long as you like before you make a decision. We will be happy to answer any question(s) you have about this study. If you have further questions about this project or if you have a research-related problem, you may contact the principal investigator, Kristina Fluty, at 773-425-2506 or the faculty advisor, Susan Imus, at 312-369-7697. If you have any questions concerning your rights as a research subject, you may contact the Columbia College Chicago Institutional Review Board staff (IRB) at 312-369-7384.

PARTICIPANT STATEMENT

"This study has been explained to me. I volunteer to take part in this research. I have had opportunity to ask questions. If I have questions later about the research or my rights as a research participant, I can ask one of the contacts listed above. I understand that I may withdraw from the study or refuse to participate at any time without penalty. I will receive a copy of this consent form."

_____	_____	_____
Participant Signature:	Print Name:	Date:
_____	_____	_____
Participant Guardian Signature:	Print Name:	Date:

Relationship to Participant: _____

_____	_____	_____
Signature of Person Obtaining Consent	Print Name:	Date:

Columbia

COLLEGE CHICAGO

Consent Form for Release of Research Data

I, _____, understand that portions of the answers to the questionnaires administered during the period of the research study "Spatial Awareness, Space Harmony, and Traumatic Brain Injury" will be published as content in the master's thesis of the principal researcher, Kristina Fluty. I herein give my permission for Ms. Fluty and Columbia College to use my writings in this master's thesis.

_____	_____	_____
Participant Signature:	Print Name:	Date:
_____	_____	_____
Participant Guardian Signature:	Print Name:	Date:

Relationship to Participant: _____

_____	_____	_____
Signature of Person Obtaining Consent	Print Name:	Date:

Columbia

COLLEGE CHICAGO

Consent Form for Release of Research Data

I, _____, understand that portions of the videos recorded during the period of the research study "Spatial Awareness, Space Harmony, and Traumatic Brain Injury" will be viewed by the supervisors and research partners of the principal researcher, Kristina Fluty, in order to further analyze the movement provided by the videos. I herein give my permission for the above-mentioned individuals to view the videos.

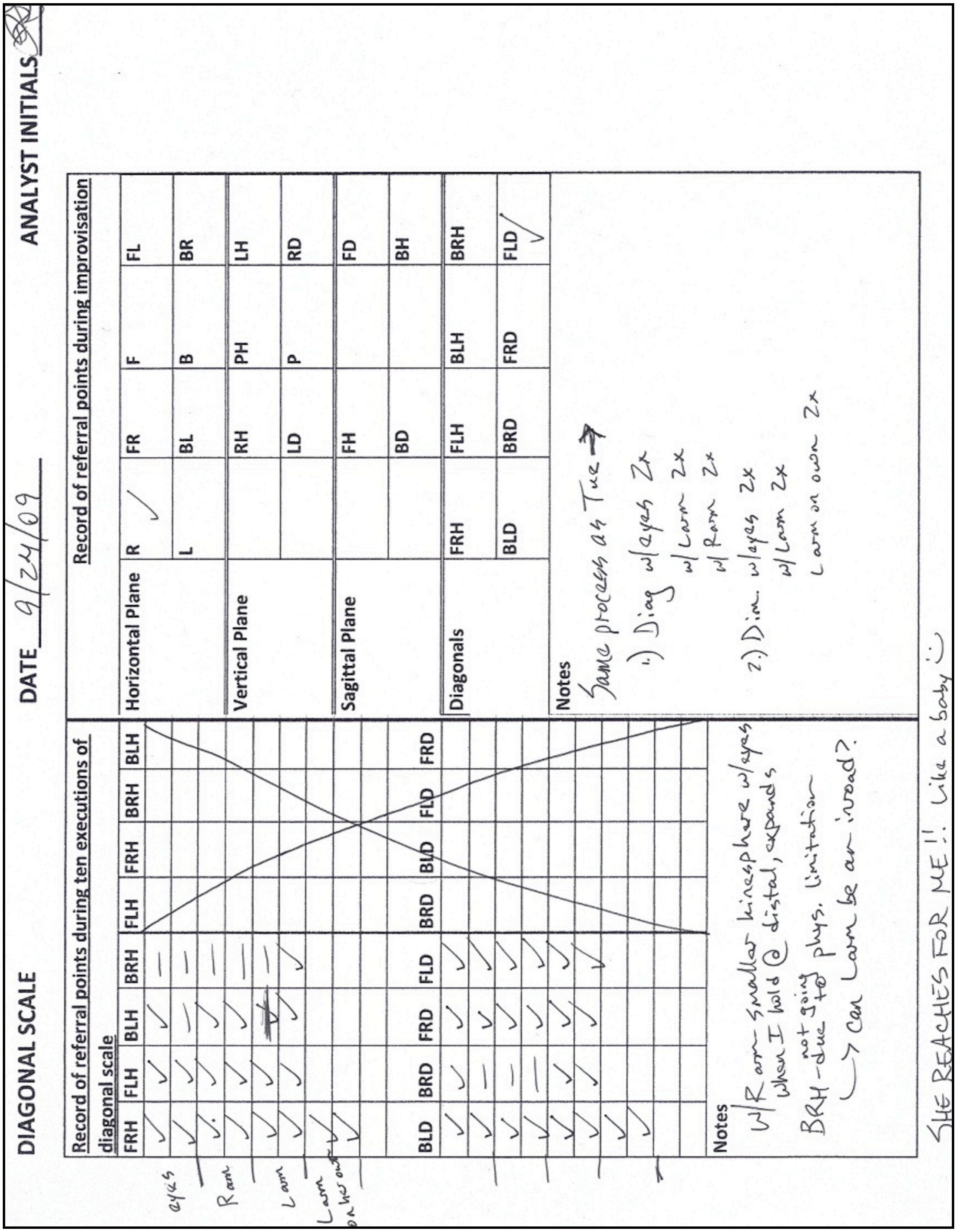
_____	_____	_____
Participant Signature:	Print Name:	Date:
_____	_____	_____
Participant Guardian Signature:	Print Name:	Date:

Relationship to Participant: _____

_____	_____	_____
Signature of Person Obtaining Consent	Print Name:	Date:

Appendix C

Sample Movement Assessment Coding Sheet (MACS)



DIAGONAL SCALE DATE 9/24/09 **ANALYST INITIALS**

Record of referral points during ten executions of diagonal scale

	FRH	FLH	BLH	BRH	FLH	FRH	BRH	BLH
eyes	✓	✓	✓	|				
	✓	✓	✓	|				
Ram	✓	✓	✓	|				
	✓	✓	✓	|				
Lam	✓	✓	✓	✓				
Lam on her own	✓							
	✓							

	BLD	BRD	FRD	FLD	BRD	BLD	FLD	FRD
	✓	✓	✓	✓				
	✓	|	✓	✓				
	✓	|	✓	✓				
	✓	|	✓	✓				
	✓	✓	✓	✓				
	✓	✓	✓	✓				
	✓							
	✓							

Notes

W/Ram smaller kinesphere w/eyes when I hold @ distal, expands

BRH - not going due to phys. limitation

→ can Lam be an inroad?

Record of referral points during improvisation

Horizontal Plane	R ✓	FR	F	FL
	L	BL	B	BR
Vertical Plane		RH	PH	LH
		LD	P	RD
Sagittal Plane		FH		FD
		BD		BH
Diagonals	FRH	FLH	BLH	BRH
	BLD	BRD	FRD	FLD ✓

Notes

Same process as Tue →

1.) Diag w/eyes 2x
w/Lam 2x
w/Ram 2x

2.) Dim. w/eyes 2x
w/Lam 2x
Lam on own 2x

SHE REACHES FOR ME!! Like a baby :)

Appendix D

Pre-test/Post-test

SANTA BARBARA SENSE-OF-DIRECTION SCALE

Reference: Hegarty, M. Richardson, A. E., Montello, D. R., Lovelace, K & Subbiah, I. (2002). Development of a Self-Report Measure of Environmental Spatial Ability. *Intelligence*, 30, 425-447.

Sex: F M Today's Date:_____

Age:_____ V. 2

This questionnaire consists of several statements about your spatial and navigational abilities, preferences, and experiences. After each statement, you should circle a number to indicate your level of agreement with the statement. Circle "1" if you strongly agree that the statement applies to you, "7" if you strongly disagree, or some number in between if your agreement is intermediate. Circle "4" if you neither agree nor disagree.

Questions to reverse code in bold.

1. I am very good at giving directions.
strongly agree 1 2 3 4 5 6 7 strongly disagree

2. I have a poor memory for where I left things.
strongly agree 1 2 3 4 5 6 7 strongly disagree

3. I am very good at judging distances.
strongly agree 1 2 3 4 5 6 7 strongly disagree

4. My "sense of direction" is very good.
strongly agree 1 2 3 4 5 6 7 strongly disagree

5. I tend to think of my environment in terms of cardinal directions (N, S, E, W).
strongly agree 1 2 3 4 5 6 7 strongly disagree

6. I very easily get lost in a new city.
strongly agree 1 2 3 4 5 6 7 strongly disagree

7. I enjoy reading maps.
strongly agree 1 2 3 4 5 6 7 strongly disagree

8. I have trouble understanding directions.
strongly agree 1 2 3 4 5 6 7 strongly disagree

9. I am very good at reading maps.
strongly agree 1 2 3 4 5 6 7 strongly disagree

10. I don't remember routes very well while riding as a passenger in a car.
strongly agree 1 2 3 4 5 6 7 strongly disagree

11. I don't enjoy giving directions.
strongly agree 1 2 3 4 5 6 7 strongly disagree

12. It's not important to me to know where I am.
strongly agree 1 2 3 4 5 6 7 strongly disagree

13. I usually let someone else do the navigational planning for long trips.
strongly agree 1 2 3 4 5 6 7 strongly disagree

14. I can usually remember a new route after I have traveled it only once.
strongly agree 1 2 3 4 5 6 7 strongly disagree

15. I don't have a very good "mental map" of my environment.
strongly agree 1 2 3 4 5 6 7 strongly disagree

Appendix E

This document is the journal of session notes from the research study procedures. It is nearly intact as recorded after each session and after viewing the videos of the sessions; I have simply made grammatical corrections and minor changes so that it flows for the reader. This journal is included as a record and support of the procedural changes that occurred as the study progressed. Table 8 is a key for the spatial point terms, which have been abbreviated sometimes in the text.

Table 8. Key

Laban Terminology	**Abbreviation**	**Everyday definition/ Verbal cue to participant**
Dimensional Scale – in sequence on the right side		
"place-high"	PH	"up"
"place-deep"	PD	"down"
"right-middle"	RM	"right"
"left-middle"	LM	"left"
"forward-middle"	FM	"forward"
"back-middle"	BM	"back"
Diagonal Scale – in sequence on the right side		
"forward-right-high"	FRH	"forward-right-high"
"back-left-deep"	BLD	"back-left-down"
"forward-left-high"	FLH	"forward-left-high"
"back-right-deep"	BRD	"back-right-down"
"back-left-high"	BLH	"back-left-high"
"forward-right-deep"	FRD	"forward-right-down"
"back-right-high"	BRH	"back-right-high"
"forward-left-deep"	FLD	"forward-left-down"

July 14, 2009

After meeting with Cathy (participant's name has been changed to protect her anonymity) today, I realize that I will have to define "up" and "down," etc., for her before I can begin to ask her the questions of where the objects are in the room. For instance, when I asked her where the chair was in relation to her location, she said "right" and "down." I would have said "right" and "forward." Who is correct? We often speak of things being "down the hall" when really we mean that it is further along in the sagittal dimension, and thus would be referred to as "forward" if we were using Laban taxonomy. I encouraged her to take a lot of time to think about it, but she did not appear to have the capacity to concentrate.

When I asked Cathy to look "up," she bulged her eyes "forward." She also did this when I asked her to look "down." When I asked her to look "left," she closed her eyes. I felt dismayed by these responses, yet also began to see how important this work could be for her. Consequently, in order to meet her needs and assess what she actually could do, instead of asking her to do things she was unable to accomplish, I then asked her to simply respond with any body part when I said a direction. She used her left arm only to arc in the sagittal plane.

She can move her right arm! I did not realize this, as she never moved it during the program. But today she lifted it from her torso, then quickly dropped it again and said, "Ow." I encouraged her not to force anything, especially if she experiences pain. I suppose there can be various degrees of weakness, or hemiparesis. Now that I think about it, I can think of other clients who have worked very hard and made lots of progress in movement on the side affected by stroke.

It will be interesting to watch the relationship with Marie, her personal assistant, and see how that affects the research.

