UNIVERSITY OF CALGARY

# Brain Injury, Memory and Learning

by

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A THESIS

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## Abstract

This study explores teaching brain injured students by asking the question: What effect does dramatic visual imagery have on memory and the learning process of the brain injured student? The students at the Life Skills Program for the Brain Injured, serve as good examples of the diversity of individuals suffering from brain injuries. A qualitative, ethnographic approach will be used.

The study includes an exploration of the fields of psychology, neuro-psychology, and biology with a view of how they contribute to the field of teaching brain injured students. I offer a glimpse into the classroom and the facility, as a whole, to provide a better understanding of what teachers face as part of their work in a predominately medical based field. Observations of the brain injured students help to show the challenges encountered by these students, not only academically as they try to rebuild their lives, but socially as well.

The knowledge that can be gained from the study of these individuals can be of enormous value to our understanding of memory and the learning process as it applies to brain injury. The use of an emotion laden curriculum such as dramatic films, novels and daily current event readings, have a substantial impact on memory retrieval for the brain injured student. This in turn, allows the brain injured student to achieve higher levels of academic progress, the key to regaining their personal impowerment and independence.

## Dedication

I would like to dedicate this paper to my parents, Lorne and Elaine, who always encouraged me to pursue my dreams, to Nancy for all her love and support, and to the students of the Life Skills Program who made me a better person.

## Introduction

In order to understand the theme of this paper, visual imagery, memory, and learning, I would like to explain how I approached this thesis. I have worked in the field of brain injury as a front line teacher and researcher for nearly ten years. Unlike most rehabilitation work, I taught a group of students a regular curriculum, if somewhat modified at different grade levels depending on their educational level. The mandate of the program I worked at was to have these brain injured, young adults achieve functional academic levels in math and language arts at the grade nine level. As you read the paper, you will see that many students were able to reach this and beyond, while others struggled. Why this occurred, and my search to understand learning and memory is at the core of the research topic.

It is also important to note that nearly one half million people a year in North America have serious accidents that result in brain damage. (Will, 1995). Fifty thousand of those are in Canada alone. Ten years ago, nearly all of those survivors would have died. The medical technology has grown in leaps and bounds in the past decade. As a result, the educational component for relearning is nearly nonexistent because there was no need for that type of rehabilitation. Rehabilitation consisted of physical therapy and special education cognitive rehabilitation. Indeed, to this day, special education is aimed at elementary based teachers with training in behavior modification. That type of intervention for brain injured survivors is of little value, as you will see in this paper. The study of brain injured survivors also gives us a unique

glimpse into how the brain and mind work. As well, the classroom allows a more natural environment to observe information from rather than a clinical facility. The students in the Life Skills class are there from six months to two years, learning and sharing information with one another under the supervision of a teacher, not a research scientist.

The thesis is a qualitative, ethnographic approach. As a teacher, I was the participant observer. I was observing the academic upgrading of the students in the classroom, which included mathematics, language arts, and social studies. I was also observing the students to see what impact the learning practices had on memory as well as the overall self image, motivation and "healing" of the brain injured student. Healing refers to recovering memory together with the positive awareness of the psychological and the social self. Qualitative researchers are philosophers in the "universal sense in which all human beings are guided by highly abstract principles." (Bateson, 1972, p.320).

I use a narrative approach to the thesis, which allows a deconstruction of a traditional quantitative approach, predominant in much of the literature regarding brain injury. The stories these men and women experience combine numerous aspects of the qualitative approach: ontological, the nature of humans and the reality of the world; epistemology, the relationship between the inquirer and the known; and finally, methodology, how we know the world and gain knowledge from it. (Denzin, Lincoln, 1994, p.13).

It is important to understand that the representations of the events I present are very emotional and dramatic. That is because the very nature of this field is emotionally driven. The lives of these people have been tragically altered. They are in the process of coming to terms with themselves and the world after their accidents. Through the narratives in this thesis, I am in effect presenting in part, the oral histories of these students. It is not by interviewing them for their perspectives, but by playing an active role as a teacher and observing these students that allows for experiences to be conveyed. "Knowing and understanding the specific nature of someone's abilities and difficulties is critical to good long-term planning and adjustment. This is especially true for people with brain injuries." (Pepping, 1998, pg.57).

By using dramatic narratives, I am able to show how the student reacts to his circumstances, and how the teacher needs to understand and relate to them as unique individuals. This is tied in with classroom participant observation, and therefore, a qualitative, ethnographic approach was the most appropriate method.

The qualitative ethnographic research approach is, by definition, the viewing of a group of individuals in a society or in this case, a micro-culture. It also allows comprehension and explanation of the individuals and the social group's processes of learning and memory. (Denzin, Lincoln, 1994, p.23). The brain injured in the classroom are a unique group of persons in society, and each of the individuals in the group is unique. Each injury is different for each person, as their own unique stories demonstrate. The teaching strategy of using dramatic visual imagery is one method

that allows the students to relate and respond to the imaginative creations presented to them. This shared experience has a profound effect on memory. "As the filters through which experience is shaped and given meaning, we might find that fictive forms or strategies could enlarge the appeal, understandability and possibly even the authenticity of empirical work." (Zeller, 1987, p.91).

It is also important to emphasize that the gathering of the participant observational data and the analysis of the data will be interpretive by nature. To be more precise, it will touch on the interpretive process. As discussed by philosophers Heidegger and Gadamer, we can only offer interpretations, not black and white explanations of individuals or events. This concerns ontology (being) and that the individual's story, as part of the social collective, is unique, and defies reductionism. (Taylor, 1987, p.75). Yet the medical based information in this thesis, does point out the sameness we all share on a biological level, and that is where the interesting dichotomy takes place.

Perhaps the single most important facet of working with brain injured individuals, is the realization of just how badly memory is affected by an injury to the brain. Memory is what defines us as individuals and that raises the basis of who you are. The complexity of how memory works has perplexed philosophers for centuries and modern science for decades. "The nature of memory is not rightly understood if it is regarded as merely a general talent or capacity." (Gadamer, 1997, p.15). It is memory that, due to damage of the brain, needs to find alternative or new pathways for

learning. It is the teacher who is the facilitator in this process. Having a student memorize does not mean memory, as a process, is functioning. The complexity of the personality and the unique experiences of the individual are woven into one's memory, and the ability to learn allows the person to grow.

In summary, the overall guiding framework for this study is qualitative, and ethnographic. The research question is, "What effect does dramatic visual imagery have on memory and the learning process?" The study focuses on participant observation of the classroom curriculum activities and their effect on brain injured students' memories.

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## Chapter One

## The Walking Wounded, Brain Injury Stories

The walking wounded is a term often used to refer to brain injured individuals. The following narratives are good examples of what occurs after a brain injury.

"In many ways, I feel like that ancient mariner: there is an albatross around my neck too. When I began recovering from my accident, it would hang in front of my legs, tripping me up when I tried to more forward. I would fall, both metaphorically and literally. I often stumbled and hurt my self. To this day, I still bear some emotional and physical scars. The early stages of my recovery were the most difficult: sometimes the pain was overwhelming. I had not asked for this punishment, nor did I deserve it. I could not understand. I might have broken down completely - but I had forgotten how to cry. I did not know what to do or where to go. Could this be life?" (Blanche, 1998, pg.70).

"After the accident my major deficit physically was not being able to walk, due to the loss of the use of my left side as well as weakness in my right side. Talking was a real chore for me, and my short-term memory was far below normal.

As time went on I left the rehabilitation centre, I still had a lot of frustrations and a low-tolerance level, even though I could not see this

> or admit to it. But, this has greatly improved as I have had to learn how to handle certain situations differently and to adjust and cope with them. The key words are 'trying to accept my new life'. This so-called "new me." (Ottewell, 1998, p.23).

These two stories are all too typical of what occurs to individuals' sense of identity after a brain injury. They are also stories that effect me as well. As a teacher working with brain injured students, the problems facing these individuals are not just academic by nature. Teaching these students requires that you constantly take into account the physical, psychological and social problems they face every day.

There are no support services for teachers working in this field as of this writing, no principals or teachers with special training to assist in dealing with the problems facing these students or the teacher. The few teachers working in this new field work in predominately medical facilities with nurses, aids, and physical therapists. Even the internet only offers the medical perspective on brain injury. I have tried many times in graduate studies to share my stories with teachers and professors, to get feedback and ideas. Usually, I get a frightened face looking back at me. Working with the dead brought back to life will do that. That is what the stories starting this chapter are about, defeating death and coming back. But they've changed, and it is the teacher they often look to for help. Except to help, teachers need to understand these student's new lives. The obstacles that affect learning and rebuilding their lives are self-image and memory.

I think most teachers can help with self image. Knowledge is a great ego booster. But memory, that is a whole different story. I needed to find out what it was, and how it works. Most importantly, I needed to learn what effect a brain injury had on memory.

Acquired Brain Injury

A brain injury occurs when the tissue of the brain is damaged or is unable to function properly. (Higenbottam, 1998). Any traumatic injury such as vehicle accidents, falls, sport injuries, can cause a brain injury. However, loss of blood to the brain or 'stroke' is also responsible for a great many brain injuries. Tumors, drug overdoses, lack of oxygen, and infections to the brain also result in brain injury.

It is the damage to the brain tissue which can affect memory. Memory is not isolated in only one area of the brain, so much depends on the extent and location of the injury. Also, the ability to think and reason, the senses, and the physical and emotional elements of the individual can also be effected. Each injury is as unique in many respects as the individual afflicted. This creates numerous obstacles for the teacher.

Much has been said about Alzheimer's disease in recent years. I have been asked numerous times that if Alzheimer's affects memory, are there similarities between it and brain injury. The memory difficulties are similar in some brain injured students and Alzheimer's survivors. Alzheimer's attacks the brain in the temporal lobe, then spreads into the neocortex. (Martin, 1994). This causes all aspects of

memory to be effected. A brain injury is usually damage to a specific area, affecting only some elements of memory. A global brain injury, where the brain is injured in nearly all areas is more similar. However, the biggest difference is that Alzheimer's is a disease. Its attack is slow and methodical, while a traumatic brain injury is fast and immediate. The brain injured person is often able to find ways of working around the damaged area through educational upgrading and counselling. Alzheimer's continues its relentless attack, making it far more difficult to treat.

The most devastating element of an attack or damage to the brain is the loss of memory. Having a student remember something is absolutely critical to learning. To understand how the memory process works is important in that it can allow teachers to create and modify curriculum to suit the students' needs. The participant observations and narrative format used in this thesis are utilized to help shed light on the complexity of memory.

## Chapter Two

### The Qualitative Ethnographic Approach

"Ethnography is the art and science of describing a group or culture". (Fetterman, 1989, p.11). The brain injured students observed as a social group for this study are indicative of the growing population afflicted by a brain injury. This classroom is a micro-culture, in that it represents the much larger culture of brain injured individuals in society. By studying and giving voice to this group through participant observation, personal narrative, student narrative, and external narrative sources, the ethnographic approach becomes focused for this micro-culture. The result is a personal journey as a teacher that allows a glimpse into the complexity of teaching these individuals.

The brain injured students, through participant observation in this thesis, helps to give voice to their experiences. The narratives presented allow their experiences to be educationally meaningful to teachers and the students. In turn, strategies regarding curriculum development in dealing with memory disorders can be better formulated and understood, based on these stories and experiences.