July 23, 2009

I was unsure of how I was going to proceed when I walked in. I kept reassuring myself, and hearing my advisor's voice in my head, that I would know in the moment. I can use my therapeutic skills to assess and guide in the moment. As Cathy and I sat down together, I decided to start simply moving along each of the dimensions several times. We began with vertical.

I explained that we would start with just moving the eyes. She agreed that would be a good way to start. I was very surprised as the session went on to find that she had great difficulty with moving her eyes independently from her head. What I thought was going to be a simplification of the scales was actually proving to be a movement that she could not execute with ease.

When Cathy responded to the "up" directive, her head tilted to the ceiling, her eyebrows raised, and she smiled. When she went to "down" she also moved her entire head, but only slightly, and sometimes closed her eyes.

I then explained again that she only had to move her eyes. She said okay, but then continued to move her head. When I checked in with her about how it felt to try this movement, she said that she could tell she was not moving her eyes independently, but could not figure out how to do so.

I then thought it might be easier for her to follow an object with her eyes instead of simply trying to look to the point. I used my pencil, held in the horizontal position so she could perhaps see it better. As she did this, she raised her head and her eyes stayed focused on my face, and then her eyes stayed on my face and her head lowered. I realized with excitement that this was essentially addressing her eyes moving independently from her head, just the reverse intention. I was sure in that moment that there was probably a thousand articles on this exact activity…I found this

fascinating, and wondered if perhaps it could be an indirect method to developing the muscles of the eyes to eventually do the movement on their own. It would be a passive development of the eye muscles, perhaps similar to an isometric exercise of the gross motor muscles.

Marie, Cathy's personal assistant, then suggested that Cathy may have an easier time following something brightly colored, and referred to a neon pink card that was in the room. As I tried this, I noticed that wherever I put the paper, Cathy still looked at my face. This was a HUGE revelation, as I thought about newborn babies and attachment formation; they seek other faces to help them self-regulate and tell them about how to interpret the world around them.

So, I had Cathy follow my face (this resulted in some comical shifting and running around on my part once we did the whole scale!). This was dramatically different. I instructed her to look right into my eyes, so she would have a specific point to focus on. This was powerful from a therapeutic perspective, as well, in respect to the development of our empathic relationship. She reported that in this method, she could definitely tell the difference between "up" and "down" by how she sensed the movement.

When I asked her to describe the difference between following the pencil, the paper, and then my face, she said that the face felt most "comfortable."

As we shifted to the horizontal dimension, I went straight into asking her to follow my face. She reported that on a scale of 1 to 10 (10 being hardest), this was a difficulty level of 5. She sometimes raised her left arm when I said "left." (Interestingly, once we started the executions and I was notating, she never looked to "left" successfully. This is supposedly her "good" side.) She stated that she could not feel her eyes moving to "right," and also said that she could not see "right." After she said this, her eyes moved in her eye sockets and she looked at me. I was to her "right." I told her that often when we speak aloud of the things that seem to be

challenging us, it is easier to overcome them. She also stated that she could feel the indirect path she takes in the horizontal dimension. I noticed that she did an "under-curve," almost like she was cycling in the vertical plane from "left-middle" to "right-middle." She also often stopped at the center when moving from "right" to "left," demonstrating what I have noticed about her prior to the study: she hesitates when crossing her mid-line. Cathy informed me that she is left-handed.

I then shifted to having Marie assist me by sitting on Cathy's left side while I sat at "right." I used verbal cues first spoken by me. I then added a rhythm by slapping my thighs, then I had Marie give the verbal cue on "left." Cathy did pretty well with this. I worried about the added dimension of the audio cue, since I have read a bit about how this greatly affects/contributes to our spatial processing, but I discarded the worry for the sake of remaining present to the client's needs. Cathy reported that this method was a level 2 on the difficulty scale.

As we shifted to the sagittal dimension, I demonstrated the bulging and closing eyes, and also added some movement with my head. Cathy described this as "like a turtle." There were lots of things happening with this dimension. The first thing that I noticed was that Cathy did not move along the sagittal dimension in the way one may imagine a turtle to advance from and retreat into his shell, but instead she inclined her head along the P1 diagonal, from "forward-right-high" to "back-left-deep." She also had the impulse to advance her torso "forward," leaning from her chair, when I gave her the "forward" verbal cue. Sometimes she would look "down" at "place-deep" when I cued her to go "back," instead of closing her eyes as instructed. I realize that this could also be a function of her learning the cues and remembering them. She also frequently scratched the back of her head when I cued "back" so I wondered if she was

unconsciously responding to this cue by feeling her own back-space on her body. I was doing the "forward" and "back" movements with her, and she often laughed at me when I did the bulging. I asked her if she would like to make a funny face with me when we did that cue, but she did not respond.

(Since she has trouble with the sagittal directives, could this mean that she has trouble with perceiving depth? That would explain a lot of her fear in walking.)

Finally, we practiced the whole scale together, with her following my face and me also giving her the verbal cues. (I will need to review the video for more notes on this, as I was too involved in the action to take notes.) When I took away verbal cues, she added them back in by saying them herself. She still was not embodying them, and I wondered if she was intellectualizing the process. At one point she said "up, down, forward…oh, shoot." She realized that she had skipped the horizontal dimension. Again, this speaks to her process of learning the scales, not necessarily to her spatial awareness. She often would even say that she was "silly" when she realized she was not doing my instructions. This process will include much encouragement from me as I continue to help her find self-awareness and self-confidence in the movement. That, alone, is valuable regardless of the research results according to the quantitative data. Once we shifted to her doing it on her own, I realized that she was going to have a great deal of difficulty. I decided to go ahead and give her verbal cues. We completed five executions of the scale. I decided to make a checkmark if she did any sort of reference to the point, whether it was a movement of her head, eyes, torso, or hand.

At the end of the session, I asked if she can envision the cross of axes in her mind, and she said that she can. This could indicate that some sort of spatial cognitive processing is intact for her. It makes me wonder if I should bring models or draw maps for her. I dreamed that I was

drawing big, thick, red lines in the horizontal for her (in typical dream-world fashion, these lines magically appeared and hung in the space like lasers). This brings to mind the research about pathways and maps and navigation. It's interesting that I thought this would not be necessary, even though I did very well in learning scales with the streamers strung through the life-size icosahedron. I have to remember that for Cathy, the dimensional scale probably feels as complicated as the A and B scales feel to me.

I also asked if she can feel the impulse to move or envision what my cue means to her and she said yes to both. She feels like she wants to do the movement, but cannot. I tried to reassure her that even this is progress, as studies have shown that mental imaging builds new neural pathways.

I quickly realized in this first session that the research is not going to go as I planned. I realized that I had so many pre-conceived notions about the procedures. Even though I thought I went into this project with no expectations of Cathy, and had endeavored to remain responsive in the moment instead of strictly planning the procedure, I realized that I did, in fact, have some ideas of how I would proceed. Once Cathy revealed that she could not move her eyes independently, I knew that I would have to rely on my improvisational skills as a therapist, dancer, and curious human being. There was some panic in this moment of understanding, but also some relief…I felt myself relax into the notion that I was simply going to be doing what I do best – attuning, teaching, supporting, and even challenging. Teaching Cathy how to do these scales would require thinking on my feet and allowing myself to be spontaneous in order to meet her needs in the moment.

I also realized that I had to let go of expectations of what I thought Cathy was going to "accomplish" in the next few weeks. As I said this to her, I realized that I was also saying it for

myself. I am simply going to be recording the process of what is happening as we engage in the scales together, rather than trying to control what she does or how she changes. I think this is important in any research process, and I was surprised that I needed this lesson!

July 30, 2009

I was sitting in the room waiting for Cathy, reflecting on what I thought might be a good approach for the session. I thought I would ask her to think of reasons to look in the directions in order to make it easier to look there. For example, if her shoe was untied, she would look "down." Giving her a clear stimulus in each direction (either to go toward or move away from) could be helpful in guiding her (this is reminiscent of Kestenberg in my mind). I thought it would also have more meaning for her if she created the stimuli/images herself, rather than I provide them.

It was about time to begin when I heard a yell from the hallway. I knew it was her, even though it strongly resembled the sound of another client in another program who often calls out in a hoarse voice. I peeked out the door, and I saw Cathy there walking toward the room. She yelled again that she hates her cane, and beat it against the floor. This is a pattern for her. She then said she had to go to the bathroom (another pattern of avoidance), and then began to sob. I encouraged her to go to the bathroom, which was at the end of the hall, and not to worry about trying to do the research if she was uncomfortable. She continued to complain about the cane, finally saying "I hate THE FACT THAT I HAVE TO USE A CANE." It is not often that Cathy accurately names her frustrations and sadness in this way. She usually just says that she hates the cane.

She finally made it to the bathroom after several minutes of sobbing and yelling and beating the cane against the floor, with very slow progress in actual walking. I returned to the session room to wait for her. She came in later, about fifteen minutes into our time. She continued to sob after sitting down, saying that she hates that she can't walk, she wants to be able to run, she has no way to release tension, she hates that her kids don't visit her… it was a flood of emotion and frustration. I engaged her in some pushing with her arms and pressing into the floor with her legs to see if she could release some of her tension in that way, and she said that it helped. I continued to listen to her, and also named that I had not ever seen her so upset. I said that it was a relief to me to hear her so accurately describe the real issues that frustrated her, rather than just saying she hated her cane.

I did not know how to proceed into the research session, as this seemed like it was going to turn into talk therapy, and I wanted to meet her needs. However, after about fifteen minutes of processing and engaging on this level, I asked what else she thought we could do to help her. She quickly responded, "the experiment, the research, your thing," so we went forward.

She said that she had been practicing every day. She liked that Marie placed objects for her to look at or named objects or places in the room for her to look toward. I told her that coincided with my idea of the stimuli. She stated that it had been going great, and when we went into the first execution of the dimensional scale, she did quite well. When we added imagined stimuli, she did even better. The strongest pull and biggest change was to "right" (her weakest area due to visual field deficit); I think it's because she imagined her younger son to be standing there. Every time I said that he was there, she snapped her head to "right." The next biggest change was in the "forward" cue. I asked her what would make her want to move forward, or get closer to something, and she named her boyfriend. (I did not even know she had a

boyfriend!) Every time I said this cue, she smiled. Backward was moving away from her cane and this improved significantly, as well. She squeezed her eyes shut very tightly on the first cue of "back."

For "up," I noticed that she moved her head every time, but her eyes stayed "forward." I asked her to consciously work on this, incorporating her eyes, for next week. I also asked her to move her head while imagining that she was trying to catch rain in her mouth, but she just moved from side to side. She did not move her face/eyes to look "up."

The horizontal dimension is still shaky for her. She travels along an indirect path, occasionally doing the under-curve/arc in the vertical plane and also stopping and starting with her eyes. On one of the "left" cues, she lurched forward and her right (unmoving) arm shook. It looked like she wanted to get out of her chair.

She seemed very proud that she had been able to do this every day and she said she can feel an improvement. Her difficulty level for the scale as a whole was a "3" this week. I would estimate that she had made about 25% improvement.

Progress when I used only verbal cues included:

1.) She always made a reference to "up" and "down," either by raising eyebrows or closing eyes. These were not the "correct" movements for the cues, but indicated that she understood that she needed to move.
2.) She frequently responded to the sagittal cues by advancing with her torso in the chair.

She still did not move at all in the horizontal dimension. As we progressed through the ten executions, she seemed to get confused at times. She took a rest after six executions.

I need to figure out a better way to record this information. This week it did not make sense to write only when she was making any reference with any body part, since she could, in fact, follow the instructions and at times move her eyes. I still used the method from last week, making a checkmark if she referred with any body part, but it almost seems like I need to have two slots on the sheet to mark: one for if she sees the actual point with her eyes and one for if she makes any reference with any body part. I am also aware that I am "giving her credit" for "up," when perhaps I should not…she is moving her head and her eyebrows "up," but not her eyes. She follows the "up" cue by doing this same movement almost every time.

I felt pressed for time this week with the late start. I noticed when I watched the video that my voice sounded a little harsh, and I worried if I seemed frustrated to Cathy. I did not do the slow following of my face as much as I felt was beneficial to her. I did it at the beginning of the session, and she did very well with it. Since she did it about 80% accurately, I moved on to not using my face as the landmark. Regardless of the use of my face as a landmark, next week I will go slower. I also am thinking about stringing some colorful streamers in the room for her to follow.

August 4, 2009

This session was completely different from last time! I almost wondered if she was trying to "make up" for her emotional outburst. There was a lot of smiling and laughing, and she seems to be really proud of herself for being able to commit to practicing at home and actually making some progress.

When I asked her how she was doing with the scales at home, she said that she feels like it's helping her with direction, like "up" and "down," all the time. She feels her perception of the

area around her has increased, even if she is not always able to see it. I am not sure what that is going to mean for this project, and it speaks to the vagueness of our general ideas about "spatial awareness." Again, some questions that are coming up for me are "From an observation point of view, how do I know what she perceives if I cannot see her do the movement that refers to the points?" and "how am I going to measure her 'perception' without advanced technology?" At any rate, we did clarify that seeing and being aware of the areas are two different things.

She also said that she can turn her head better. In review of my notes from last session, I said that the horizontal dimension needed the most work; now it is the clearest! Her eyes are moving more quickly and directly, although it is a very subtle change.

Before we began the executions, I asked her what kind of cues she wanted from me in order to perform the ten executions most easily – verbal and visual? She said both, especially visual. She first scratched her head before going to "left." Here is an issue: I sometimes record that she is hitting the points after a couple of seconds of delay, but this delay feels important. Maybe later I can time them? She also might scratch or look at me before going to a place I have cued. In contrast, on the first execution, she did not wait for my cue to go from "left" to "right." This is when she said proudly, "I have been practicing." She responds very well when I point to "left" with my pencil, instead of just saying "left."

I had asked her to practice the scales going to "left" first instead of to "right" first, so I asked if she noticed a difference when working at home. She said that looking "left" first is much easier for her, and then said it's because she is left-handed. I asked if she thought it could also be her visual field deficit and she said, "oh, yeah, that too." Marie, her personal assistant, also jumped in and said that it took Cathy three times into doing the left side first before she

mentioned that there was a change. I asked if she had perceived it before and just waited to say something, but she said that it took her that many times to register the ease.

She is consistently closing her eyes for "down." I asked if she could still see me on the "down" so that she would keep her eyes open. She said yes and then did so.

In the sagittal dimension, I noticed that she was doing the opposite of me, and I said that it felt like she was responding to me like in partner dancing. When I said and did the "back" cue of closing the eyes, she would advance as if she were responding to the cue for "front," and vice versa. So I asked her to actually mirror me and do the movement I was doing. She tried, but had difficulty.

I decided to use touch cues at this point to help her with the sliding motion of the sagittal. I placed one hand on her occipital area and one had lightly on her chin and applied light pressure in either direction, to give her a sense that her skull could slide along the sagittal axis. There was very little movement occurring, but she said it felt good.

At one point, I was using the "kissing boyfriend/move away from cane" images as stimuli for "forward" and "back," as we established in the last session. I was being quite demonstrative in my prompts, and she was laughing. I asked her if it distracted her when I was silly and she said "kinda." I wonder about this, since my emotional involvement seems really important to her, and when she is laughing it feels like she is connecting more to me and the material. This told me that I can rein the antics in a bit.

We practiced sagittal for a while. I checked in about her sense of it, irrespective of her actual movement. Could she feel a sense of going forward into the world, and then retreating away from it? Pleasure/displeasure? She said that she feels that a little bit. It does not surprise me that this was her answer, since she is generally removed from her own emotions and is not able

to take pleasure from the world in the way she used to do. She has said previously that sometimes this detachment feels like a defense mechanism against feeling the pain of shift in her life after her strokes.

After I asked this question, I made an adjustment to the camera, and I said that she looked younger today. She said it could be because she was in a better mood. She seems to really enjoy our time together, and has said that she looks forward to it.

I decided to use a pink streamer to help her to see the pathways in space. This was not as helpful as I thought it would be, because she had a hard time following the line of the streamer with her eyes in a smooth pathway. Initially, I explained what I wanted her to do, and asked if she could see the streamer. She said she could. When I asked her to follow it from "forward-deep" to "forward-high," she stopped in the middle at "forward." The path was not smooth.

When I asked if she could see the whole pink line that resulted from her pathway, saying "this line represents the path your eyes just travelled" she said yes, she could see it. However, she was not looking at it when she said this, but appeared unfocused in her gaze at something in the area of "forward left." When I asked if she could look "up" and "down" along the streamer, her eyes unfocused and she looked past it and all around. After that movement, she said "I'll try."

At this point, she started saying she was distracted because she could not clear her throat. She coughed repeatedly for a few seconds.

It was clear that she could see the points, but not the pathway between. This is in line with research that states we cannot really do this anyway, so it is no surprise that someone with a brain injury would have bigger gaps between the points they do see. I asked her if my face was still her best cue to follow, and she said yes.

In the horizontal dimension, as we began, she did a very clear ONLY EYE movement from "forward" to "forward-right." I asked if she felt it and she said yes. When I asked if she could she do it again, she laughed and said no. This is when I decided to just practice half the path, from "forward" to "right." I kept trying to demonstrate with the streamer, but she was not able to do it. I used the examples of following a road map, watching a bug, "travel" with your eyes. Nothing helped her do the movement, even though she said that she understood the analogies. As I have mentioned before, I think this indicates that some of her cognitive processes are intact, but the eyes are not fully functioning.

She tried to clear her throat again, and said it was frustrating. I asked if maybe that was representative of other frustrations for her, trying to get something out of her that would not budge. She said it had been happening a lot lately, and named support group during the program as one time.

I wanted to stay on track with the movement, so I kept going. I tied the streamer to the cane, placed it at "forward," then I sat at her "forward-right." We practiced looking from "pink" to "me" several times. I observed clear movement during this practice. Then I moved further around the horizontal plane to sit directly at her "right." This also elicited clear movement. I was very excited. I realized at this point that even though the imagined stimuli had been a good starting point, that practice was not as effective as placing real objects at the points. We also did this procedure on the left. She could only do the movement three or four times before appearing to be tired. Her path became more indirect and she closed her eyes between executions. I said it seemed like a "palette cleanser" when she closed her eyes and she said that was an accurate description. As we completed this practice, she said, "That was awesome." I asked if it felt clear in her body, and she said "Yes, I feel like I get it." She also said, when

asked, that she can feel her head moving more smoothly. Finally, I placed the pink cane at her "left" and me at her "right," and we did the whole path. She still often lingered at "forward right" and still does the under-curve movement.

When I asked her to rate her feeling of the movement in this session on our scale, Cathy said that her overall feeling of difficulty in performing the scales this week is about a two.

I explained to her that before the next session I would like her to try the improvisation exploration at home. I called it "making your own pathways." I explained that she knows the points and the paths now, so she can play around in them. I also called it "following impulses." She asked if she could just go "wherever my head wants to go" and I said yes, but with consciousness. I talked about the concept of the kinesphere, and she liked that. I also said that Marie could help if she thought she might need it. I told her that during the next session, she would show me her process, a demonstration of what she had been doing. I then said that it would be like making a dance with your head and eyes. I then opened it up to include arm and torso if those impulses were strong.

I am trying not to get too excited about how much progress she made between these sessions. I probably should not expect this every time!

August 6, 2009

Today's plan was to immediately go into doing the scales ten times on the left first, then ten times on the right. After that, I wanted to spend a lot of time on the improvisation. I even brought music so that she could play around a bit. However, I also wanted to make sure I checked in with Cathy about what she needed for the session.

This was a good example of how difficult it is to do quantitative research and maintain a client-centered therapy practice. When I asked Cathy if she wanted to practice, she said yes, so I had to let go of my plans. We spent a lot of time on the vertical dimension today. This is congruent with our process so far, since last time we spent time on sagittal and horizontal. I really wanted to address the issue of her closing her eyes for "down," and I had asked her to be practicing keeping them open. Since only two days passed between sessions, I'm not sure if there was much chance to enact this re-patterning.

Cathy began coughing immediately today as we began, trying to clear her throat and naming her frustration. She seemed over-stimulated; every time I gave her a cue, she looked all around her. I was sitting at her "right." (As I viewed the video, I thought I might change this later. I think I was assuming that it would be helpful to have me at her "right" based on the last session).

I gave the light immediately above her as a visual cue for "up." When I said "up," she shifted in her chair and her right leg began to move! She laughed about this, but I was excited. Although this was not the movement that went with the cue, it was progress for her overall recovery that her leg was moving. I told her I got excited when that happened, and she was curious about why. I told her that something is happening in her neurological system; something, somewhere, is firing and creating a new pathway or repairing a damaged pathway.

As I moved to a place behind the camera and gave her the first "up" cue, she lifted her left arm quickly and directly and immediately laughed. She notices when she does something different from the cue. This time we had a purple streamer at her "left" and Marie was at her "right." On the second execution, she closed her eyes for the "up" cue. I took this opportunity to address the issue of her closing her eyes for "down." I told her that I observed her looking

"down" at her shoes or her clothes often, and that I know she can do the movement that goes with the cue. She did well with looking "down" at her shoe. Marie then placed a lunch bag at "forward-deep" for her to see. I liked the shoe better, since it was located closer to the actual point of the scale ("place-deep"), but she responded well to the lunch bag.

"Up" elicited a clear movement for her, but still needed work because she is not moving her head. She raises her eyebrows and tilts her head slightly. I gave her the rain image again. She could easily open her mouth and even stick out her tongue, but could not tilt her head back on the atlas vertebrae. I gave her some support on the back of her head, and also a touch cue on her chin. She could do the movement about 45 degrees more with me there, which is quite an improvement She had her eyes closed during this, so I asked her to open her eyes. She opened her mouth when I asked her to open her eyes, and laughed at her mistake. I encouraged her to keep that seemingly positive, light-hearted attitude. I then compared this movement to getting your hair washed at the salon, and gave her a few light strokes on her hair. She said that this hurts her neck. I told her that is probably why she is not doing it voluntarily, as pain is a message to our brain that something is wrong. I asked her to point to where the pain is on my body as I kneeled in front of her, and she directly gestured to my trapezius muscle on my left side.

We then did a little experimenting with trying to do the "up" movement with some core support. I had her sit forward a bit in her chair and try it. She had less pain in her neck when she did it from this position. I explained that this is because when she moved her torso off the back of the chair, her deep abdominal muscles had to engage to keep her from falling over, and this added to the support of her neck when she did the movement. I then gave her the image of a fountain coming from the base of her spine/tailbone area, and shooting up her spine through the

top of her head. I also demonstrated the movement for her. She smiled and said "Wow." She said she absolutely understood the image and how it related to the movement for "up." As I was demonstrating how not to do it, with a compression in the cervical spine, she did movement very well with the core support. I then went "back" supporting the back of her head with my hand, and also placed my other hand on her spine between her scapulae. She did not make any movements as I was doing this, but kept her eyes closed and said she could feel the energy moving through her.

As I was talking, she was looking "up" at me with just her eyes, so I then stood on a chair, put my face directly above her at "place-high," and asked her to look "up" at me. She did the movement; her eyes were wide as her head moved back in the sagittal place. She said that this felt strained. I showed her some easy stretches to do at home with Marie's help. I also used some touch cues and lightly stretched her myself. She loved that. I also gave her some light massage on the trapezius muscles, and could feel that the muscles were very tight. She said that area is where she holds all of her tension and it feels like a 60-lb bowling ball on top of her shoulders. I recommended that she try to incorporate regular massage into her schedule if she could manage to find the time. This is really important information. Some of her movement limitations may not relate to a spatial awareness issue if she literally cannot perform the movement due to physical limitation beyond the hemiparesis. I said that we would just work with it, and she agreed.

The following is a summary of things I noticed during the ten uninterrupted executions of the dimensional scale:

- She consistently closed her eyes for "forward."
- She needs significant cuing to keep eyes open for "down."

- She goes quickly to "left," stops in the middle, and then slowly and indirectly moves "right."
- After the sixth execution, she asked me "did I get 'em all that time?" I said that we are still working on keeping the eyes open for "down." I asked, amused, if it is like a game for her, and she said yes and smiled.
- I asked her to think about keeping her eyes open until the very end of the execution; after we had done all the directions she could rest.
- She was also doing an over-curve from "forward-middle" to "right-middle,"" in addition to the under-curve from "left-middle" to "right-middle" "that she always did before. She does not move directly from "left-middle" to "right-middle."

After the ten executions, we worked on the vertical dimension with the streamer wadded up into a large ball as a visual anchor. She was still following my face. At Marie's suggestion, I began touching her feet for "down." She had some tremors and kicks in her legs when I did this. She laughed, and said "my body is so weird." She either laughed or said she was sorry when she did not follow the directional cue, so it seemed clear to me that she knew when she was not doing it correctly. The right leg sometimes kicks on "up" and the left leg sometimes kicks on "down." In conversation, she can look "down," but when she is directed to look "down" there seems to be a "misfire." I kept waiting to see that her eyes were focusing on me. At one point, I decided to go really close to her with the streamer to see if that would help her to see it, and I watched her eyes. She had trouble taking her gaze from my face.