The ethnographic approach assumes an holistic outlook when dealing with a social group. The description includes history, politics, and environmental factors that may affect the group. That is why it is necessary to include areas such as brain biology, psychology, and neuro-psychology. In order to give a detailed account of the educational problem at hand, the data from each subject is contextualized.

**The Philosophical Aspects of an Ethnographic Approach**

To understand what a brain injured person's life is like is a daunting task. An interpretive approach to another person's experiences seems to fall under the post-modernist paradigm. This refers to the idea in the process of interpretation that there can be no "right" or all-knowing way to view knowledge. Elements of life can be better understood within its particular social context. (Richardson, 1994).

The way in which the researcher interprets what is observed is key to understanding the link between interpretation and pedagogy. The participant observation is based on viewing the impact of artistic and emotional curriculum (film) upon brain injured students. Noting the observable events, and writing them in an interpretive manner does not necessarily mean facts are ignored. Ethnography blends many disciplines and styles. The dramatic and emotional scenes I convey by using narratives, allow the human elements of brain injury to be understood as opposed to the purely scientific approach.

"To recognize the poetic dimensions of ethnography does not require that one give up facts and accurate accounting for the supposed free play of poetry. 'Poetry' is not limited to romantic or modernist subjectivism: it can be historical, precise, objective. And of course it is just as conventional and institutionally determined as 'prose'. Ethnography is hybrid textual activity: it transverses genres and disciplines." (Clifford, 1985, pg.26).

The sometimes narrow views of schooling and education based on traditional

methodological controls used to measure success such as purely quantitative approaches, are changing. The post modern era is allowing teachers to question the pre-conceived notions of truth and knowledge. Hans-Georg Gadamer talks about genuine speaking. This refers to each event having something to say, not based on pre-arranged signals. (Gadamer, 1997). "Words that connect with other people is the universal human task. This is the hermeneutic circle that educators must enter in the post-modern era." (Slattery, 1995, p.112). The brain injured micro-culture allows us to explore the human condition. Individuality, belonging, and a sense of hope for the future are made even more aware as seen through the lives of these individuals.

The complexity of individuality often throws up barriers between student and teacher. The brain injured student has even more obstacles preventing him from receiving or conveying meaning. I found that human emotion is a great tool to use in breaking down barriers between individuals. The use of artistic expression is perhaps the best ally of all. "In the end, works or art are the only media of complete and unhindered communication between man and man that can occur in a world full of gulfs and walls that limit community of experience." (Dewey, 1934, p.209).

**The Possibilities and Limits of Ethnography**

The stories that are brought froward in this thesis are used to convey the experiences of brain injured students. The ethnographic approach of the micro-culture allows the stories of the brain injured to respond to a key question: What has changed for you since your accident? By the participant observation of the students, a better

account of experiences, events, and outcomes can be described and understood because the participant observer is part of the action in the classroom.

To best understand the experiences of my students, I have used both descriptive and explanatory techniques. The description of the brain function and brain damage help to explain the biological and theoretical influences on the individual's life changes. The narrative observations of student experiences help to show how these changes impact on the student's social and academic life. The stories, in other words, do not stand alone, but are linked to events influencing the narrative. "If description deals with what is, interpretation focuses upon why or how." (Eisner, 1991, p.98).

The limits of the ethnographic approach result when generalizations are made of the brain injured students. However, the basic observational data does have implications for further educational applications. Knowledge of one situation may lead to a new perspective of another situation.

**Rationale for Choosing an Ethnographic Approach**

The role of teacher in the field of brain injury is a new one. To convey to others in the educational field what I experienced and taught, I chose an ethnographic approach. It was selected to describe a detailed, but very human account of teaching brain injured students. (Janesick, 1994).

By participant observation and in the narrative derived from the researchers' observations, conveyed the student's situation, experiences, and classroom performance. This way, the use of dramatic visual imagery's impact on memory and

learning can be better understood. The loss of memory has significantly taken away much of the previous life experiences. Therefore, participant observation of the students would be more appropriate than delving into the student's past through interviews of pre-injury events. So much had changed for the student, that new avenues of learning would have to be explored. Academic performance prior to injury is often slow in returning, which indicates long-term memories can be effected as well. Here is an example of the dilemma the individual faces often after a brain injury.

"As a result of my accident, my old self died and was replaced by a new self. I underwent what I refer to as a 'change of self'. This concept is difficult to seize, even for the person who undergoes the change. Every thing I know how to do today I have learned at least twice. I had grown to a nearly mature eighteen-year-old, died as a result of the brain injury, and was reborn. I had to learn again all of those things I already knew, as well as grow to be a man." (Blanche, 1998, p.71).

## The Process of Ethnography

The process of ethnography does not have a formal theoretical framework. (Atkinson, 1994). However, the process does come about from the researcher's goal. The observations and narratives influence the inquiry and the borders of the study become set as the lives and situations of the participants unfold.

### The Participants

To avoid the assumption that a particular group of individuals are alike, I have chosen key individuals at the Life Skills Program to show its diversity. These students

and their stories reflect the wide range of individuals who suffer from brain injuries. Included are teachers, police officers, oil rig workers, and truck drivers. The diverse educational backgrounds of these participants shows the range of previous knowledge that exists in this type of a classroom. The teacher may have half of the class at a current grade eight level in math, for example. Yet, of the students in this group, half again may have post secondary education. These students not only have the difficulty in relearning, but often suffer from depression and poor self image as a result of their current academic standing.

I also chose the participants to show the diverse employment backgrounds. This helps to show the range of brain injury in the workplace and what life experiences are available in this classroom to draw from.

The family network of the selected participants in touched upon as well. This shows the scope of those touched by the individuals brain injury, particularly spouses and children. This is important for teachers to understand as family support, or the lack of, can impact the learning process.

Data Collection

When the research question seeks descriptive data about its effect on the participants, it is the observations and interpretations that are key to the ethnographic method. As a researcher, any values, biases, and ideological views interject with the data interpretation. (Atkinson, 1994). This, of course, has an impact on the interpretation of the narrative account. Also, as a teacher I was an active participant in

the classroom, not just an observer. I chose the films and readings to present to the students. The acknowledgment of my subjectivity and interpretive views are assumed as it relates to the social micro-culture.

Data Analysis

The observations and narrative accounts of the students describe human actions in a specific cultural setting, in this case, brain injured students in the classroom. The participant observations and actions convey meaning to the educational curriculum being offered. The interpretation of the educational process allows a plausible account about its impact on the individual's life. "Above all, it is of considerable importance that we do not lose sight of what has hitherto been the goal of ethnographic research, namely, the production of knowledge." (Atkinson, 1994, p.254). From this knowledge, greater understanding of the social context of the brain injured student in the classroom can be better appreciated. This, in turn allows a clearer understanding of why an emotional, visual based curriculum was used.

## Chapter Three

## Childhood's End

We had the sky, up there, all speckled with stars, and we used to lay on our backs and look up at them, and discuss about whether they was made, or only just happened.

- Mark Twain, Huckleberry Finn

If only youth knew, if only age could.

- Henri Estienne

To understand how important memory is to all of us, it is necessary to look at the different types of memory. Memory can be broken down into three separate stages. The first type of memory is immediate memory, also referred to as sensory memory. This allows temporary storage of sensory information that bombards you daily. The duration of retaining this information is about one or two seconds. (Springer, 1998, p.206).

The second type of memory is short-term memory. Information that is of particular relevance at the time, is processed and retained for about one to two minutes.

The third type is long-term memory. This is relatively permanent storage of information, and works in conjunction with short-term memory to determine what is relevant to retain by the person. (Springer, 1998, p.206).

These basic forms of memory also link with parts of the memory system of the

brain, known as implicit and explicit systems. The implicit memory system is linked with unconscious conditioning systems that allow you to realize that fire, for example, can hurt you. The emotion of fear is an "emotional memory". The explicit memory system works as a "memory of an emotion", and is linked with many memory systems, not just one. (Cohen, 1980, p.207-209).

These emotional memories, I believe, have a tremendous impact on the ability to remember and learn from.

I would like to share an emotional experience that has been stored in my long term memory since I was ten years old. I had many previous views of life altered by this experience of going to a particular movie. This in turn, opened the doors for me to the world of the arts and how much impact the dramatic forms of expression can have on a person. The emotional art form effects memory which allows the person to remember, and to learn from the memory, "We remember what we understand; we understand only what we pay attention to; we pay attention to what we want." (Bolles, 1988, p.23). When emotion is aroused, attention leads to understanding and insight.

The film I begged my mother to go alone to see was "The War of the Worlds", showing at the Tivoli Theatre downtown. I can remember other events that day as clearly as the film itself. A testament, I believe, to the effect of emotion on memory. This story shows how memory is retained, and how dramatic visuals can effect the openness to look at things differently and learn. I now take you back to the summer of 1967.

For me, one of my most vivid memories began on a hot and cloudless day in July. I had recently turned ten and was about to go and do the ritual that all my friends and I did throughout the summer weekends during the sixties, go to the movies.

The Calgary Stampede was on as well and we all loved to go to the grounds and eat spun sugar and watered down pop, and then ride on the midway rides until your money or your stomach ran out. However, we all agreed that Kids Day was best since you got in for free and you would have more money to spend on everything else os going to the movies was the agreed upon option that day.

I remember lying on the front room floor, the paper splattered out in front of me. I turned to the theatre section, my eye drifting down the still images of the current releases, past the adult section, rats. Back then, most theaters had Saturday matinees for kids, so you had a pretty good choice. The Capital, the Grand, the Strand, and the Palace, all offered kids two hours of peace. My favorite theater, though, was the Tivoli on Fourth Street, the " mecca" for kids.

The Tivoli was not the fanciest theater in the city but it was easy to get to, one bus, no transfer, it had a pretty big screen, and best of all, it was the cheapest. Fifty cents got you in and you got to see one feature and two cartoons (always Warner Brothers classics) or two features and no cartoons. How could you lose? If you could scrape up another twenty-five cents, you could buy a pop and a chocolate bar. Who says there is no Heaven on Earth?

That day, I had planned on going with my best friends, Steve and Ken, the

Dawsons and Donny. We were inseparable, the four musketeers, the four stooges, the four - , well you get the idea. That day however, the Dawson brothers couldn't go, they had relatives or something in town, and Donny was going shopping with his Mom for clothes, poor sucker. But what was I going to do? My parents never let me go downtown alone, and I didn't want the option that made the youngest in any family feel sick at the thought, "Your big brother can take you!" would be my Mom's solution. Why not just take me out back and shoot me? My brother and I, the oil and water of the family, no thanks. The thought of him pummeling me in the ribs throughout the movie and gulping all of my pop sent shivers down my spine.

I ran my finger down the newspaper page and there, by the Tivoli Theatre logo, was something that made my dilemma seem even more horrendous. They were showing a movie I had never seen, but always wanted to see - "The War of the Worlds". Even the poster of it was great, a giant claw stretching out of the sky about to crush two terrified people gazing up at it. Like any ten year old would think, I have to go.

I went into the kitchen where Mom was clearing up the breakfast dishes and asked if I could go to the matinee.

"With no one else, just you?" she asked, her big blue eyes flew open in surprise.