Her legs continued to kick in the aforementioned pattern. She said "it's so weird," and I said, "Well, it's just different. It's not what you expect to happen. You think 'down', and your leg kicks." She confirmed that this was what seemed to occur. We then clarified that she does,

indeed, have a clear impulse in her mind/intention of the "correct" direction, but it does not travel through the neurological system to get the message to her body. She used the word "translate" for the process from brain to body.

I also spoke briefly about the difference between being directed and spontaneously moving. We then transitioned to the improvisation.

Her words about how improvisation felt:

- Liberating
- Free to do whatever I want
- Didn't have to follow any directions

I asked if she noticed any of her preferences, and she said the left. She thinks it is because she is left-handed, but also acknowledges her right side hemianopsia when I remind her of it. When I asked what area on the left felt like a natural place to look, she said eye-level area. I also asked if there were any images in her mind or things she was thinking about when she was moving spontaneously, or that felt like they came from the movement. She responded, "I think I was just thinking 'am I doing this right?' (long pause) but that's my own like, um, paranoia…wanting to do everything right." I validated this by saying I can relate, and furthered her thoughts by saying, "Even though you are given complete freedom to do whatever you want, you still wonder if it's 'good enough'."

She said she would try moving for about ten seconds. (At first she said a minute, and then realized that was too long.) I asked if she wanted to listen to music, and she asked if I had any jazz. She wanted upbeat music to match her mood. She did not like what I played at first, and asked if she could bring in her own stuff. While we were looking for music, she mentioned that she did not get to see her kids last weekend because her husband just did not show up.

When I asked if she wanted to have a set time or just go until she was tired, she said she wanted to just go. I said to just tell me when she was done. I asked if she wanted me to go with her, and she said sure, so I said I would just mirror her movements.

She began by lifting the left arm repeatedly. It seemed a little different this time because she had some rising in the left side with her scapula. I reminded her that she could use her head, too (at this she placed her hand on the back of her head and stroked her hair. I had never seen her do this!), and to remember all the points she had to work with. She responded by bulging her eyes to "forward" and closing and opening her eyes twice. She then spread her left hand while it rested on her left knee. If I responded with an appreciative noise, such as an "mmm" or an "uh-huh," she would smile brightly. Her eyes were sparkling. She moved her left foot and rolled her head around its vertebral axis. She closed her eyes for a few seconds

She then tried to clear her throat and said she just could not do it. This segued into a statement about going to the doctor to find out what could be wrong with her throat. She then scratched her nose and face, looked at Marie, smiled at me, and seemed to be disengaged from her dance. I asked if she liked the music, and she responded positively. There was more scratching and clearing of her throat. I told her to just tell me when she was finished and she said she was.

Cathy described this process as "great" and "I like having the freedom to do other things." I compared doing the scales to doing scales as a musician (she played the piano as a child). Playing the scales, even though you might not want to do them, made you play other things better. I hypothesized that the movement scales did the same for moving in more complicated and creative ways.

We finished by reviewing when we would meet again. She had court on the scheduled day of our next meeting, so she would not be coming to the program that day. The purpose of the court date was to finalize her divorce. I wanted to keep in mind that it was going to be an emotional week for her, so I really had no idea what to expect in regards to her behavior. I would not be surprised if she did not practice as much at home during this week.

In reference to the timeline of the research period the next session would be the perfect halfway point to add in the diagonal scales, and I thought it would be good for her, if she will be emotionally ready to handle a new challenge. I previously thought that she needs to have the dimensional scale really well before moving on to the diagonal scale, but I realized that the two scales together would enhance and reinforce each other.

August 13, 2009

A whirlwind session! Cathy was a bit late and told me she was having a meltdown. Then she informed me she was going on vacation for two weeks. I thought this was great for her; I could imagine she really needed a vacation and would likely have a wonderful time. I could, however, understand why she had prefaced the vacation information with the meltdown statement, since she was going on a cruise with her family and she had told me previously that her relationships with her mother and sisters were strained. Of course, I selfishly panicked about what was going to become of my research. I wondered if I should not introduce the diagonal scale in this session, since I would not be working with her at all over the next couple of weeks and she would probably not practice on her vacation. I asked her what she wanted to do, and she said that she would love to try something new.

I calculated that I would meet with her once before she left, and then when she returned I will only have three sessions left. I reminded myself that it was fine and I just needed to relax. We agreed that we could play it by ear towards the end of the planned research period as to whether we wanted to add more sessions.

I had mistakenly assumed that she would not practice the scales at home during the week of her court date. She said that she recognizes the work is beneficial and reported that it actually provides some respite for her from a hectic life.

I introduced the diagonal scale by explaining the concepts of stability in the dimensional scale and mobility in the diagonal scale. She understood this. I explained that she should imagine that she is sitting in a cube (which in actuality we were since we were in a square room). She grasped the concept immediately. We talked about how the points behind her might feel a little mysterious, but she was okay with that and even talked about using her peripheral vision when she could not turn her head. This was exciting in reference to the growth of her compensatory strategies. We also talked about how the points have three distinct characteristics in the three spatial pulls, i.e. reaching "forward," "right," and "high" at the same time.

I used my face and the wadded pink streamer to provide visual landmarks for Cathy. It made sense to focus on the front space first since she could see those points with ease, so we worked the high/forward halves of the P1 and P2 diagonals for a while. As we began, I went close to her with the streamer and she reached for it with her left hand. I asked if she wanted to feel the path with her arm, and she said yes. I placed the streamer in her hand and guided her along the pathway to "forward-left-high." I noticed that when she did this movement, she did not move her eyes along the pathway without my cuing her or going to the point so she could see my face there. Then we focused on the forward/deep halves of the P3 and P4 diagonals. I had

progressed to standing on chairs for "forward-right-high" and "forward-left-high" and lying in the floor for "forward-right-deep" and "forward-left-deep."

We then did the same procedure with the "back" space. She stated that she was willing to try to see the points behind her even though the tightness in her neck muscles made it difficult. I reminded her that she only had to go as far as she could without discomfort. We started the process by moving from "forward-left-high" to trace the top left edge of the imagined cube to "back-left-high." This seemed to work well.

When I walked from her left side to her right side, she did a very clear scan of her horizon as she followed me, with both head and eyes. She cycled in the horizontal plane! This was harder for her a couple of weeks ago, and it made me think of how the scales can reinforce and enhance each other. She said she could feel the path from "forward-right-high" to "back-right-high" clearly and also said it hurt to turn her head that way. I wondered if the tightness in her neck forced her to move her eyes independently from her head, because I could clearly see this distinction. And this was her deficit side! I explained how this eye movement was happening for her, using the example of classical Indian dance and how they use their eyes as part of the expression of the story. I told her she is doing an eye dance now.

I could see very clearly in her eyes the moment that I disappeared to her. Her eyes became unfocused and she also had bound flow in her head, neck and torso. We did this path (FRH-BRH) three times and she consistently followed every time.

When I asked if she was ready to attempt and execution of a full diagonal, she immediately agreed. She wanted to start with the right side to challenge herself. Her pathways along the diagonals were like stair steps… she moves in the dimensions to follow my face. For example, her path was "forward-right-high" to "forward-middle" to "left-middle" to "left-deep"

to “back-left-deep.” This happened two out of three times on each side. When she was attempting to see the “back” points, she would generally turn her head to the side and then drop her eyes directly “down” to the deep point at her side instead of all the way back to the “back-deep” point behind her. She said she could see the “back” points with her peripheral vision. She also consistently moved her head first and then her eyes followed, rather than moving her head and eyes together.

I noted that she was moving in her chair a bit, too, and asked if she could feel the mobility in the diagonals. She said that she could, and shifted forward as she coughed.

When we started with “forward-left-high,”” her arm quickly moved to the point. I encouraged her to not restrict any movement. She said it felt good to move her arm. She seemed a little bit embarrassed when she did this movement. Again, my verbal responses to her movement were consistently “Can you see me?” or “Find me” or “Where are you” or “There you are.” This feels quite relational between us and also validating for her. She continued to smile and seemed pleased with herself. At one point as I looked back to my paused video from my note-taking, I saw that I had captured a beautiful moment of true affect; her smile filled her face and eyes, and she looked extremely happy. This expression stayed for about twenty seconds. I have not noticed this expression on Cathy’s face before.

I need to be careful about naming the points. At one point, I said in a very vague manner, “Now we are going to go from back here to that point where I was on the floor before. Do you remember that?” UGH.

As we moved “back” to “front” along P3 and P4, she had the same stair step pattern. She never appears to be seeing the points in the back space, but she insists she senses and sees them.

At the end, I reiterated the points and the diagonals. It felt like I was bombarding her with so much information. We talked again about mobility/stability, and I asked her to focus on doing only the diagonal scale until our next meeting. I told her that if she felt like she needed a break or a change or a "palette cleanser" she could switch to doing the dimensional scale a couple of times.

I also asked if she still felt like she was having a meltdown, and she said no. I asked if the body awareness helped her to calm down, and she said yes.

Cathy did really well with this. These pathways seemed more comfortable and naturally accessible for her. She also moved her eyes separately from her head more than she did in the dimensional scale, especially when trying to see those "back" points. She was smiling the whole time and seemed to respond well to my positive feedback. Marie also thinks that Cathy will do better with diagonals than with dimensions. This was puzzling to me at first; since she is apparently so immobile at this point in her life, I would think that the dimensions would feel more familiar. But then I remember that she used to be a runner, and she was quite mobile before her strokes. I also wondered about how she always feels like she is going to fall, and this speaks to diagonal pathways. If she is always leaning…

I also did something a little different during this session. When she ceased to follow me with her eyes, I would stop moving along the path. This made her laugh and also seemed to be a clear indication to her that she was not following the direction. She was not always aware of what her eyes were doing in their sockets, but she could clearly identify when I stopped moving.

We only worked about twenty minutes before she had to leave. This session was a good lesson for me to let go of things I could not control. I could not control when her family surprised her with a vacation, and that is much more important in her recovery than my research.

I also could not control that she had meltdowns on her way to the room in which we have the sessions. She generally became very frustrated when she had to use the cane to walk long distances, and during this session she said she hated the program because she had to use the cane. At any rate, even though things did not go (and often will not go) as I planned, we still did so much good work in this session!

August 17, 2009

I was dismayed to hear that Cathy did not practice the diagonal scale at home this past weekend. I tried very hard to reassure her that this was okay, because she did seem a bit defensive when she stated that she just did not have time. It was difficult to convey this reassurance, however, because I was disappointed and also worried/curious to see how it would affect her execution of the scales.

I asked Cathy if she could remember the scale, and she said no. She did not recall what she learned, even though the movement had been so clear for her during the session

We began immediately with simply reviewing what we did the last session. I stayed with the idea of moving from seeing her body to seeing the point before doing the entire diagonal, and we did her forward space first. I tied a colorful toy made of balloons, feathers, and pipe cleaners to her shirt and asked her to refer to this as her starting place, stating that her body was her starting point and I would be at her ending point. After the first time of referring to "forward-right-high,"" she said, "I got the me part okay, but seeing you was harder." This is interesting to me, since usually she appeared to see me but seemed unable to reference "place-deep" or "forward-deep" when I asked her to see herself. I then tied a streamer in the far corner of the room and asked if she could see it. She said that she could and it helped to have the feeling that

the point was farther away (I had been standing about five feet away from her, but she preferred this literal corner of the cube/room that was about fifteen feet away). When she transitioned to "forward-left-high,"" she closed her eyes or scratched her face for the self/"place-deep" cue.

Cathy said that once we started doing the movement, she remembered the session and the scale more. After some practice, I asked her if she would like to try the ten executions of moving to these four points in a sequence. She said, "Yes," and so I asked her what sequence she would like to do them in and she chose the following: self to "forward-right-high"; self to "forward-left-high"; self to "forward-left-deep"; self to "forward-right-deep." She said that this made sense to her because she was making a square in front of her. This felt important to me in the potential later study of the full scale because the sequence for the starting points of the diagonals travels around the top of the cube like a square (i.e. FRH, FLH, BLH, BLD). I was curious to see if this would translate for her.

She did seven executions fairly well, and then the eighth one I recorded as being very indirect. I decided to stop there since she seemed to be tired. It was interesting to note that at first she was more indirect, and then at the third execution became more direct. I gave her a break after the fifth one. And then it declined in specificity from there.

Cathy anticipates "forward-left-deep," moving to the point before I cue her. For FRD, she does the stair-step path I had noticed in the previous session.

For reference objects in these executions, I tied a streamer to the camera for the starting point, asking her to now look straight ahead. There were streamers in each "high" corner, and then the toy and a wallet in the "deep" corners. As I am writing my notes, I am wondering why I changed the starting point from self to "forward-middle." This creates less of a diagonal feeling

in this execution. Hopefully she will be able to return to the diagonal feeling in the full scale as she has to move her focus through her body to find the "back" space.

As we completed the diagonal scale study, I asked Cathy if she would like to practice the dimensional scale as reviews. She complied, so I gave her the choice of which side and how many times. She decided on the left side three times. I prompted her to name the points, and she said: "up," "right," "down," middle, "left" (with my cue). I asked what "middle" represented for her, and she said forward and back. I think it is interesting that she said them out of the order in which we do them. She remembered the side with her field deficit, but not the side she can see clearly. Cathy still closed her eyes for "place-deep" two of the three times. She did not move to "forward-middle" two of the three times, or to "back-middle" one of the three times. All other points were successful. She reported that this scale has a difficulty level of 3 on a scale of 0-10.

Cathy's energy was quite low this session. She reported at the end that she felt she did not do well. She said she was excited for her vacation. She had a new haircut. We discussed her vacation a bit at the end, and I reminded her to use the scales as a grounding tool if the family dynamics became difficult for her to manage. I doubted that she would practice while she is away.

September 8, 2009

As I anticipated, Cathy did not practice or think about the scales while she was away. She said immediately as she came into the room that she was exhausted and burnt out. (I think she always said this because the walk from the program area to the room in which we work was a long distance for her, probably the equivalent of a short block. It was difficult for her to report

accurately on how she feels about something specific when she is facing an immediate stimulus or effect from something she has just done that affects her overall.) I remarked that sometimes vacation is more exhausting than it is restorative. She then reported that her vacation was really great and she did not speak of any difficult times. She talked about how great it was to be with her family and see her friends in New Orleans after the cruise. She also mentioned that she got along well with her mother (someone she does not often refer to fondly) and she felt her mom was doing better about accepting Cathy's current situation.

I asked if there was anything about the diagonal scale that she remembered. She said: "Right to left, upper to lower, back and forth." I was excited to hear that she was naming the three spatial pulls, even though she was not saying the exact words I used and did not speak about the sequence of the scale. I said that she named the dimensions, and reminded her that she was naming the parts of the dimensional scale. I then related the dimensions to the diagonals by saying, again, that each diagonal has three spatial pulls, and asked if she understood that concept. She replied that she did. She also said that she does them in DMT with Jeannine, so they felt more familiar to her.

We started the practice by simply finding each of the points in her front space (FRH, FLH, FRD, and FLD). I placed the streamers at the "high" points, a tennis ball at FRD, and a tomato at FLD. The tomato made Cathy laugh. I stood with her and pointed to the places, and asked her to look with me. I asked her to look at her chest or straight forward for each starting point, saying "we start with self." Each time we went to self, she usually closed her eyes. In the first attempt, FRH was accurate. FLH came with some hesitation. FRD was fleeting (her head was already slightly turned in that direction, so her eyes went there for a moment) and she said "wow." I asked her why she said that, and she said "it's a stretch." I checked in with her about

wanting to close her eyes on "self" and she said she prefers that. I tried to have her close her eyes and then look straight forward by simply saying "Close your eyes and open them. What do you see?" When she opened her eyes, she was already looking to FRD and said she saw the tennis ball that was there for her visual landmark. It was great that she did see this landmark, but I wondered about the fact that she had moved her eyes before she opened them. I pondered how to "cleanse her palette." There were many metaphors within this conundrum. I was asking her to start at "self" and she was unable to do that. Could this relate to her deficit in self-regulation, self-awareness, and independence?

FLD was clear for her, and she laughed again at the tomato placed there for visual landmark. As we completed this exercise of going to the front space points, I asked her how it was for her, and she said "good." I said that it seemed clear to me, but since I was crouching beside her I could see her eyes to judge if my perception was correct.

I then moved to sit in front of her, and asked her to use my face as a cue for a starting point, saying that seeing me can be a return to self (oh my, what a therapeutic metaphor we have there!). At the first cue for FRH, she searched all around the point but never focused in on it. She said she did not see it. I tried sitting beside her for the next attempt. She successfully looked forward at the camera on my cue (every time she looks directly at the camera, she smiles…it is really endearing), then seemed to go to FRH on my cue. She said, "I see it, the pink, the streamer." I then moved to adjust the camera and asked her to move her eyes around a bit so I could test if the picture was recording clearly. She looked to the "left-middle, "forward-middle," "right-middle," and moved her head in small circles. I turned the view screen of the camera around so I could see it as we progressed.

I determined that it was better for me to lead her while sitting beside her and pointing. I ask her to find herself in the camera screen, and she smiled and looked forward. As we went to FRH, she kept her eyes on her image and moved her head, finding the point with her eyes after a short delay. When she went to FLH, she did not move her head, looked at the camera, and looked at me. I repeatedly moved my finger and arm along the pathway, but she continued to look at herself in the camera. I asked if she was distracted by her image and she said "absolutely" and laughed. I made the adjustment to turn the view screen back around so that she could not see it.

I then moved to her left side and tried to guide from this approach (before I was on her right side). FRD and FLD were very clear. As I watched the video, I noticed that Cathy's affect had completely changed from the beginning of the session. Her eyes were not fully open and she looked very distracted, seemingly with her attention on something internal. I wondered how it affected her to see herself in the camera, because she was definitely not as focused afterwards. She never clearly looked forward after that.

I asked if she would like to try referring to the points with her own arm instead of following mine. She said "sure." I asked if maybe it would be clearer for her if she had that feeling in her body of the point in space. She said "maybe." Note that I was moving her arm for her through this process. As we went to FLH, she smiled, but did not follow her hand with her eyes. On my cue, she included her eyes. She still did not follow to FLH on the second time, and still had that sleepy look on her face. When I gave her a touch cue to turn her head to "left," I gave a bit of pressure on the right side of her skull. She looked to "right" as a response to this cue. This is interesting. She eventually moved her head and eyes to the point, and I asked her if she could feel that her arm was also going there. She did.

I prepared her for FRD by saying "we are going to cross over now." FRD also required my cue to move her eyes to the tennis ball. I then said we were going to "open up" for FLD to the tomato. She moved her eyes but not her head; she still looked sleepy. She reported that doing it with her arm was just "okay." When I asked if it helped to have her body go to the points she said she thought so. She said more but I could not hear it on the video; she was rubbing her right eye and blocking her voice.

I transitioned to doing the same exercise to the points in her back space. I stated that this would be a lot harder and asked if she remembers doing the "back" points before. She said she thought so. She did watch me set up her visual objects. I named them and pointed to them for her, and she looked to them as I said each one. For BLH, she needed me to go there. It was the same for BRH; the fire alarm was not enough as a landmark. She turned her head but did not see it.

At this point, Cathy appeared not only sleepy but slightly sad. I sat close to her at BL and used my finger at L so she could follow my pointing to BLH. She saw my finger but did not follow my pointing. I then moved to stand at "left" with my face even with hers, asking her to follow my face. I asked her to tell me when she could not see me anymore. We did some back and forth and I noticed I could not see her eyes but she had not indicated she could not see me. I asked if she was using her peripheral vision. When I asked this, she turned her head and her eyes to see me directly at BLH. I exclaimed "There are your eyes!" and she smiled. I asked if it is tiring for her to reach all the way to the point with her eyes and turn her head, and she affirmed this by saying her neck was stiff.

I continued this process for BLD. This was easier than BLH. She finally realized that she could not see the point unless she turned her head. I asked her how she feels about the

"back" space. She said it was uncomfortable. When I asked if she wanted to keep working with it, she said "yes, it increases my range." Way to go, Cathy!

As I moved to BRH, she said "wow." By this time, I surmised that this exclamation means, for her, that it was difficult to see the point. We went through the same process of her telling me when she could not see me. Her eyes moved back and forth from FR to BR, and then when I asked her to find my eyes, she very clearly went to BRH. Now, maybe she could not really see this, but her eyes did the movement twice! That is a good start, yes? When I asked her to do it one more time, she did not. I asked her to turn and look, and she leaned forward and now changed at this point, perhaps in respect of how difficult this side was for her. I was quieter and more encouraging in my tone. We spent some time looking from the RM to the RH on the right side. I assured her that her eyes were moving, and asked if she could feel it. She said she did. She stayed there for several seconds.

This felt like huge progress! It was my turn to say "wow." She smiled at this and said, "The thing I love about this research is that it increases my scope and my abilities." I told her that was my hope for her, and that the work we did in the sessions could translate to everyday life. I gave examples of seeing parts of her bedroom that she did not see before, as it was not the same to see with the peripheral vision. We moved on to BRD, and this was easier for her. I moved from R to BRD. I asked her how she was feeling after a couple of times; she said "it's hard." I continued to validate her struggle by agreeing that it was hard and encouraging her to rest when she needed it.

We then progressed to moving along the whole P1 diagonal from FRH to BLD. It was difficult for me to figure out how I was going to cue her and provide the landmarks she needed. I decided to sit beside her on her "right" and point with my right arm, moving my finger to her

sternum, then changing to my left arm to go to the "back" space. She did not need my cue to finish the path, though! I then asked her to retrograde the pathway, and she did this successfully. Then she successfully moved from FRH to BLD again. I asked her to try to do that path a couple of times on her own. I cued her twice verbally to look "up" at the streamer, and then return to the tomato. She did it directly from FLH to BRD on the first time. Coming to FLH, she hesitated in the mid level. Then going "back," she did a stair-step pattern like she had done before. But she did it!

When I asked her to do it with her own timing, she hesitated while staring at me. She eventually did it twice, moving along the stair-step pattern, but clearly hitting the points. As she moved "back" to front, she did the under-curve.

For the P2 diagonal, FLH was very clear for her. She moved to between R and RD on her attempt to go to BRD. On the second attempt for this diagonal, she leaned forward again on her effort to go to BRD. She turned her head when I cued her. Cathy then stated that this was also good for increasing her field of vision. It was excellent that she was realizing this, and interesting that she said this after working that right side (where she has the deficit). I told her I would love to know if it was really doing that, by using the spatial testing that is available in some research labs or hospitals. I also said that the important thing was that she felt like that is happening for her.

We then moved on to the P3 diagonal. This appeared easier, possibly because I was walking the pathway since I anticipated coming from the back would be more difficult. Now that I am reflecting, it feels like inconsistency in my data, but I remind myself that we have to practice somehow! On the third time, she moved her head in the horizontal from side to side, and her eyes made the pathway. When I asked her to do it without me walking, she did the same

head movement but her eyes moved to see me at FRH. When I dropped to FRD, she followed me.

I then stood at her hardest point of all, BRH, for the P4 diagonal. I asked her to find my face, saying I was "back, right, and high." I told her I could see her trying. Then I asked her to find the tomato at FLD, and she went directly to it. This is why I chose to stand at the most difficult point to find, because I knew she could find the FLD as her easiest point. She did this twice. She appeared to be following my voice. She only turned her head in the horizontal, not inclining on the diagonal axis. I asked her to use the rain-catching image to move her head to the high points. She closed her eyes and did this successfully.

I asked if she was tired, and she said a little bit (I felt tired reviewing the video!). I asked if we could get through one execution of all the diagonals, and she said yes. I reminded her of all the points and pathways. She did one execution of the scale, hitting all the points except for BRH. P1 is a perfect direct path; P2 and P3 she stopped in the middle to see me; P4 she needed more cues to go "high." She said this felt easier than at the beginning of the session.

I then asked her some questions about how she perceived the points, the objects at the points, my verbal cues of saying the points, my pointing, and my walking. I asked if she responded more when I said the names of the objects or gave her the names of the points/directions, and she said both. She also said that it was easier when I pointed to the point while I said both cues. I asked what would happen if I just said "forward, right, high." She said "not much. It's very hard for me to distinguish what that means." She said that it helps to have the objects there to remember the points. Tennis ball and tomato are easier than streamers (because they are definitive objects, perhaps?).

To conclude, I guided her through doing three executions of the scale with her left arm. She did not follow with her eyes, but said she felt each diagonal pull in her body. She said she did not feel a difference when we went to "right" first or "left" first, and she said she could not describe the difference between doing it with her arm and her eyes. She did state that the pathways felt clearest when using both arm and eyes.