"I've gone lots of times, Mom, catch the Manchester 10, it takes you right there."

She stared down at me, wiping the soap suds off her hands with a towel. "Well, your Dad and your brother have gone for the day".

"Great", I thought.

She did the old mother stalling trick of staring intently into a kids eyes for any hint of deceit or vulnerability. I held my breath.

"Well, OK, but you be careful and be home right after the movie!"

I yelled out an "I will" as the door slammed behind me and I ran out into the bright, late morning sun.

I was trusted with independence on the largest scale I had known, I felt I was on my way to manhood, at least for a few hours.

The bus ride was uneventful, but agonizingly slow, as if the driver knew I wanted to taste freedom and decided to pull it away from me. "Want to go to the movies, eh kid? Alone, eh, kid? Not on my bus!" he was probably thinking. But, the bus pulled up across the street from the Tivoli and I dashed out the back door.

"Watch the traffic," he yelled after me.

Fourth Street was a busy road and I knew that. The warning made me slow down and I looked both ways before I jaywalked to the theater.

It was already in the low seventies at 11:30 (about 21 for you celsius fans), and the wall you lined up at to get into the Tivoli was a cinder block wall painted white, facing south. We kids figured that they built it that way so you roasted for an hour and would have to drink down the pop to cool down, dumb adults.

I was there a full hour before the doors opened, and an hour and a half before the movie started, and there was still a line up of about thirty fellow movie nuts. I didn't recognize anyone, good, this was for me, my time to explore H. G. Wells in the dark. The heat was beginning to work on the restless kids. A few had broken down and were gulping down orange and grape pops from the local corner store. The rest of us were clutching our pockets full of change, while waiting our turn once we were in the cool darkness of the theatre. Then after a few handfuls of popcorn loaded with salt, we would see who had the better plan.

Twelve o'clock. The line began to move into the childhood mecca, sixty or seventy sweaty little bodies swelled to get into the air conditioned theater. A pimply, bored usher barked orders at us not to shove although no one listened. I passed the poster showcase on the wall for next week's show "Godzilla vs. Rodan". I'd be there. "Come on, come on," I thought, it drove me nuts when some kids didn't have their fifty cents ready and wasted time fumbling for their change. Waste time, bad seat choice, was my motto.

I quickly jumped into the front of the line for the candy counter, grabbed my pop and popcorn and dashed for the theater. I always sat in the back row, no kids to kick your seats, or bean you in the head with a Lifesaver or some popcorn.

I sat patiently, waiting for the movie, nibbling on my popcorn, sips of pop washing it down (no gulping, nothing worse than dying of thirst with an hour of the movie to go).

Kids flew past me laughing and chasing each other for good seats, or stomping up the aisle to buy sugar and salt treats. The theatre lights bathed everyone in an eerie orange glow, creating the perfect atmosphere for a movie about Martians attacking Earth. A few kids had already started whipping popcorn at each other, the young usher trying to get them to stop, good luck. My sneakers were already starting to stick to the floor from the previous night's deluge of sodas. The smell of popcorn drifted in from the lobby mixed with the sounds of laughter and youthful exuberance.

At exactly 12:30 all of us began pounding our feet on the floor, shouting out, "We want the movie, we want the movie." I often wondered, years later, how many managers aged prematurely or had heart attacks because of Saturday matinees across Canada and the States.

The lights dimmed, a roar went up from 200 kids, a few ouches could be heard as empty pop containers bounced off heads, good thing they were made of cardboard. I remember, just as I squashed myself down in my seat, two figures bent over me, blocking the screen.

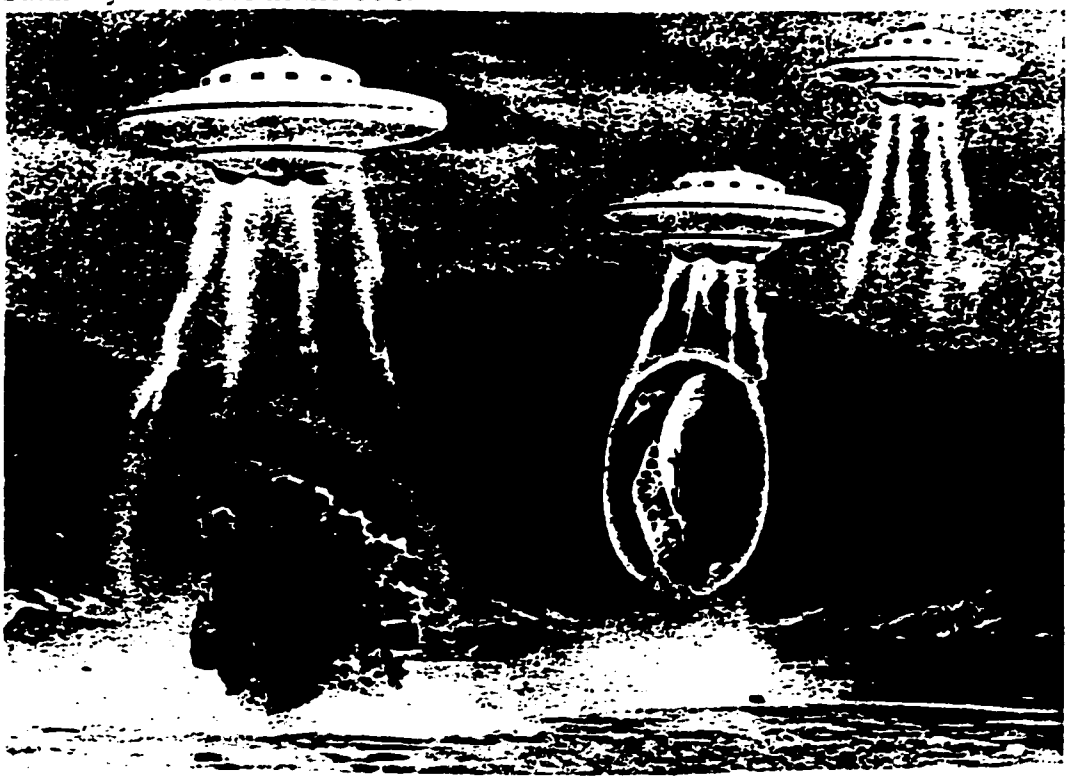
"Hey,Thurston."

"Now what," I thought.

It was Mike Bauer and Steve Moore, both heavier than me and sometimes as mean as snakes.

"Hey," said Bauer, "don't forget we got a Lacrosse practice tomorrow "Now what," I thought.

Two of the movie posters that would entice thousands of children, including me, to the Saturday Matinees in the 60's.



Godzilla and Rodan are transported to another planet to do battle with Ghidrah in Monster Zero. Below: The creature from Twenty Million Miles to Earth.

(Rovin, 1975)

I tried to peek past them at the flickering screen, "Yeah, right, practice."

"Eight o'clock in the mornin'," said Moore.

"Yeah, eight AM, I know," I strained to see what was on the screen, coming attractions, luckily.

"You come alone, Thurston?" asked Bauer.

"Ah, well no, Steve Dawson just went to the can." I didn't want them sitting with me.

"I hate Dawson," said Moore, "guy's a nerd."

I nodded and shoved some popcorn in my mouth, trying to watch Godzilla stomp on some Japanese tanks in next weeks' preview.

"See ya," said Bauer.

Moore stood there eyeing me. "Don't stay," I thought. He turned and ran after Bauer into the darkness. That was close, I almost had my big day scratched by two incessant talkers. Great guys, but can't shut up in a movie. I'd gone with them a few times, but I stuck to playing sports with those guys, not dabbling in the "arts".

The movie finally began, in all its technicolor glory and I let the moment rush over me, alone, popcorn in hand, and a film I longed to see. I had no idea how it would place its mark on my life.

In the film "War of the Worlds", the original Wells' book is updated to the Twentieth Century, but the story is essentially the same. The Martians invade Earth, we are helpless to oppose them, and the germs in our atmosphere finally kill the

invaders. The film is played straight, not tongue in cheek like many other films did and have done since, which only added to the impact. As the images of fleeing humans and Martian death rays played out before my eyes, the theater now quiet (always a sign of a good movie, when hundreds of kids attention can be transfixed), I remember one key scene to this day.

The Army has surrounded the first landing spot in the U.S. with all its modern war machines, ready to "blow them off the face of the map" as one character remarks. A minister tells his niece that no one had really attempted to make contact with them. "But they're Aliens," the girl remarks, "some sort of advanced civilization."

"If they're more advanced than we are, they should be closer to the Creator for that reason," he smiles back. I shoved another handful of popcorn in my mouth. She returns to the dugout with the scientists and military leaders, while he walks towards the Martian death machines gleaming in reds and blues.

As he nears the machine, it turns its glowing weapon towards him, as if in curiosity.

"As I walk through the valley of the shadow of death, I shall fear no evil," he proclaims.

The niece screams for the military to stop him, but he's too far away.

My hands were wet with sweat and fear as I watch, the Minister finishes "- and I shall dwell in the house of the Lord, forever."

The Martians attack in War of the Worlds.

(Rovin, 1975)

As the minister finishes, the Martians unleash a deathray, that disintegrates the minister.

I remember this clearly, a voice somewhere in the darkness, on the verge of tears screamed, "No!"

Man had lost to the invaders, God to technology, the beginning of the end of innocence, childhood's end! All of these thoughts and the emotions filled me then, and for the rest of the film. I had gained my first taste of freedom and independence, and it was bittersweet.

When the film was over, the Martians were killed, and the credits were rolled, all the children in the theater quietly left. All of us had seen something that made us think and burned images into our memories and made us bump up a level towards adulthood. The Cold War, for one thing, seemed more real, closer to taking away everything dear to me. The film and its images stuck in my memory as I rode the bus home, a little wiser and a little more frightened than I was after watching other sci-fi films before.

I ran from the bus stop past some friends playing street football in the heat haze of a summer afternoon, and raced up the walk to the back door. I went inside and found Mom and Dad sitting at the table talking and drinking a glass of lemonade. "Did you have a good time?" asked Mom, her blue eyes twinkled and she winked at Dad.

I gave them both a hug, they looked shocked and then smiled.

"You all right, honey?" asked Mom.

My brother walked by and gave me a playful belt in the arm, "runt," he said.

"Yeah, I'm fine," I said. They were OK and I guess I needed to know that. Yet those images had changed me a little, my memory would not let them go. Childhood had begun to lose its carefree grip on me.

This personal narrative has stuck in my memory for many years. Why should these memories stay with me and others be lost over the passage of time? Did these memories allow me to learn about new possibilities in life by opening new mental pathways?

I believe these memories were enhanced by the dramatic visual film. A frightening experience is usually well remembered by people of all ages. It allows us to prevent the experience from occurring again, or at the very least, recognizing it. This type of reaction has been called a "learned trigger." (LeDoux, 1996, p.127). This means that the response to something frightening or dangerous is encoded in the brain's memory system. Later on in life it is quickly remembered and the person can make a decision to respond to it. I believe that my experience of this film, and many others in my life, allows me to recall them quite easily. In combination with the fantastic visual image I remember, comes the memory of the well written prose in the film. These two memories allow my new views on the cold war, religion, and my own existence to be recalled as well. Does this mean that a base emotion such as fear, can be used to learn new things? I believe so. I don't suggest you scare people so badly

they are traumatized. What I am saying is that basic emotions can be used to help memory function. This in turn can lead to helping individuals learn new ideas by focusing their attention with the help of fantastic visual images. As Howard Gardner suggests, "Experiences that have emotional consequences are likely to be retained and utilized subsequently." (Gardner, 1999, p.82).

We have all heard about the power of television advertising on consumers. We have also been warned about the destructive influence television and film can have on people. Reality blurs, attention problems result, even antisocial behavior can result. (Healey, 1990). However, I am talking about the positive influences these images can have, if properly used in the classroom. I was able to remember what I saw that day in 1967, and the resulting images may have opened new ways in my mind to look at things. What could I have gotten out of the experience with a teacher discussing it with me? Would the combination of biological memory and academic tutelage have allowed me to explore and retain even more elements in life? Years later, would such a combination be of value to teaching brain injured students?

To answer these questions, it is necessary to look at how teaching can make better use of what is known about the function of the brain.

## Chapter Four

## Mind Machine

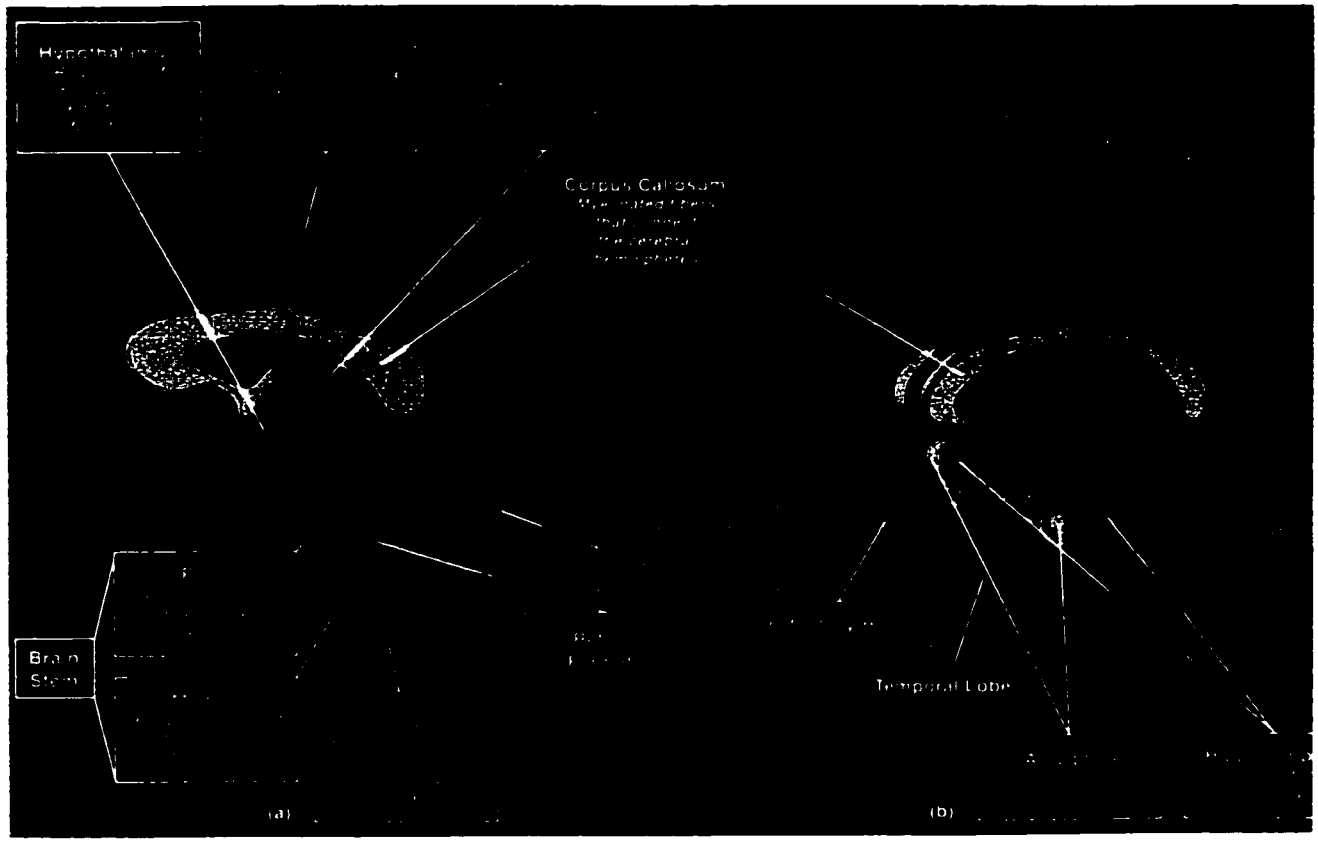
The hardest thing to understand is why we can
understand anything at all.

- Albert Einstein

Firstly, it is important to get an understanding of the grey matter in our skulls in order to better understand its role in the mysteries of the mind. The brain weighs approximately three pounds, and is about the size of two fists put together and turned inward. The brain is composed of a number of specific areas best explained by Paul MacLean's triune brain model. This is basically a three-layer hierarchical brain that has evolved. "Evolutionary theorists believe that these structures developed because they were needed for survival as animals faced more complex environmental demands." (Smith, 1993).

The first and oldest part of our brain assembly is the reptilian brain or brainstem. This area controls our lower involuntary system such as blood circulation, respiration, etc., our basic survival instincts, if you will. The paleomammalian brain, or limbic system, developed around the reptilian brain and plays a strong role in our emotions and acts as the coordinator of the central nervous system. This area is also important in that it contains several important structures that influence learning and memory.

The thalamus integrates information from sensory organs to the cerebral

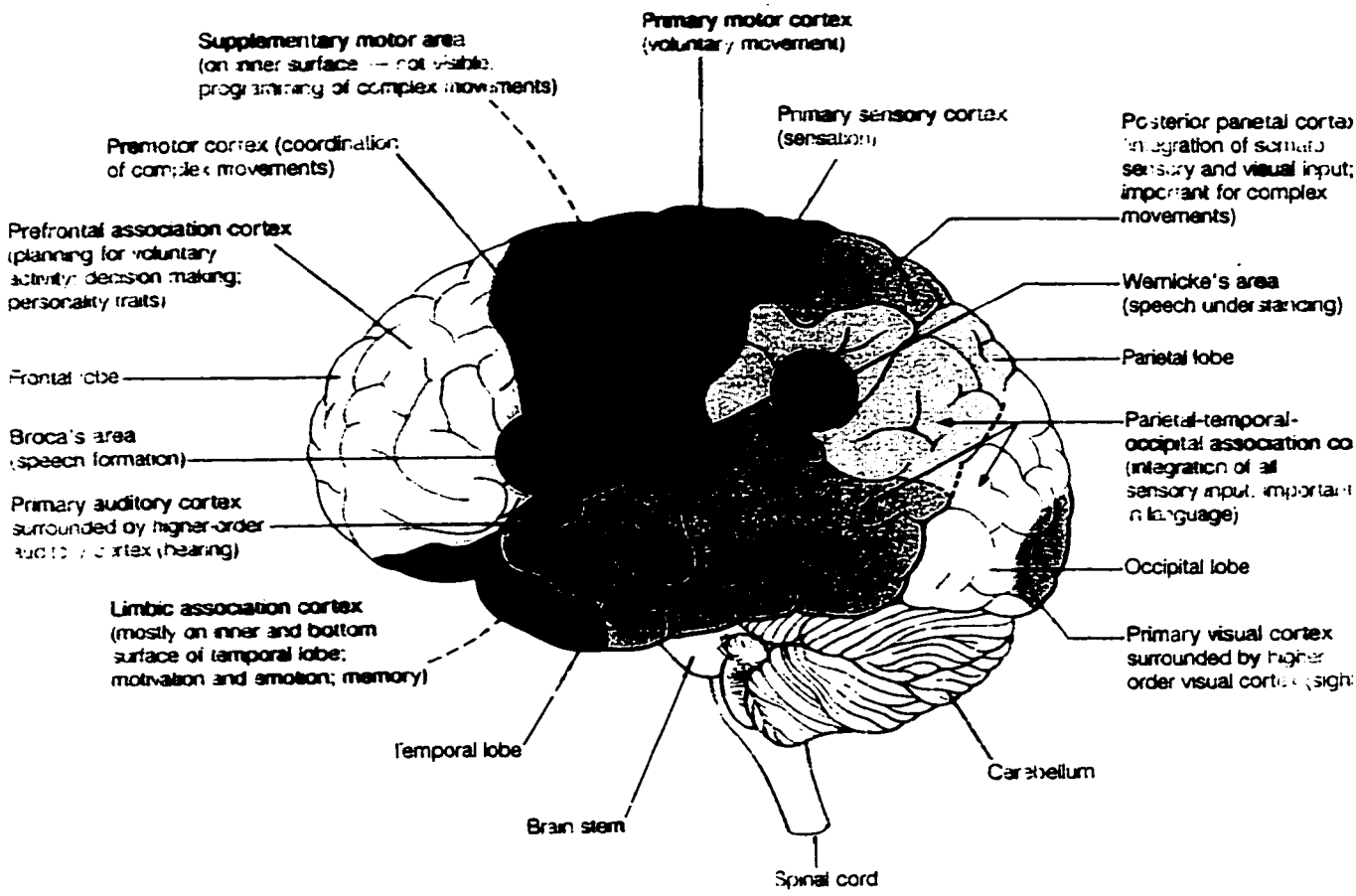



(Smith, 1993)

cortex. The hippocampus is critical to both short and long term memory. The amygdola is critical to learning, it also associates events with emotions by linking sensory data to feelings (eg: ignoring the feel of a comfortable sheet, but noticing the itch of a tag at the back of the collar).

The neomammalian brain or neocortex is a series of folds and makes up the bulk of the human brain. This region is divided into four lobes, each with its own properties and functions. All four lobes are important, yet it is our frontal lobe that perhaps best explains what makes us 'human'. One prominent neurologist has suggested that the entire period of human evolutionary existence can be considered the "age of the frontal lobe". (Smith, 1993).