We then had some discrepancy in her reports, because I asked her to rate the clarity with eyes, arm, and both. She reports 5, 10, and 5; strange. I did not ask her to clarify. I also asked if perhaps when she moved her arm, her eyes went automatically, and she said "yes," but I could see on the video that this was not the case.

(Whew! That was a lot of information and I was exhausted after watching and taking notes on that video!)

September 10, 2009

Cathy began the session by saying that she was still tired, laughing while saying "chronically." We discussed sleep hygiene. We also talked about her inability to really exert herself physically during the day, so she never really gets physically tired like she did before her strokes when she was running every day. She told me that her sister had bought her an elliptical machine, but that her doctor and physical therapist did not want her to use it yet. She did not practice at home in the two days between sessions.

We began practicing. P1 and P2 were very clear for Cathy in three executions of the pathways. When moving from "left" to "right," she was still doing the "stair-step" pathway. It seemed like she was really trying harder to get the points on the right, and they were subsequently clearer than the previous session. I also practiced the version we began in the

previous session where I helped her move her left arm to refer to the points. When I stood close to her and supported her core with one arm while supporting the arm that was reaching distally, it felt like a joint effort between us. When I held her hand and guided her distally by walking around her, it felt like we were dancing together and I was leading. She loved the stretch the latter version provided.

In four executions of the diagonal scale, I notated that she referred to all of the points successfully. I was very curious to see how the video supported or did not support this data. This also made me think that I should go back and review all of the videos just to get straight-forward, raw data, instead of relying only on my notations during the sessions.

Cathy wanted to start with the right side to challenge herself. I sat beside her at "right" and pointed with my right hand to FRH. When I asked if she saw FRH, she said yes but did not look there. Her next two P1 diagonals were clear.

She saw FLH immediately and also went smoothly to BRD. I told her that even if she was not seeing clearly, her eyes were doing the movement. For the second time, she kept looking at me instead of FLH, so for the third time, I moved to her left side.

For BRH, I reminded her that my face was her cue. I started in front of her, and then moved to BRH. She followed me, and then moved to FLD on her own. Second and third times occurred very clearly with no hesitation.

For BLH, she also needed the visual cue of my face to go "high." When I said "high," she did the movement she usually does for "up" in the dimensional scale, raising her eyebrows and tilting her chin. We tried it two more times; the last time, she was distracted by something on her shirt. While she was still having difficulty turning her head to go to the "back-high" on both sides, she seemed to know where the point was located.

NOTE – we practiced all of the diagonals, doing each one three or four times, in about four minutes. This was speedy! She was fairly clear with each pathway. When I asked which points still felt "murky," she said everything on the right. I asked her if she would like to practice more on the right, or if that would be too exhausting. She said she would like to do that. I reminded her of when we practiced just the front and back areas, and ask if she would like to do the same on the right side. She remembered and agreed to do it.

I explained the points we were going to practice finding (FRH, FRD, BRH, BRD) and I told her that I was imagining that she has strings or poles coming from her core and reaching to those points, anchoring her to them in space. I remembered thinking in the moment that I was giving her such wonderful imagery that I thought would really help her, but as I watched the video, she was looking "down," around her, and scratching her face while I described these images. It seemed that she was not really paying attention to what I was saying, but she said she understood.

When I asked how many times she would like to go to each point, she said two times. I used my face as her cue, standing in front of her and then traveling to FRH. I then stood at FRH, asked her to see the camera and then see me. She had trouble finding straight forward. When I asked her to turn her face to where she could feel the air conditioning (the unit was located behind the camera), she was able to find the point. The second time to FRD, she moved her whole head to the point!

Now to the most difficult points of all…For BRH, I started by having her look to "forward-middle," then look to me at "right," then try to go further to BRH. She looked "down" and around her. I then used the more specific use of my eyes as her cue, placing myself at "right" and moving back to BRH, asking her if she could "stay with me." She said she would try

as she looked "down" and around her, but eventually found my eyes at BRH. I told her to be gentle with herself…but now I am wondering if that was a reminder to myself to be gentle with Cathy. I am struck by how my voice softened and my demeanor changed when I sensed that she was having greater difficulty. There was a moment where I was kneeling by her chair and my face and voice were so "nice." She seemed to respond to this; once again, therapeutic relationship seemed to be aiding in the process.

For BRD, she successfully looked straight ahead. When I asked her to go "down and back and right," she looked "down" and moved her left leg. She eventually found me. On the second try, she was smiling and looked from me at "right" to BRD. I told her that it was good, and she thanked me. She said "I don't feel like I'm doing much." I told her that her eyes did hesitate on the right side, and reminded her of the importance of being gentle with herself. I said that she might consider that her eyes and her vision on this side had possibly, in a sense, atrophied, so she had to be patient in rebuilding them. She agreed, and said that was why she likes the challenge of this work. I assured her that she was doing a great job of "hanging in there."

After the practice on the right, we did the scale with me guiding her left arm. I explained the pathway of the scale, how the starting points of the diagonals go around the top of the cube. She did not follow with her eyes as we did this, but kept them downcast. When I asked, she said she felt the diagonals in her body. When I changed my hold to distal by grasping her hand, she was more apt to follow with her eyes, probably because I (my face) was at the end of her arm and at the point. I told her that I liked that version better, and she said that she did, too. She agreed that it felt like we were dancing.

I asked her how she felt about doing the right side with the right arm (the side with hemi-paresis) and she was willing to try. I insisted that she must tell me if I moved too far. She kept her eyes downcast as we did the scale with me beside her, supporting her core with my left arm and moving her right arm with my right arm. I said that I was hesitant to try the right arm with the distal hold because I felt like I needed the feedback of her core and she needed the support of both of my arms. She was quiet, and then said "I think I can do it." Through this version, she was smiling and said that it felt good. She appeared to really enjoy it, and she looked at me through almost the whole thing (which meant she could be seeing the points). I told her thanks for pushing me, and she said it felt great.

I told her that I would like to make it a goal to do the executions with eyes, left arm, and right arm for every session. She agreed that would be beneficial. The executions with the eyes went as follows:

- First – it really helped her for me to walk around to the points.
- Second – excellent!
- Third – she always smiled when I referred to the visual landmark of the crab at FLD
- Fourth – she went from BRH to FLD without my cue. I actually perceived this as not reaching BRH, so I asked her to do it again. I was asking her to reach higher with her eyes.

I praised her for getting all of the points, and then I explained to her my process of looking at the video to see HOW she was getting to the points. She responded by saying "I'm glad you are enjoying this as much as me." I told her that I loved it and I was even inspired to possibly pursue a PhD after doing this work. I told her that this experience had instilled my desire to continue to do research.

We also practiced the dimensional scale. I asked her if she remembered it, and she did not respond (scratched, looked around, etc.) I explained it and she recalled. I rearranged the objects in the room to reflect the points of the dimensional scale, asking her if she could see them at each placement. We did not have objects at "up" or "back," but she could see the light above her and she closed her eyes for "back." First, we did just the eyes to the "left." I stood at the camera first, cuing her with my hands and voice. She did it almost perfectly, and she said it felt like a 10! I called her Miss Perfect; she even moved her head to look "down" at the crab. Second time was also perfect. (Wow!)

With the arms, left side first, she did not move her eyes. She closed them. She leaned forward for "forward." I told her I could feel her arm releasing as we went along. With the eyes to "right," on the "forward" cue, she smiled. As I asked her to get ready to repeat, she looked "up" without my cue and said "up." Also said "down" when she looked "down."

With the right arm, she used her eyes. It is interesting that when we moved the left arm, her "good" side, she did not use her eyes. When we moved the right arm, she used her eyes to see some of the points. Possibly it was not as clear in the body, so she needed the eyes. I wondered if the diagonal scale was helping her understand the dimensional scale, or if it just seemed really easy after the more complicated spatial pulls. She said that adding the arm helped to clarify the points, and her left side felt clearer than her right side. When she added her eyes to the movement, this felt the best; she said eyes and body together are clearest.

At the end of our time together, she said that the session was fun and challenging.

Cathy was defying my notions that practicing would make her perform better. She was doing a great job even though she said she never does it at home! Although, I had to wonder

how much more improvement I would see if she was doing it at home. I had to remember that I could not control that, and could only encourage her to do it.

September 17, 2009

Cathy was very talkative today! This was a great session filled with so much information from her self-reports. We did six executions of the diagonal scale, but the majority of the session was talking. I followed her lead and did not want to discourage this lovely and productive processing. Marie also participated in the conversation.

She started by saying that this work is helping her in dance/movement therapy (DMT) in the program. She feels more engaged in the groups because she knows the scales now. She stated that she is more familiar with the dimensions and "knows where they are in space." She said her general spatial awareness improvement also makes her feel more aware in the groups during the program.

When I asked how she felt about how the work applied outside of DMT, how familiar she felt with the dimensions in general, she said, "I think I know as well as in DMT." She said that she is able to make adjustments quicker when she is walking and going to the right inadvertently (I referred to this as "listing").

I asked if she feels like her map of her environment has improved, i.e. at home. She said it has not improved. She still struggles with getting around her house, especially with her cane. This could be another case of her feelings about her cane interfering with her ability to report accurately on her spatial awareness.

I wondered aloud if we could translate the work we do in the sessions to her home. I talked about how in the session, we place objects at the points and use them to help her find the

points. She could do the opposite at home, i.e. ask herself, "Where is the lamp?" I asked her and Marie if they would be willing to try the following:

- Try to identify where things are in the living room
- Practice both of the scales
- Try to identify again and see if it is easier

They said they would try. Marie then weighed in about her perception of Cathy's improvement. She said that she believes Cathy is "seeing more side to side, turning her head more often." She reported that Cathy now pays more attention on walks and sees people and things she did not notice before – the neighbor, a flower, etc.

Cathy also asked if I could recommend some stretches since she has such difficulty turning her head. I reminded her of the ones I had given her before and also recommended doing the movements slowly and smaller in many repetitions until she felt that she could do the movements larger.

Cathy also said that she feels her periphery is "opening up."

THEN!!!! She said that she also feels more "easy-going, cooperative, and independent." Marie jumped in and reported a time when Cathy actually stood up from the kitchen table, turned around and walked to the sink, and got her own glass of water. WOW. When I expressed my extreme delight and encouragement, Cathy said, "See all the avenues you have opened up for me?" She continued by saying that since starting this work, she feels more desire to improve herself, to stop fighting the process, and especially to stop fighting with her mother. I wondered aloud if this work and its very specific structure provided a very clear avenue for doing the work she needs to do. It is so simple and straightforward, yet it translates to so many other parts of

life. I provide structure, feedback, and validation constantly in our process. Can she really be applying all of this to life?

I named the metaphor she was referring to – we are working on spatial awareness and widening her literal perspective in a visual and sensual way, and she is feeling the effects psychologically. WOW.

Cathy also said that the good weather is making her feel more energized, and again talked about how badly she wanted to run. I asked about the elliptical machine she mentioned before and she said she understands she cannot do that yet because "I only have one arm." This saddened me greatly, and I commented that she does have two arms, but it does not feel like the right one is there. Was that right? She said yes; it is not in her awareness.

This was a great segue into doing the diagonal scale, and I asked if we could eventually do it with her right arm since we did it with the left arm the session before. She said sure. I wanted to enliven that part of her since she was reporting its absence from her awareness…

We did the scale twice with her eyes first, and she successfully reached all points.

It was very difficult to move Cathy's right arm. I could feel how much tightness she has accrued since not moving it due to her hemiparesis. She is unable to reach to BRD or BRH, but her eyes go there more clearly when she is attempting to move her arm there. She said several times how it felt really good to stretch while moving. I did one execution standing beside her and one holding her hand distally and moving around her.

With her left arm, Cathy did two successful executions of the left diagonal scale with no problems at all. She was still not taking her eyes to the point without my cue, but the arm movement was very clear. Again, she loved the stretching.

This was a great session. All of her reported feelings may be secondary to my research, but they are certainly primary to Cathy and her recovery. I hesitate to say they are "secondary"…because they are so important to the process. I am even more excited about these reports than I am about her actual spatial improvement! I suppose that speaks to the fact that I am her therapist first and a researcher second.

September 22, 2009

Cathy came into the room today and fell when she started to sit down in her chair. She did not hurt herself, but she then just lay there saying she was exhausted. She did not attempt to assist Marie at all when Marie was lifting her off the floor. I wondered if she really was not able to help, or if she was being stubborn (Marie reports that sometimes Cathy refuses to help.) They eventually got her situated in her chair, and everything seemed fine.