The frontal lobe is the source of adaptation and planning, it is the region that allows us to express our 'free will', so to speak. Decisions are made based on current sensory information. If the frontal lobe is damaged, a person may no longer be able to solve problems or make decisions that were once second nature. For example, a client I taught when working at the Life Skills Program for the Brain Injured could make a decision to have a shower. However, the decision of when to get out could not be made, and he stood in the shower for over an hour until a staff member noticed him in it. The temporal lobe is where auditory centres are found. Language and sound production as well as language and sound interpretation are held within this region. Emerging thoughts are processed here as well. The parietal lobe is responsible for actions, motions, and emotions. The occipital lobe is located at the back of the brain,


Supplementary motor area
(on inner surface — not visible;
programming of complex movements)
Premotor cortex (coordination
of complex movements)
Prefrontal association cortex
(planning for voluntary
activity; decision making;
personality traits)
Frontal lobe
Broca's area
(speech formation)
Primary auditory cortex
surrounded by higher-order
auditory cortex (hearing)
Limbic association cortex
(mostly on inner and bottom
surface of temporal lobe;
motivation and emotion; memory)
Temporal lobe
Brain stem
Spinal cord
Primary motor cortex
(voluntary movement)
Primary sensory cortex
(sensation)
Posterior parietal cortex
(integration of somatic
sensory and visual input;
important for complex
movements)
Wernicke's area
(speech understanding)
Parietal lobe
Parietal-temporal-
occipital association co
(integration of all
sensory input; importan
in language)
Occipital lobe
Primary visual cortex
surrounded by higher
order visual cortex (sigh
Cerebellum

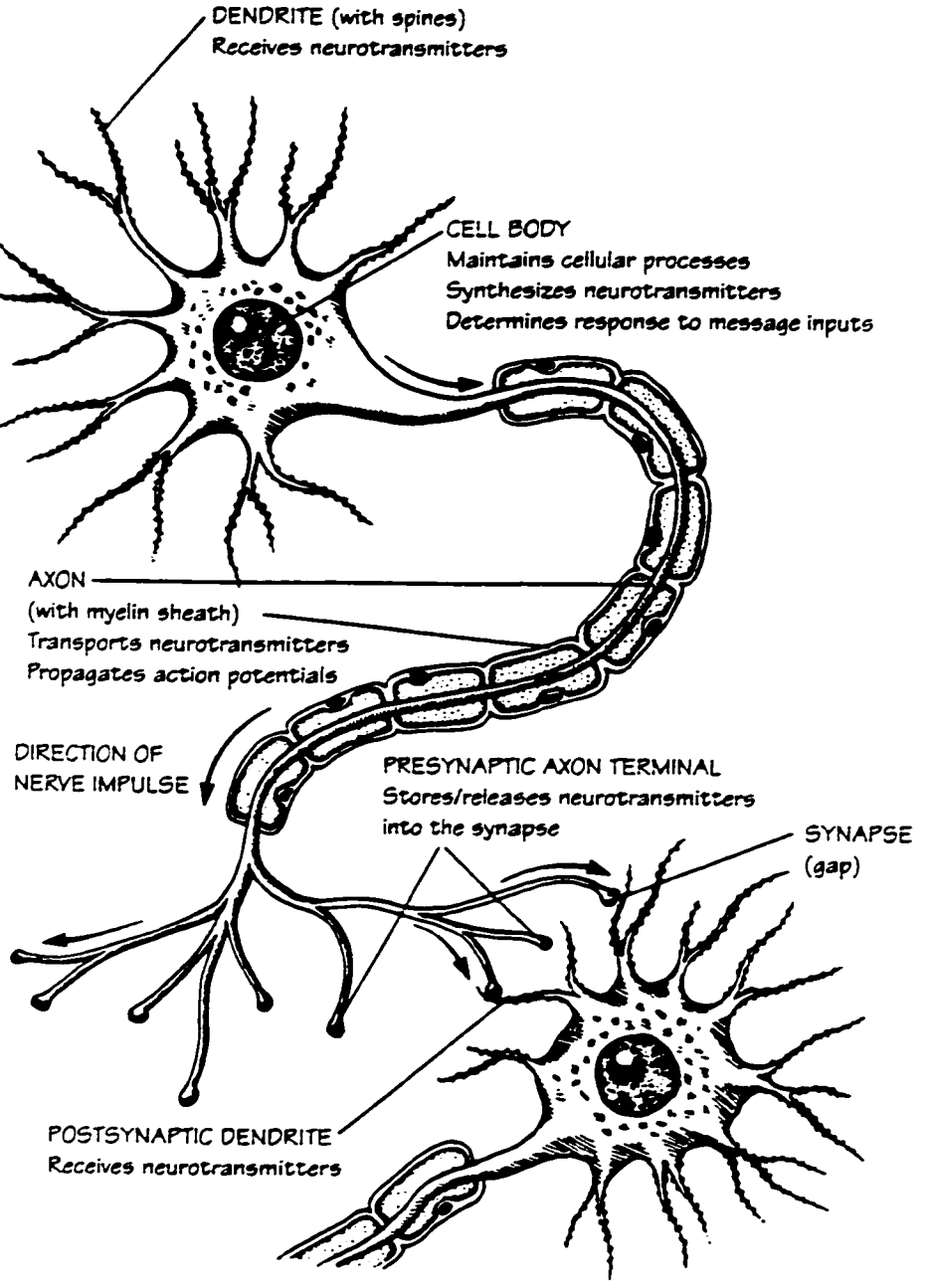
(Smith, 1993)

and this is where visual information is processed and stored. An example of damage to this area is a client I taught who had suffered a blow to the back of the head and become legally blind. His eyes were undamaged, but his ability to process visual data was destroyed.

Exactly how is information transmitted between the three main areas of the brain, and the regions of the neocortex? The brain is made up mostly of neurons (nerve cells) and glial support cells. The glial cells are the structures that shape the formation of the brain, they help in forming part of the blood-brain barrier. That is to say, they stop dangerous molecules found in the blood from entering the brain. They also aid in the transmission of molecules released by neurons that transmit messages to other cells.

Neurons are nerve cells that constantly receive and send messages to other cells in the body. Our brain contains tens of billions of these cells, and if damaged, many cognitive difficulties arise, as well as extreme headaches as a result of neural tearing. The neuron will send a message if the right chemical interaction takes place. These chemical molecules are called neurotransmitters. Some of the most common known neurotransmitters are adrenaline, dopamine, acetylcholine, and serotonin. Even as lay people, we have heard about such chemical agents, basically they carry out the communication between neurons. The small area between the neurons is called the synapse. The neurotransmitters allow the two nerve cells to communicate. It is now known that there are more than fifty neurotransmitters and possibly many more. How

## FUNCTIONAL MODEL OF A NEURON




(Novitt-Moreno, 1995)

do neurons know what messages to take in or disregard? "Though neurons are always firing and incoming signals merely cause it to fire at a faster or slower rate, the neurotransmitters either excite or inhibit the message to the neuron, do or don't do. (Popper, 1995).

Interestingly, the parts of the cerebral cortex that make up the human brain look much alike, in fact, they look the same as the brains of different animals. So why don't humans and animals have the same mental activity? Psychologists David Rumelhart and James McClelland state, "The only reason that humans are smarter than rats is that our networks have more hidden layers between stimulus and response and we live in an environment of other humans who serve as network trainers." (Rumelhart, 1984). Also, they make the claim that the simple neural networks, by themselves, account for most of human intelligence. We have more neurons to connect with. Furthermore, man, along with most primates, has more visual areas in the brain which link up with our frontal lobe. Our brain is quite sophisticated visually, more than many other animals in terms of our ability to perceive depth, colour, motion and visually guided touching. Our eyesight may not be as good as other primates, but the areas of our brain that process visual stimuli to language and complex-form processing are larger. Also, the frontal lobe areas responsible for planning and thought are about twice as large as an apes.

What seems to distinguish us the most from other primates is the patterns of connections between the neurons. Little is known about the functioning microcircuitry

of the human brain, however, since the numbers of people surviving brain injuries is increasing, we can now get a better understanding of how we learn, think, and remember. Because different areas have been damaged, our ability to study the brain's functioning process, via the educational setting can indeed break new ground.

## Chapter Five

## I, Teacher

Here I stand. I can do no other. God help me. Amen.

- Martin Luther

Perhaps the best way to explain what I saw and learned in my teaching experience with brain injured students, is for you to go back with me to the facility I worked in, and meet the staff and clients.

The Life Skills Centre for the Brain Injured was a division of Bethany Care Centre and growing up in Calgary, I had heard of Bethany before but always associated it with a senior care centre. Our facility was located in an ultra modern building, where we had a wing of the care centre to ourselves. One of the key principles I had learned in working with disadvantaged groups over the years, was not to "group the disadvantaged individuals with another in order to prevent labeling." (Wolfensberger, 1991). Here I was going to work in a facility where people come to die, and I was to instill learning and hope for a rebuilt future for brain injured men and women. The environment was definitely an obstacle.

It was the middle of winter, the drive from Calgary to Airdrie was cold and slick, my car swerving on black ice all the way.

"Great, I'll be late the first day," I mumbled to myself. The facility loomed up in the swirls of snow, I looked at it with a bit more intensity today than I did during my interview for the job and was pleased. At least it didn't look like your typical nursing

home, more like a small community college actually.

I stepped out of my car and the wind snatched my breath away, my dress pants provided no warmth at all as I bolted for the entrance, clutching the books I had brought with me.

I flew into the sliding doors and into the warmth of the building.

"You the bus driver?" said a voice.

"What?" I said, wiping snow from my eyes.

"Ya deaf? I said, you the bus driver?"

I looked down at an old man in a wheelchair wearing a parka and sipping on a mug of coffee. His eyes were cold and hard, and his face heavily lined from the weight of life.

"No, no, I'm the teacher just starting today," I explained.

"Teacher?" he sat back in his chair. "What the hell do we need a teacher for?" he shook his head and gulped down some coffee.

"Mr. Thurston," another voice called out.

The head of the building walked up, Mrs. Brown, a stern woman, impeccably dressed and solidly built, in her mid fifties. "Now, now, Mr. Jones," she said to the elderly man, "The bus won't be here until 8:30."

She turned her gaze back to me, "Come along and we'll go to the Life Skills Unit."

We walked past the open courtyard and cafeteria where a hundred or so senior

residents were enjoying their breakfast, past a nurses station where two nurses were busy going over some paperwork.

"You're right on time," said Mrs. Brown.

"I wasn't sure I'd make it through the storm, Mrs. Brown."

"Please call me Peggy."

We walked through the fire doors and into the Life Skills unit, and stopped in front of a door with a sign stating it was the classroom. Peggy knocked on the door and stepped in.

"Excuse me class, I'd like to introduce you to your new teacher, Mr. Roy Thurston."

I scanned the class, about a dozen and a half faces shifted their gaze onto me. They were the faces of young men and women in their late teens to their early thirties, but something in their eyes was what struck me the most. Their eyes showed a deeper age, they had all experienced something and it showed as they looked me up and down.

"Pleased to meet you," a petite woman, slim, with a broad smile extended her hand.

"This is your teachers aid, Lyla Matthews," said Peggy.

"Hi," I clasped her hand.

"Nice to meet you all," I said to the class.

Those knowing eyes shone back at me from the lineless faces, and I knew this

class would be different from any other I had taught.

We left the class and proceeded to meet the rest of the staff.

The nature of rehabilitation is, for the most part, medical. Science and technology rule the healing business and a teachers' role is an afterthought. I would find out soon enough that this organization would prove to be no different in its views.

I knew from experience that often a student who may be doing poorly on some testing results, is in fact, still learning. I would have to debate this view with the team over and over in the years to come.

The team was termed multi-disciplinary, and indeed did have numerous professionals involved. When a person suffers a brain injury, the medical people are the first to be involved, nurses and doctors stabilize the person. A neuro-surgeon who understands the nervous system, brain, spinal cord, etc., is the head of the initial team. When the persons' condition is stabilized, the rehabilitation team takes over, Bethany is in these cases, with the neurosurgeon keeping in contact.

Our multi-disciplinary team consisted of the following individuals: a psychiatrist who is available for consultation if extreme psychiatric problems occur, a psychologist who is on site for counseling services in conjunction with the team social worker. They deal specifically with the emotional and behavioral problems that often arise from brain injury. The social worker acts as a counselor for family issues and support for personal issues that again often arise. Our neuro-psychologist was available upon a client's first introduction to the program.

Neuro-psychologists understand brain injury and behavior and identify memory and cognitive problems that have resulted. I would often work with their recommendations on types of cognitive retraining methods to be used in the classroom.

Speech/language pathologists would be utilized in order to deal with specific speech and communication disorders that can arise from an injury. An occupational therapist and physiotherapist were also on the team to deal with independent living skills and motor function problems arising from the injury. A dietician and a vocational rehabilitation specialist who dealt with job training were also on the team. Nurses were available on site because of the nature of the Bethany Nursing Home facility.

The team was managed by our Director and my boss, Jill Wolf, who was an occupational therapist by trade. Like Peggy, a rather stern woman whose gaze was enough to cut you in two if need be. So there I was, the lone teacher in a sea of medical personnel. Even my aide, Lyla, was a nurses aide by training, and our social worker, Norm, had worked exclusively in medical based facilities, as did Vic, our psychologist.

My training as a teacher allows a different approach to the problem of brain injury. As a result my views would differ from my co-workers and I realized from the first day I would have to be careful not to bump philosophical heads too often. Yet I knew that what I offered could help these clients in ways the other staff could not. Mental rehabilitation was as important as the physical healing process of the brain.

## Chapter Six

## Root of the Problem

"The world" van Gogh said, "is a face

In which I see my souls grimace."

But has reality become

Merely emotions medium?

O universe of forms, I ask

Are you a mirror, or a mask?

- Theodore Melnechuk

What exactly is a brain injury? Any traumatic injury that results in the tissue being destroyed or damaged that results in the brain not being able to function properly is a brain injury. Injuries can occur from sporting accidents, accidents at home or work, but motor accidents are by far the most common cause of brain injuries.

Diseases of the brain such as bacterial infections, strokes, loss of oxygen and tumors can also cause significant damage to brain tissue. All of these types of damage cause problems with normal cognitive functions and as a result, affect learning new information or retrieving already acquired information.

The number of people in Canada and the United States who suffer a brain injury is on the increase due to an increase in vehicle accidents and the increase in medical technology that allows people to survive. In Canada, approximately fifty thousand cases of brain injury are reported per year, five hundred thousand in the

United States. About twenty percent of these require significant long-term rehabilitation, physical and cognitive. This increase in survival rates is beginning to have a significant cost to families and society in terms of dollars and personal and social issues. (Granville, 1990).

I began to learn more about the types of brain injuries in the first few months of work where I inundated myself with as much information as the facility had on brain injury in general and with the reports on the clients we had, past and present. The medical terminology was certainly different from an educators view but not indecipherable. Injuries were categorized as mild, moderate, and severe. Our clients were in the mild and moderate areas, the majority of most brain injuries, the severe cases were referred to Ponoka Brain Injury Facility in Alberta.

The Glascow Coma Scale is used to rate the severity of injury and is broken down into three main areas. Eye movement, motor response, and verbal response. This scale allows the medical team to check the patient as they emerge from an accident and judge how severe the brain injury is. The scores on the test range from a low of three to a high of fifteen. An eight or less is a "coma" state, and a severe injury, nine to twelve is a moderate injury with twelve to fifteen considered mild. The recovery time determines length of stay in hospital and post injury rehabilitation needs. Interestingly, many of my clients had eight or less scores, but gained significant cognitive function and ended up in my classroom. So many times I worked with individuals that were considered too severely injured to make significant gains. This

shows how little we still know about the brain.

As I continued to research who was in my classroom, I began to understand how the brain itself worked, and that would allow me to better understand how the injury of each of my students affected their ability to learn new information, or retrieve previously learned knowledge. Perhaps a basic look at the physiology of the brain will help to understand its workings and show how injuries affect its normal biological workings.

The cerebral cortex is divided into right and left hemispheres. Much has been written about right and left dominant brain activity, and I will try to explain the functions with examples of brain injured individuals. The two hemispheres of the brain are connected by the corpus callosum, which functions as a connection for the two areas, synchronizing their activities. The left hemisphere processes language, what is said, while the right hemisphere processes the emotional context, how it was said. The two perspectives are processed and a unified mental experience of a conversation is processed.

The amount of information that our brain is bombarded with is staggering, which is why specialized areas have evolved. As you look at the world, your right brain gathers a broad view of what is seen, heard, etc., a general sense of what you are experiencing and the left hemisphere is used to analyse these broad elements. The two processes work at the same time because our brain cannot examine what it sees and analyse each item simultaneously. Our left hemisphere processes information

sequentially, and therefore has some limitations. A good example of this is how the human language is interpreted by the brain. A word expresses a lot of information in a small number of sounds and symbols, it is the left hemisphere that allows us to comprehend the subtle differences to understand the message.

The right hemisphere appears to play the largest role in emotion, particularly with negative emotions such as fear. The left hemisphere appears to process positive feelings such as joy. The stronger feelings seem to be the negative ones, probably because survival instincts are more important for the brain to be aware of than feelings of contentment.

The difference between men and women in terms of utilizing the hemispheres or one hemisphere, has been documented. (Halpern, 1992). Women, on average are superior to males on a wide range of skills that require language, such as speed of articulation and grammar. Also, women are considerably faster at tasks that require perceptual speed, matching items, manual precision and arithmetic calculation. Men perform better on tasks that are spatial by nature, maze performance, picture assembly, mental rotation, and mechanical skills, also in mathematical reasoning and directional finding. Males who suffer damage to the left hemisphere, such as strokes or traumatic accidents, suffer more speech and language problems than do women. Women appear to utilize both hemispheres to a greater extent and do not suffer from as much difficulty with language skills.

As suggested, the male brain appears to be more specified and localized in each

## Problem-Solving Tasks Favoring Women

Women tend to perform better than men on tests of perceptual speed, in which subjects must rapidly identify matching items–for example, pairing the house on the far left with its twin:

In addition, women remember whether an object, or a series of objects, has been displaced:

On some tests of ideational fluency, for example, those in which subjects must list objects that are the same color, and on tests of verbal fluency, in which participants must list words that begin with the same letter, women also outperform men:

| | |
|---|---|
| L _ _ _ | Limp, Livery, Love, Laser, Liquid, Low, Like, Lag, Live Lug, Light, Lift, Liver, Lime, Leg, Load, Lap, Lucid ... |

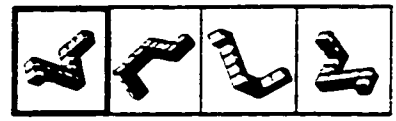
Women do better on precision manual tasks–that is, those involving fine-motor coordination–such as placing the pegs in holes on a board:

And women do better than men on mathematical calculation tests:

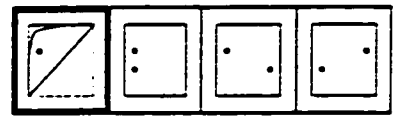
| | |
|---|---|
| 77 | $14 \times 3 - 17 + 52$ |
| 43 | $2\,(15 + 3) + 12 - \frac{15}{3}$ |

## Problem-Solving Tasks Favoring Men

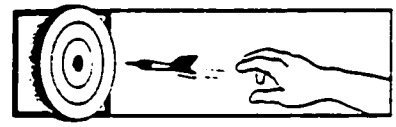
Men tend to perform better than women on certain spatial tasks. They do well on tests that involve mentally rotating an object or manipulating it in some fashion, such as imagining turning this three-dimensional object



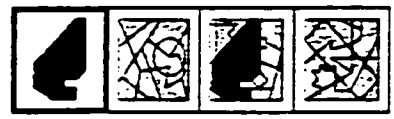
or determining where the holes punched in a folded piece of paper will fall when the paper is unfolded:



Men also are more accurate than women in target-directed motor skills, such as guiding or intercepting projectiles:



They do better on disembedding tests, in which they have to find a simple shape, such as the one on the left, once it is hidden within a more complex figure:



And men tend to do better than women on tests of mathematical reasoning:

| | |
|---|---|
| 1,100 | If only 60 percent of seedings will survive, how many must be planted to obtain 660 trees? |

(Kimura, 1992)

hemisphere, while women's processes access the two hemispheres, particularly concerning emotions. Men restrict language to the left hemisphere, and emotion to the verbally silent, right.

Michael Gazzaniga, a neuro-scientist, has theorized that a region of the left hemisphere is responsible for our ability to interpret events that are normally difficult to explain. This interpretive function is believed to be central to our own personal belief system and view of self. Issues that are personal such as religious values, political views, etc. are formulated in combination with personal experiences. (Gazzaniga, 1992).

The brain's ability to identify and respond to the environment through problem solving analysis is located chiefly in the cerebral cortex. Our ability to draw from the past and predict future occurrences is what allows the individual and the social system to grow cognitively and survive as a species. As the brain develops biologically, from child to adult, it, in effect, follows the stages of development that Piaget attempted to identify from childhood, the formulation of sensorimotor and coverete stages, which relate to memory and problem solving, to adulthood, formal operative stages and planning.

A traumatic brain injury has a dramatic effect on an individual's physical and psychological well being. The location of the injury and its severity cause different types of learning difficulties and sensory problems. Injuries such as concussions and

contusions can result in the jarring of the brain and neural tearing which results in headaches and memory loss. This tearing and internal bleeding causes the connections between the brain to become disrupted or destroyed. The result can affect the physical body as well, such as paralysis in the extreme cases. Global brain damage, where the brain literally bounces around in the skull, can have devastating consequences. The regions of the brain that allowed past, present, and future memories and actions to be played out, can all be affected. This occurs when the neural networks are destroyed, the chemical connections originally in place are disrupted. Depending on the site and extent of injury, some connections are gone, some remain.

The destruction of biological cells results in the loss of function, whether it is an arm, a leg, or areas of the brain. The complex process of memory, however, is much more difficult to heal than is a broken arm. It is important, therefore, to understand how the brain takes in, retains, and accepts memory. The classroom would speak volumes about this topic.

## Chapter Seven

## The Classroom is a Harsh Mistress

> The known is finite, the unknown infinite, intellectually we stand on an islet in the midst of an illimitable ocean of inexplicability. Our business in every generation is to reclaim a little more land.
>
> - T. H. Huxley, 1887

The best part of the job for me was to be away from the medical based staff meeting (which we had every morning), and to go into the classroom and teach. It was, after all, why I was hired and it was, as far as I could see, where the real mind healing took place.

Our facility had the staff room and offices at one end of the hall, with my classroom and computer room at the other end of the hall. As I walked down to class every morning, the clients' rooms on either side of the corridor were a buzz of activity. I'd walk by, greeting or being greeted by clients. "Morning, Roy," said Alan, a great kid in his early twenties who had been chased on his motorcycle by police and lost out to a tree in a head on collision. He was expected to die, or at least never walk again. He proved them wrong on both counts.

"Morning, Al, how's it going?" He smiled, scratching his trachea scar, similar to that which many of my students had. That is where a slit is cut into the opening of the throat to provide a breathing hole after a serious accident. The brain has been that

traumatized that even breathing stops.

"Not bad, what's up in class today?"

"Math, this morning," I said.

"Oh, great," he turned up his nose.

I walked along, almost walking into Louise, the cherub sized teacher from Calgary who had survived a car accident. Her vision was very poor as a result, and she adjusted her thick glasses, gazing up at me.