We were in a different room for this session. I asked Cathy if she noticed any differences, and she said not really. I said that it felt smaller to me, but she said she did not notice that. There were fewer tables and chairs in the room, the whiteboard and phone were on the opposite side ("left" instead of "right"), and it was about a third smaller. I also did not bring a video disc today, so I could not record the session. I was frustrated with myself for forgetting.

While I was setting up the room with the objects in their places (we had been working with a toy lobster, a pink tub of clay, a green box of tea, and a yellow theraband, along with the pink streamers still at the "high" points), I asked Cathy if it mattered to her where each object was located. Was she memorizing the location of the object to help her remember the point, or were they simply objects to focus on once she reached the point with my guidance? She reported

the latter. She also said "I don't know the difference between right and left, except I am left-handed." I also pointed out that her left side has more movement.

I asked again if anything sparked in her mind when I named the points, i.e. "forward, right, and high," or if she just followed me and my voice. Again, she reported the latter. For the executions of the scale, I decided to do two times with her eyes, two times with her left arm, and two times with her right arm. Also, we started with the left side first. She did the following for each type of execution:

- Eyes – she saw every point both times, except no BRH on the first time.
- Left arm – she still needed my cue to see the points, but referred to every point with her arm. She almost saw BRH, and on the very last point of FRD, she hesitated with her eyes. I noticed she was very open in her shoulder in this session, finding an increase in external rotation. When I did the execution with the distal guidance, she said she felt more of a stretch in her pectoral and trapezius muscles. I asked her to be very adamant about telling me if I was going too far. I told her I felt like I was a kite she is flying.
- Right arm – She did not reach or see BRH or BRD. She did not see FLD on the first time. All other points seemed clear to her. I felt like she had a slight increase in range of motion in the right arm today, and she agreed. I expressed my worry that when I held her arm distally, I felt less sensitive and had to rely on her to tell me if I am going too far. When I supported her by standing closer and keeping a hand on her back, I felt like I had more information from her body (of course).

She reported that the P1 diagonal was clearest in her perception. We then moved into working on the dimensional scale, and apparently I did not take any notes.

At the end, I asked for the scaled report on difficulty/clarity, she said "10!" I reminded her that this meant she felt complete clarity in seeing all of the points, with no areas feeling murky or difficult at all. She said, "Okay, probably a 3." I then asked her if maybe she felt like a "10" because we were so productive and she did so well in this session, and she agreed. I also reminded her that when she came in, she was literally falling down with exhaustion, so it was remarkable that we made so much progress! Her low expectations of herself at the beginning could also contribute to feeling so "ten-like" after doing that much successful work.

September 24, 2009

I planned to follow the same process as the previous session, which was as follows:

- Diagonal scale

  With eyes – two times

  With left arm – two times

  With right arm – two times

- Dimensional scale

  With eyes – two times

  With left arm – two times

  With right arm – two times

I also wanted to have her try doing the scales on her own with her left arm, without me guiding her.

I felt as though I was able to better gauge how and what Cathy could do in terms of exertion. It is interesting to me that it took me until the end of the study to figure this out. However, it has not been that much time that has passed since the beginning of the study, and it

sometimes takes a while to truly observe someone and manifest adjustments based on your observations. I regret now that I never revised my coding sheet to reflect my discoveries and adjustments.

As I pointed to all of the points of the diagonal scale, she followed my pointing with her head. The first execution was quite clear. She still did not look to BRH, but actually looked to "left-middle" at my prompt for BRH. I sang out "I am over here" in a silly way, and she smiled and looked in the general direction of me. She still did not see me or the point. Sometimes she paused between the points of the diagonal. In the second execution, between FRH and BLD, she let out a huge yawn, yet continued to follow the pathway with her head. At BLH, she needed my cue to go to "high" because she only went to the middle level at the first prompt. When I said "higher" she first raised her eyebrows and then looked at me and the point. The same thing happened on the second attempt to look at BRH: she looked to "left-middle" until I said "over here." Cathy's self-report was that this second execution was "okay." Then she said I should ask Marie how much this work had helped her. I reiterated that I appreciated all they had told me so far (recorded in notes from previous session).

Since we did the right side scale with the eyes, I started with right arm instead of left today. Cathy tended to close her eyes or look "down" when I moved her right arm. She needed several prompts to use her eyes, too, and then looked all around before finding the point. She often looked at her moving arm. She said she enjoyed the stretch of me moving her right arm.

The coughing was back! She looked to "left-middle" again on BRH. At the end of this execution, she sat very still for a couple of seconds with her eyes closed, then scratched her head and hair for a while.

I noticed that she was going to the points with her eyes in this execution, but it felt like a smaller kinesphere. I explained the concept of kinesphere again to her, and she said she remembered talking about it before. I wondered if it was because I was closer to her as I gave her the touch cues and verbal prompts, so I tested this hypothesis by standing farther away from her. I verbalized my observation that when I stood farther from her, she moved a little farther out in her kinesphere with her gaze. She said she understood this.

For the second time, I did the distal hold on the right hand. She immediately looked to my face on FRH and smiled. For FLH, I had to say "see me" and then she looked "up." It was the same for BLH. For the deep points, she did well. On BRH, I misspoke, saying "back-left-high" and she promptly raised her eyebrows and moved her head a little to "right." This was the clearest she did this point so far…I corrected my mistake by saying "excuse me, BRH," and she smiled and then went to FLD before I went there.

When I asked if she could feel how she was seeing farther away when I was farther from her, she said "A little bit, yeah." As I made my notes, she sat very still, gazing to FD and "place-deep"…I wondered what she was thinking.

We then began the executions with the left arm. She was very clear on FRH, but needed cue of "eyes, too" on BLD and FRH. On BRD, I could not move to the point because of my proximal hold. She paused and then looked at me, which was "left-middle" for her. I said "that way" and pointed, and she looked to "right-middle." (Getting there!) On BLH, she did not look to the point. FRD required me saying "to the tea (the object there) before she looked. FLD required me saying "do you see him (the lobster)?" before she looked to FLD and said yes.

At the end of this execution, she spread her left hand very wide on her leg, and stared at it…her breathing had deepened. She then closed her eyes and moved her head back a bit.

(Wow. This could indicate that she is feeling more relaxed, comfortable, and emotionally regulated.) For the left arm distal hold, her torso was involved a bit. On BRD, I said "all the way over" and she saw me. On BRH, I said "see me" and she looked! Why was I not cuing her to see me at BLH??? Her eyes were not going, and she was clearly not turning her head. Did I think that because her arm was moving so well that it was okay? Was she fooling me??

I told her that it felt like she was gaining range of motion, so I wondered if the left arm could help her start to feel the space to the right that feels murky. She smiled and said yes as I demonstrated by reaching across my own body.

She was willing to try the left diagonal scale with the left arm with no touch cue, reaching for my hand. FRH was very clear. It was nice to see my gentle touch when she reached me. She dropped her arm as I walked to BRD. At my verbal cue, she first reached to "place-high" with the left arm (this is a very comfortable and oft-repeated movement for her) and then went to "left-middle." I helped her lower her arm by giving her a gentle touch cue.

I asked her to repeat just this P1 diagonal. As she reached to FRH, she involved the torso, and she advanced! When I reviewed the video, I paused and caught a wonderful still of her doing this movement, touching my hand, and smiling. She was clearly making eye contact. (Yea!) She went directly to BRD for the second time. The third time was clear at both points. She kept contact with my fingertips but did the movement on her own. For the next time I said I would follow her, and asked her to move to the streamer at FRH. She looked around a bit, and then went to a point between FRH and FM. Then I said, "Now let's move to that yellow piece of string" and she looked at it first, and then moved the arm. (Wow!). I asked her if she realized that she looked and saw it first, and then went to the point with her arm. She said that she did feel the difference. This was significant because 1.) She was looking at the points first before

she moved her arm, which was different from the executions so far, 2.) She was moving almost entirely on her own with only my fingertips as a light touch cue, rather than me guiding her arm, and 3.) She was aware that she was doing something different. I tried to do the same thing with the FRH, but it was not successful.

She was willing to try the pathway all on her own. She first did the reach to "place-high," and then moved her arm to FRH from there. I said to go straight back to BRD, and she moved quickly in an arc to "left-middle." This was not the exact diagonal, but for her volitional movement, it was pretty impressive. The next time was not successful, in that she repeatedly waved her arm "up" and "down." I encouraged her that she is definitely making change, explaining that the reach to "left" and "down" was different from her habitual movement. As Marie came in, Cathy did the diagonal successfully. I wondered if she was showing off.

There was a very significant moment Cathy went from completely relaxed to reaching directly to FRH! Note that out of all of these practice executions, I notated two successful reaches on the P1 diagonal. I then told her that she could think of this work as re-patterning, and if she could allow herself to be in the mindset of an infant, as though she does not know anything about movement and has to learn. I told her the way she reaches for me reminded me of a baby. I explained how her brain has to rebuild itself in this way. I also told her that I could see and feel her frustration and that it was normal. She smiled and said she understood. I spoke of the paradox and the dichotomy of knowing and not knowing.

After that, we moved on to the dimensional scale. I repositioned the objects. She successfully looked to all the points two times! She continued to wave her left arm "up" and "down" a few times, and I asked her if it felt like she had activated it now after all that work. She said yes. I reminded her not to restrict herself if she felt like she wanted to move it.

As we went to moving the right arm, she did the close-kinesphere focus again, and said that it felt great to stretch. I had to remind her to use her eyes too. This time as we completed the scale, I said "excellent" and she said "thank you." She usually did not reply to my compliments and encouragements, so this was a different response. With the left arm, on the "forward" cue, she leaned forward in her chair.

When we moved on to her doing the dimensional scale on her own with her left arm, "up" to "place-high" was very clear, even with her eyes. She did not just raise her eyebrows this time. She expressed dismay at not getting to "place-deep." On the cue for "right," she hesitated, then said, "Right…" and reached across her midline to her right forearm! "Left" was direct and quick. "Back" made her just look "down."

On the second execution, she did the same thing for "right," and also leaned forward. For "left," she reached "up" a couple of times, but then reached "left" when she looked at me. I reassured her that since she was sitting forward and then leaning back for "back" she does seem to understand how to move "back."

I asked her if there was anything else she wanted to do, anything that did not feel clear, etc.; she said "not really." She then asked if there was something I wanted her to do. I replied that she had only done the improvisation a couple of times, and did that feel productive at all? She said that she liked it, and that she would try it again. I told her that any of the points in the diagonals or the dimensions were included in her options.

This was her improvisational movement: PH with left arm, R with head/eyes, FLD with eyes, FLD-R/FLD-R/FLD-R with eyes (in succession), PD, and F, left leg kick. She then smiled – spreading in the horizontal! - and closed her eyes (could that be considered "back?") Wow, she loves music! At the end, she laughed and said it was so funny. She was a bit distracted by

the earphone falling out a couple of times. I asked her what it was like, and she said fun. I asked if it was weird to have someone watching her. She replied "a little bit."

On the scale of 0-10, she reported the day was a six. I reminded her that on Tuesday, she had literally been falling down. When I asked if there was anything else she wanted to say, she said it felt smoother. I also asked what it was like for her to reach to the diagonals by herself, and she said she liked it. I tried giving her some words – scary, exhilarating, confusing – and she said no, it felt good. I told her that I felt the session was the clearest of all, since we did not "practice" at all, but went straight into the scales. This video was 33 minutes long!

September 30, 2009

I was waiting quite a long time for Cathy in the session room before she arrived. I saw her earlier and thought we were right on time as I was leaving the program area, but she had to go to the restroom after that and ended up being very late. We jumped right in and started with the plan for the day, which was as follows:

- Diagonal scale

  Right side two times with eyes

  Right side three times with arm
- Repeat on the left side
- Dimensional scale

  Once with eyes

  Five times with the right arm

  Five times with the left arm

Since we only had twenty minutes to work, we did not get to all of that. Our session was the following:

- Diagonal scale

  Right side two times with eyes

  Right side two times with arm

- Diagonal scale

  Left side once with eyes

  Left side twice with arm (distal hold cue)

  Left side once by herself with the arm.

- Dimensional scale

  Right side once with eyes

  Right side once with arm

  Left side once with eyes

  Left side once with arm

  Left side once by herself with arm.

I have to admit that I was frustrated that our time was cut short, especially since this was the last day. I wondered if Cathy was avoiding the session for that very reason. I briefly mentioned that it was our last time working on the scales (spatial awareness testing to occur next session), and how much I appreciated her hard work through the research period. She said again that she was grateful to have been working with me.