"Who the hell's that," she muttered.

"It's Roy," I said.

"Oh, trying to knock me over, teach?" she quipped.

"Of course," I said, joking back.

"Umpf!" she snorted and headed to the cafeteria to get her morning coffee. Louise had taught for nearly twenty years, and the idea of someone teaching her was upsetting. Even worse, as a result of her accident, she was at about the grade nine level in Math and English. The last three months had showed little improvement. I think she had a right to be mad at me and the world.

I walked along, hearing the support staff trying to get Gary up.

"Get bent!" he yelled at them.

Gary was hurt on the oil rigs and had a temper that equaled his physical strength, both were intimidating. I could hear the same type of argument with Bruno, another rig worker who knew Gary. They despised one another.

A half dozen clients walked towards me, heading for the classroom.

"Hey, Thurston, how about a day off?" yelled Dennis, the joker of the group, an industrial accident survivor. He adjusted his ball cap, always on his head.

"You mean, I can go home and you guys work?" I smiled.

"Yeah, right," remarked Arlene, a nice kid whose car was struck by a train, he had a permanent limp as a result. I had a pretty good rapport with most of my students after the first six months. I had convinced those that had always hated school that this was more like a college for upgrading. How far they went was up to them, everyone seemed to like that analogy, and it empowered them as individuals.

"Morning, Lyla," I said. My teachers aide had already picked up the newspapers for current events. I had each student pick an article in the paper, read it, then without looking, talk about what they had just read. I did this for a number of reasons. First, every one of my students had a memory problem, with the majority of head injuries, that is a given. This exercise helped me to see how much, if any, memory difficulties were being helped by the cognitive rehabilitation my classroom provided. Second, I felt it was important for the class to work as a group, and get to know one another in a formal education setting. Peer interaction was beneficial for their mental and personal well being. In a sense, they were all they had at this point in their lives. Divorce rates are about ninety percent for the head injured individuals and friends pre injury, rarely keep in touch. (Gronwell, 1990).

The group has now settled into their seats, cups of coffee and donuts set before

most of them. They busily leafed through the paper, finding their favorite section - sports, local news, sometimes the entertainment section. For many, it's the first time they have regularly read the paper and they had learned to enjoy it. Many times the discussions get pretty lively, especially when stories about provincial cuts to hospitals and education came up. They now had a vested interest in both.

"Who would like to go first?" I ask.

The students are still a bit nervous speaking in front of each other, especially those with grade nine or ten education before the accident. Half a dozen of my students at this time had degrees, the other ten or so feel intimidated by them.

Bruno and Gary are busy looking for hangnails. Arlene, Armand and Alan sip coffee.

"I'll go!" Gerry pipes up. Gerry is an RCMP officer who had a stroke two years ago at age thirty-eight. A big man and one of the kindest men I'd ever met. "Looks like Klein is going to cut more money to health care, fifty million according to the article," Gerry looked right at me, his memory for what he just read is perfect. Half an hour later he wouldn't remember anything about current events.

A groan came from everyone else.

"Again?" Louise sipped her coffee.

"That guy needs a warning shot right there!" declares Armand, the trucker who survived H2S poisoning. He points his index finger to his forehead.

Everyone laughs.

"Why more cuts?" I ask Gerry and the group.

"Doesn't really say," Gerry rechecks the article.

"Didn't it say something about it yesterday in the paper?" I asked them this because we did talk about it in yesterdays' class.

They all looked at me, the teacher was playing his role and I had just questioned their memory recall. I looked at them struggling to remember, some frightened they could not remember, others mad at themselves, others mad at me for asking.

"The deficit!" yelled out Christine, a young teacher who had a stroke just a year ago. Quiet and frail, she rarely spoke, so this was a bit of a shock for the group.

"Good for you, Christine, that's right, the good old bogey man, the deficit," I smirked.

"Right on, Christine," said Dana, the most badly hurt of the group. His thick curly hair and glasses gave him the look of a young Einstein. He had been blown through a steel wall at a rig site by an explosion. He suffered a global brain injury, so both long and short term memory were badly affected. He was also partially paralyzed on one side, his body a road map of scars. But you never met a more game person in your life, he never gave up and would try anything I'd ask him.

Christine smiled a shy smile at him, her hands folded on her coffee cup, as the rest of the group heaped praise on her. It was a way for them all to share in any sign of recovery. I wanted that for them.

Louise put up her hand, reading the paper quickly before offering her news item.

"Go ahead, Louise."

"Well, it seems that The City of Calgary wants to put up taxes to build more roads."

"Oh, great," said Gary.

"What do you care, you piece of junk?" quipped Bruno.

"Because I own a house, jerk," Gary snapped back.

Louise shot them a dirty look, I could tell the interruption had made her lose her train of thought.

"Go on, Louise."

"I - ," her mouth snapped shut, her eyes widened in fear, "I can't remember." Gone that fast, her short term memory was still very bad and she knew I knew.

"Taxes, you mentioned taxes."

"Oh," she looked down at the paper, not to remind herself but because she was embarrassed.

Bruno and Gary felt bad, I knew, but they weren't the type to tell her so. Everyone was quiet, a sound I never really got used to working with these students. It was always a reminder of the frailties, a common bond that they really didn't want in some ways. The silence was always an exclamation point in the room, a reminder of the possibility that there may never really be an answer to their questions. The little

boy and girl looks of worry that flashed across their adult faces was always part of that awful silence.

This type of situation was always present, and still is with the students I tutor. The classroom allowed the students to share good and bad days with each other, and they helped one another in ways that staff never could. I felt that if I was going to continue to be of any value to their recovery, I had to continue to investigate how the brain worked in order to help heal their minds. As a teacher, I spent most of my time nurturing the mind, helping it to develop, but working with the brain injured individuals allows an exploration into the workings of the brain. Even if I didn't want to, the vast medical knowledge that is brought to my attention at meetings with the medical profession helped pique my interest. I began to further investigate just how the brain itself works, in order to perhaps allow me a window of opportunity to help my students relearn.

## Chapter Eight

## Remember

I've a grand memory for forgetting, David.

- Kidnapped, Robert Louis Stevenson

Memory is still one of the most difficult and complex areas of the brain. It is so integral to our survival that isolating it in order to understand what it is and how it works becomes increasingly difficult. Neuro-psychologist, Dr. K. Lashley stated, "In reviewing the evidence on the localization of the memory trace, I sometimes feel that the necessary conclusion is that learning is just not possible." (Lashley, 1950). Nearly fifty years later, the science of memory is nearly as stymied by the complexity of memory. However, in the past ten years, imaging technology has greatly aided in understanding what areas of the brain activate during memory recall.

Nuclear magnetic resonance imaging, or MRI, uses strong magnetic fields to induce changes in water molecules in the brain. These can be measured and they can be reconstructed to show anatomical detail of the brain. More recent developments have allowed neuro-scientists to study actual cerebral activation when mental activity is taking place. This type of imaging is similar in use to an x-ray in looking at a broken bone. For the MRI, it allows us to see specific brain injury sites and the correlation between the biological damage and the memory loss that resulted.

The measuring of brain activity in this way has shown that the left - right hemisphere theories of the last fifty years are not as clear cut as some once thought.

The two large areas are more likely only one of the many different organizational schemes in the brain. To simplify the workings of the brain in hemispherical terms would be a mistake to a great extent. However, the relationship between a local area of the brain and its function allows us to get close to understanding memory and complex behaviour (Deutsch, 1992). For example, the memory for direction involves linguistic processing in the left hemisphere and imaging processing in the right. Yet where this takes place does not completely tell us how it takes place. As educators, we can use stimuli to help the brain 'fire' in different areas and therefore, contribute to the connection between where and how.

Researchers studying memory at the cellular level use small single organisms like snails to link learning and memory. They found that when learning takes place a physical change also takes place in the synapase. The neural connections are strengthened within the memory network responsible for that memory. Therefore, as educators, the more stimuli we give a student, the likelihood of strengthening a memory will allow learning to take place. This is the basis for my work with brain injured students, and for understanding how learning takes place within all of us.

Memory networks from chemical connections at the synapse, or the gap between the neurons. When objects or events are to be processed, a large number of neurons are activated, such as shape or colour recognition. As more and more neurons are activated, the chemicals in the brain or neurotransmitters, are related by the neurons making even more connections. So, if you are looking at a car, various areas

of the brain are activated and the message of the car is processed. No single site is responsible for this or any other image, but a collaboration of many brain areas. Thought occurs when the stimuli you perceive causes related neural networks in the thalamus (processing the situation), and the cortex (containing memories related to that situation) to fire. When the object or situation occurs frequently, the synoptic connections become stronger. So, some neurons become stronger and the person's memory of the object or the event also strengthens. Strong neural networks, therefore, can easily trigger a memory without much mental activity, while weaker memories take considerably more effort.

A neuron can play a part in many memories and therefore, our brain can process a great number of related memories. Emotions play a part in that they connect memory networks with other networks allowing you to recall many events from one source of stimulation. This is described as a cortical map, part of the cortex of the brain. (Gassaniga, 1995). Interestingly, the fiber pathways of your visual areas of the brain are two-way. Information travels from the sensory lower levels of the brain to the upper conceptual levels, and from the higher levels down to the lower sensory levels. Theoretically, this is how you are able to download data and visualize memory images (Pinker, 1995).

Short term memory is critical in the role of information gathering in that it allows us to determine the importance of current stimuli. The function of this type of memory occurs when the neural networks in the thalamus and the cortex synchronize

in their firing patterns so current situations, along with related memories are working together. The number of bits of information that can be processed by the short term memory is about half a dozen at a time (Novitt-Moreno, 1995). Therefore, the brain is able to categorize larger units of data, similarities, differences, etc. to help limit the onslaught of information so we see a car as a unit, not all the specific parts, one at a time. Your brain is now able concentrate on interesting or important incoming information.

Long term memories are stored via two main areas of the brain, the hippocampus in the limbic system, and the temporal lobe areas in the cortex. Two types of memory are stored in the long term memory, episodic and semantic. Episodic memories are personal ones tied to a specific episode, while semantic memories are more abstract, such as mathematic or language symbols.

Procedural long-term memories are ones that are automatic skills such as riding a bicycle. As a skill develops, the prerequisite skills are blended in with more advanced skills. The areas responsible for this type of long term memory are the amygdala, the emotional centre, and the cerebellum, found at the lower back of the brain. This procedural system quickly activates our automatic motor system (cerebellum), when we feel a threat is looming. Motor neurons react and trigger the next reaction. Educationally, that is why tasks that do not link with emotion, such as drills and work sheets, are difficult for many students to do, the need to store that type of information takes more effort. A memory that is linked to more senses, sight,

hearing, etc. becomes more accessible and powerful because it is stored in more than one area of the brain (Restak, 1994).

Damage to the brain, as is the case with the students I work with, shows how short and long term memory is affected. Damage to the higher mental functions has an impact on memory. Retrograde amnesia may occur, loss of memory prior to the accident, and anterograde amnesia, which affects the person's ability to acquire new information. Retrograde amnesia usually fades quickly with the oldest memories coming back first. Fortunately, anterograde amnesia usually diminishes as well except for the more critical cases. However, this shows how the shock to the brain due to injury causes the brain to concentrate its energy on basic survival, running the heart, lungs, etc. and will disregard the higher levels of consciousness.