At the beginning of the video, I made a joke about her smiling for the camera. She always did that. As we started the right side diagonal scale with the eyes, she was already looking at her first point (FRH) because I was talking from that place and she was looking and

listening. As I named the point, she said yes, and raised her chin slightly as if to emphasize the point. As she looked to BLD, she stopped at "forward-middle" and then clearly turned her head to see the point. She went directly to FLH, and then actually followed the path along the diagonal to BRD! After my "good" and a bit of a pause (I had already moved on to BLH), she said, "That's a hard one." I agreed and she said "yes" again. As I named BLH, she said "wow." I think she was saying that because she turned completely and looked at the point. I am not sure why I did not ask her if that was true. She then went directly to FRD.

For BRH, she turned her head again to "left" as she had been doing in previous sessions, even though she had already followed me to the point. It is interesting how that verbal cue is working for her. I said "I'm over here" and she looked briefly at BRH before looking to FLD without my cue. I told her that even though the BRH was hardest, she always remembered to go to the lobster at FLD. As I said this, she said simultaneously "the diagonal." Wow. As we started the second time with her eyes, I misnamed FRH as FLH. I corrected myself and she said "I was gonna say, I don't think that is right." WOW. I told her she was starting to know the points, and she agreed. This execution was perhaps her best one yet. She hit all of the points! She did a smooth path from FLH to BRD, and even turned her head without me prompting her. I told her this was "good with the head." BLH took an "I'm over here" prompt from me, but was clear and then she did a smooth path along the diagonal to FRD. BRH was not preceded by a look to "left" this time, and she even used her eyes more when I said "Up to the right." She did not anticipate FLD this time.

We did the first execution with the arm with the proximal hold. She did not close her eyes this time, and instead watched her arm and hand move. When I encouraged her to use her eyes, she looked "up" and "down" her arm. She still said that she liked the stretch. For BLH, I

told her to look back at the scarf, and her eyes went immediately to the point. She said, "Now I see it."

As we finished, I told her that the fact that she kept her eyes open and also saw some of the points was very different from when we started doing this. This was the ensuing conversation:

C - "That's good because my sister got very upset with me the other day."

K - "For not looking?"

C – "Yes"

K – What did she say?

c - She said she is not going to take me anymore

K – Take you where?

C – Anywhere.

K – How'd you feel about that?

C – I…I felt bad.

K – Did you tell her about our work? Which sister was it?

C – Mindy.

K – What did she say? She knows about our work

c – She said it's not working. It's not enough. Do more.

K – Wow. *pause* I really don't have a response to that.

C – I know because I think I am working as hard as I can.

K – Does she think you should be practicing more at home maybe?

C – Maybe.

K – But again, that's, you know, you are here all day, and you have a lot of appointments…it's if you can fit it in…I think, um…do you want my feedback?

C – Yes

K – I think that maybe it would be a matter of trying to apply this even just in everyday activities, like when Marie was saying you were noticing more things on your walk.

C – Yes.

K – Instead of thinking that it's another daunting thing that you have to do.

C – Yes

K – Just always reminding yourself to look around more.

C – I look at flowers.

K – Exactly. And while you are seeing everyday objects like flowers, just saying to yourself, you know, those flowers are to my right, or those flowers are ahead of me. Just starting to think in terms of "space." Which is also tiring!

C – Yes

K – But that might be a better way for you to start to integrate.

C – OK

K – And you know your progress better than anyone else

C – Yeah but I don't feel like I'm making any progress.

K – At all?

C – Very little

K – Last week you said you felt like you were making tons of progress. Do you remember?

C – Yes

K - This kind of work takes a lot of time. You have to be patient.

C – Yes (coughing)

K – Which can be, again, another thing that is hard to do. I hope you can work it out with Mindy. That is difficult…to feel that you are not getting support. And I can see how she might be feeling frustrated, too.

C – She is very impatient. And I'm impatient with myself.

K – I know….well, you know what? I have a lot of patience, so…if that can help you at all…

C – Any secrets?

K – No, I just mean in this process. I can have enough patience for both of us, for now (What did I mean by that? It was our last session!) if you can let that happen. What do you think?

C – I would like to try.

K – Secrets? I don't have anything. If anything, I can relate to you because I am also impatient with myself. I can be really patient with you, but when it comes to my own processes, I understand how it feels to want to see results quickly. It's almost like a mantra –

C – Yes

K – Constantly saying to yourself, just be patient, just be patient. And this work is not a cure or a fix-it, it's just a…and we will be finished next week.

C – Really?

K – Yes, and I wish it weren't so.

C – Me, too.

K – But I feel like this is work you can continue on your own. And knowing that the end is coming can help you prepare. I don't have any secrets to share, but I think you are doing well. Shall we continue?

C – Sure.

We did the second time with distal hold. All points were clear except the BR ones. Her eyes were very clear, and I told her so. She said she got good sleep last night. As we started the left side, she was scratching her left eye. She looked very clearly at all of the points. On my coding sheet, I gave her a check-minus for BRH, yet it was one of the clearest on the video. She was no longer doing as much of the stair-step pattern that was so common at the beginning of the diagonal scale study.

I told her that for the left side, since she always did this one really well, we would do two executions with distal hold and one execution on her own. She was moving her torso a bit on this side. She looked to all the points, but her gaze was delayed, going after the arm went there (almost a full second). If I could continue the study, I would have her looking first before I helped her move her arm. Going from FLD to BLH, I said I felt her move before I did.

For the execution on her own, I reminded her that she was going to reach for my hands. FLH was very clear. For BLD, she hesitated, lifting her hand and letting it drop a couple of times. It almost seemed like she understood the "down" part, but could not get the "back" part. She then reached to BLH, and I gave her a touch cue at her fingertips to move "down." When I asked if she could feel how it was lower, she said "yes, it feels great." She returned to neutral with her hand on her lap, and I asked to try again. She said yes, and she went almost directly to it. This time was exceptional because she looked first! It was a split second difference, but she definitely moved her eyes before her arm.

For BRH, I asked her to see me first and reach for my hands. She remained with her eyes on me and reached to FH. I then lightly touched her fingertips to move her to BRH. Her elbow was up to the ceiling, causing her arm to externally rotate, almost as if she were arcing to RH, so I asked her to drop her elbow. She needed the touch cue for that, too. As I asked her to move to

FLD, she went to it immediately, and then quickly came back to neutral with her left hand on her left leg. I told her she had it, and she reached again, this time with advancing in the torso! I encouraged her by saying, "Yeah, you can move the body too." BLH was near perfect. As she saw me and reached for my hand, it became clearer. The FRD cue resulted in hesitation. She then looked to BLH and followed a perfect diagonal to FRD with her eyes. WOW! I asked her to do the same with the hand. As she went to cross the midline, she immediately reached for her right arm and tried to lift it, saying "ow." This is interesting since this was not the cue, but possibly was something patterned as a habit. We tried the diagonal again. BLH was beautiful, and then as I said "go right to FRD." She did it! She had a nose scratch in-between, but she did it. She even advanced in the torso.

We moved on to the dimensional scale. I repositioned the items in the room, reminding her that these were the "straight-across" pathways. I asked her if she remembered the dimensions, but did not ask her to name them. I named them for her, saying "up and down," "right and left," and "forward and back." She did some movements as I said them, lifting her arm, then looking "right" and "left" while smoothing her hair, then smiling for "forward," and then closing her eyes for "back." I stood in front of her and named what items were at what point and she also looked at them all. (Why did I choose not to go to the points for her to see me?) When she looked "right" and "left," she smoothed her hair again. She also tried to reach across with her left arm to "right."

When we did the execution with the right arm, she kept her eyes mostly closed.

When we started the left side, she lifted the left arm to "place-high" very clearly. When I said "down," she reached "down" between her legs, something she has not done before. She also

looked “down.” She smoothed her hair again for “left” to “right.” She smiled again on the “forward” cue, and tightly closed her eyes for “back.”

When we moved on to the left arm, I guided her first. She used her eyes with this arm. She did not see all the points, but kept her eyes open the whole time. She saw “left” and “right” because I cued her.

When she moved on to do the scale on her own, “up” is very clear. I helped her reach past her leg for “down,” saying it was like picking something up off the floor. “Left” required me saying “reach for me.” I told her that for “right” she had to cross the midline. She looked back and forth from her arm to me. I told her to reach for my hand. She did not move, but looked to “right-deep.” She seemed to be thinking. I told her I had something she wanted in my hand, maybe a piece of salmon. She said “yum” and then reached for her right arm and picked it up. Again, is this a patterned habit?

For “forward,” she reached to “forward-high.” I asked her to reach for my hand. I was very persistent with my own reaching, and I twiddled my fingers. I also continued to ask her, “Can you reach me?” She finally made contact with my fingers and I said “good.” I asked her if she could feel how far she was reaching on her own; she said “yes.”

Appendix F

Diagram of Human Brain

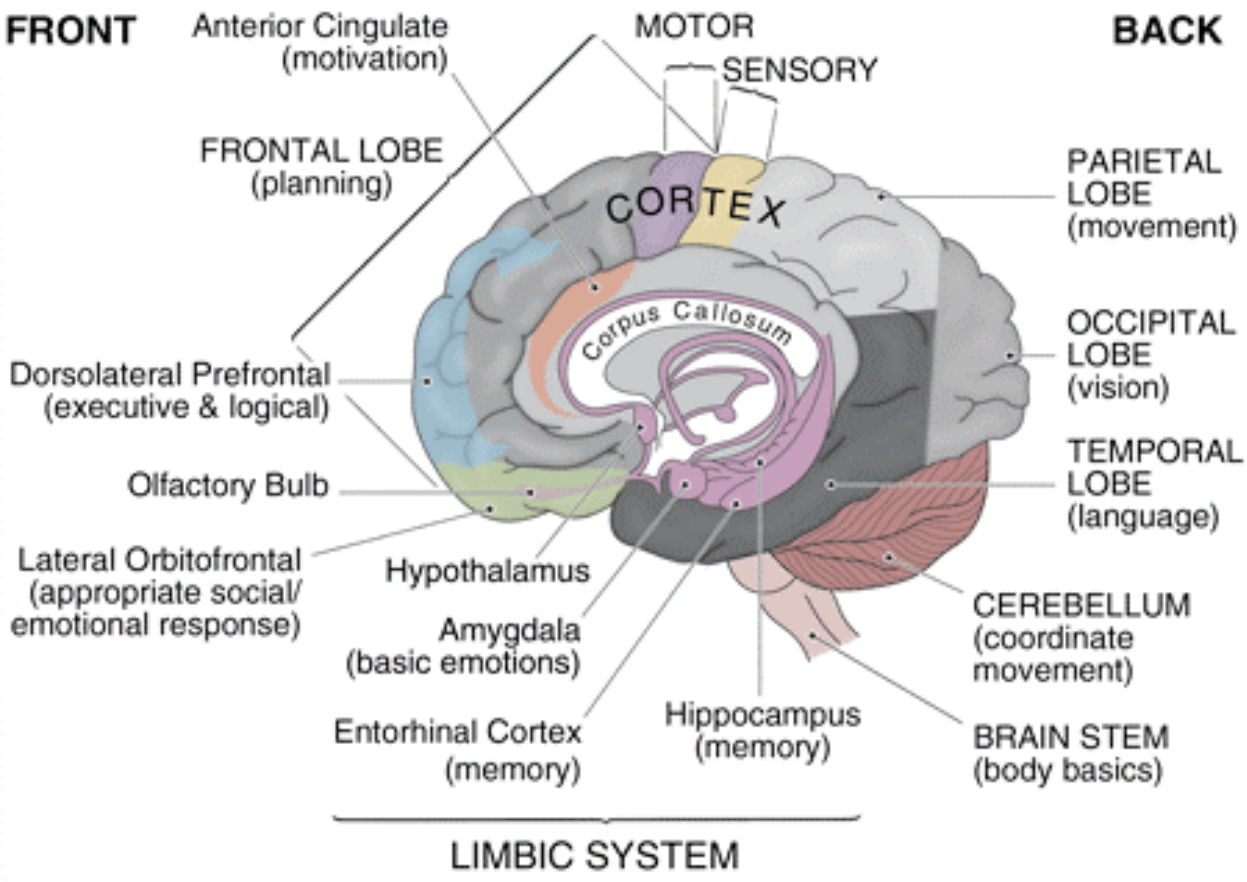


Figure 16. Diagram of Human Brain (Gamon & Bragdon, 2003)