Alzheimer's disease, which has been talked about more and more in the past ten years, shows how memory is affected. The degeneration of tissue in the cerebellum region and in the temporal lobes causes prominent memory loss. Older memories are kept whole, the newer memories are the first to go. Attempting to understand the causes of cellular degeneration is where the researchers are currently putting their efforts (Deutsch, 1987). Research into the similarities between Alzheimer's and brain injured patients in terms of memory retrieval is just barely underway.

Another interesting element of the brain memory system is the conscious versus the unconscious memory. Amnesia is now considered to be an impairment of

conscious memory, of recently acquired information, not a global failure to retain it. Neuro-psychologist, Morris Moscovitch, works with the theory of conscious - unconscious memory. He believes that memory that is procedural, more automatic, occur without conscious effort, even though it may be complicated in nature. Areas such as visual input may deal with one type of information, 'record' the information, and when the stimuli occurs, the neurons connect and offer the memory without conscious effort. That is why an image may 'pop' into your mind. Moscovitch believes the hippocampus functions in such a manner. (Moscovitch, 1991).

The conscious effort to recall memories involves the frontal lobes, and therefore damage to these regions, (many of my clients) shows how the unconscious memory can show itself. For example, many of my clients will confabulate when talking because the stories will not have the proper spatial or temporal order they should have. Their stories become fabrications because the ability to remember when it happened and in what context has been damaged, the frontal lobes. The damage affects not only memory, but other aspects of their lives, often with tragic results.

## Chapter Nine

## The Human Factor

The doors of Heaven and Hell are adjacent and identical.

- The Last Temptation of Christ

(On being urged to make his peace with God.)

"I did not know that we had ever quarreled."

- Henry David Thoreau

Every week, the staff would meet with a client for their IPP conference (Individual Program Planning). This occurred for each student every three months to review their progress and to make recommendations for future goals. It was always pretty intimidating for the clients, sitting in a room full of staff and medical professionals having their life laid bare before them. Any and all problems were brought up from cognitive problems in the classroom to personal problems with a spouse or family member. I remember one such meeting with Dennis, the happy-go-lucky forest worker, who was hurt on the job and wanted desperately to go back to the work he loved.

We were all sitting in the conference room waiting for Dennis to arrive, his doctor, the neurologist, the psychologist, and the Bethany team I had already mentioned. Dennis came in and walked up behind Jill, my boss, lifting her ponytail.

"Dennis, what are you doing?" she asked.

"Just checking to see if what they say is under a ponytail is true," he smiled.

"You jerk!" she laughed back.

He plunked down beside me and whispered, "Here we go again, Thurston."

His doctor, a gruff Scots gentleman, cleared his throat and began.

"Let's get to the point quickly everyone," he looked at Dennis, "you keep asking to go back to work, Dennis, correct?"

Dennis looked at him, a smile spread across his face. "Yeah, Doc, you know that."

The doctor looked at him for a long time, expressionless. "What did I tell you last week?" he asked.

The smile disappeared from Dennis' face, his eyes lost their sparkle. "You said my coordination was poor and that I probably wouldn't make any progress."

"That's correct, and I believe everyone in this room would agree with that assessment."

I had heard this type of clinical assessment of my students for nearly a year now, and it had always bothered me how black and white their assessments of someone's life could be.

"Now, wait a minute," I said. "I never agreed that Dennis couldn't return to work. His cognitive progress has continually improved. In fact-," I pulled out my testing results from my briefcase, "Dennis is now at the grade ten level in both English and Math-"

"Mr. Thurston," he interrupted.

"Not bad for someone who dropped out of Grade Nine."

"Mr. Thurston!" he barked at me. "Are you a doctor?"

"You know I'm not, but-."

"Then, when we want your classroom information, we'll ask for it."

I could feel the anger well up inside me. This was becoming a regular occurrence at these meetings, the teacher had better know his place. After all, what could I possibly know about the client's brain injury and resulting problems. Dennis leaned over to me and whispered, "Nice try, teacher."

The doctor handed some papers over to the neurologist who scanned them and shook his head.

"Dennis," he began, "I have to agree, these latest medical reports show little improvement with your hemi-palligia. How could you return to cutting down trees?" he adjusted his glasses and peered at Dennis.

"Look, I already told you guys," Dennis stood up, "I wouldn't be out in the field, I could work in the cutting shop."

"And cut your hand off?" asked Jill.

Dennis looked around the room at everyone. "Look, I'm tired of doing everything you ask me to do and then have my goals taken away."

"Your goals," said the doctor, "have to be reasonable ones."

"Yeah?" Dennis walked over to him. "Well, I'll decide that. You know I've been married, helped raise my little girl, paid bills, bought a house."

"We know that Dennis," his psychologist piped up.

"Do you? You know, I've got a brain injury, I'm not stupid!" he yelled.

Everyone sat silently. Dennis stood in the middle of the room, surrounded by a dozen people that were supposed to be helping him. He felt attacked, powerless, his life was being decided by strangers, "What would you like me to do?"

"We are ready to offer you a settlement and a monthly wage to live on," the WCB representative, a young woman of thirty spoke up.

Dennis looked at her and laughed, "I don't want a settlement, I want to work!" He plunked back down in his chair resting his head between his hands.

"I'm sorry Dennis, that just wouldn't be safe," the doctor said matter of factly.

As the meeting wore on and everyone gave their results, independent living skills, cooking, finance, group activities, etc., Dennis just sat there and said nothing. No one in the group really looked at him, they just read their notes, gave their recommendations and gave the floor to the next person. In the end, Dennis would be discharged, receive his WCB pension, and try to find things to fill his life. Pretty hard for a thirty-one year old man to do.

As I got up to leave the meeting, I watched Dennis walk by everyone without speaking and go out into the hallway to the smoke room. A hand touched my shoulder, it was Norm, our Social Worker, "Roy, you're Dennis' key worker, right?"

"Yeah, Norm, I am."

"Well," he looked around and pulled me aside. "I thought you should know,

Dennis' wife left him last week."

"Oh, God," I swallowed hard, "not now."

Norm bit his lip and continued, "Worse yet, she's taking the daughter with her."

"What can we do, Norm?" I asked.

"Just be there for him, talk if he wants to."

I went into the smoke room and tried to talk to Dennis. His usual happy nature was buried in despair. He promised me he'd be alright, he just needed some time to think things over.

That weekend, I couldn't stop worrying about Dennis and tried to phone him at the apartment that we had moved him into as part of transitional living. I couldn't reach him.

On Monday morning, I came in to work and the unit was unusually quiet. I walked down the hall past the client's rooms, they were either empty or the doors were closed. As I got closer to the staff room, I heard someone crying. I walked into the room, the staff were all sitting there, a couple of them, Lyla and Leanna were crying. Jill, her usual stiff upper lip trembling came up to me and put her hand on my shoulder. The words came out, but I already knew what she was going to say, "Dennis killed himself."

The classroom was quiet the following week after the death of Dennis. Most of the clients knew why he had done it, some did not. The same could be said for the

staff. The psychologist and social workers talked to all of us, but it really didn't help, I suppose in these circumstances it never really does. Each person deals with loss and grief in his or her own way. I think what makes it worse in this field is you know, or at least catch a glimpse of, what causes a suicide, but like an avalanche, it builds and builds to an uncontrollable end. The brain injury is the enemy, and both the staff and the clients know it. The mechanisms that control rage, depression and anxiety are often destroyed as a result of the injury. The frontal lobe controls emotion and inhibits impulses (Smith, 1993), and Dennis had acquired a serious frontal lobe injury.

I became even more determined to find another approach in the classroom that would help in fighting off the waves of depression that many of my students were facing. Since they spent the majority of their time with me (four to six hours a day, five days a week), I felt I was the first line of defense for them.

A person who suffers from a brain injury is described quite often as 'not being the same as they once were.' This is because often their ability to relate to others, family and friends, has been affected by the damage to areas such as the frontal lobe. Certain behaviors that we can check or catch ourselves doing and prevent, are now overlooked or not realized by brain injury survivors. I noticed in my classroom some of these behaviors, they included inappropriate language or humor, staring, temper and rage for little reason, and impaired judgement. These often could be dealt with by Lyla, my aid, and myself, and verbal cues would help the student remind themselves to stop. It is important to note, that these individuals, for the most part, look normal, and

therefore the society in general has great difficulty understanding their social deficits. We, as a society, find it easier to sympathize with a physical disability than an emotional one. Let me give you an example. Lyla and I took the class to the University of Calgary for a tour. Many had never seen the inside of a University and they all agreed they would like to go there and make a day of it. We drove in from Airdrie and proceeded to walk through the buildings and answer questions for the group.

"Hey, Thurston," said Gary, "you went here?"

"You got it," I said.

"Were they desperate that year for teachers?" he smirked back. The group laughed and traded insults with me and each other.

When we stopped for lunch at the food court, it was spring and not very busy, Lyla was going to the washroom with Christine, the young teacher. Now, as a result of her stroke, Christine's speech is slurred and slow, and she was very conscious of that fact. The rest of us sat around eating and talking when Lyla and Christine came back about five minutes later. Christine was crying and Lyla was red faced with anger.

"Stupid jerks!" Lyla plunked down next to me.

"What happened?" I asked, the group was now quiet.

Lyla's dark eyes filled with anger, looked into mine, "Two girls in the washroom asked Christine what time it was, and because of her speech they -," her eyes softened and tears began to fill up in them, "they called her a drunk."

"What?" said Bruno. "Those dirty !"

I waved my hand at Bruno to be quiet.

"Is she going to be alright?" I asked Lyla.

She looked at me, gamely fighting back the tears, and leaned towards me and asked, "Would you?" When we returned to the Centre, Lyla went into our office and cried to me about Christine and the cruelty of people for about an hour. We both agreed to double our efforts in the classroom. To do so, I had to continue to explore the science of the brain to better help the mind.

## Chapter Ten

## Connections

> As far as we are able to understand, the only aim of human existence is to kindle a light in the darkness of mere being.
>
> - Memories, Dreams, Reflections, Carl Jung

In understanding the brain and its biological workings, we can understand how the neural network works and how memories are stored and retrieved. Yet, as teachers, our field struggles with a question that has perplexed philosophers, theologians, and anyone who has ever asked "Who am I?" The consciousness is the relationship between mind and brain. As has been mentioned, as scientific knowledge brings us closer to understanding the workings of the brain, we hope to understand how the brain gives rise to subjective experience.

Consciousness is the ability to process information from the brain. We know that information about something is located in various parts of the cortex. It is accessed by the synchronization of the neurons and neural networks which is achieved by the release of chemical connections, or neural-transmitters. The frontal lobes allow us to plan and carry out, to express our free will. So consciousness is the connection of the brain's neural tract ways to the frontal lobes, at least it appears to be the best working understanding we have so far. How do humans access their consciousness?

Firstly, we are aware of sensations around us, colors, shapes, sounds, smells,

and feelings of our bodies. Secondly, this information is brought to our attention. It goes in and out of short term memory and becomes part of our deliberate cognition. Next, these sensations come with an emotional colouring, pleasant or distasteful, exciting or calming, etc. Finally, the 'self' comes into play, we make decisions as to what is to be responded to. All of these play a role in decision making, thought, and perception. (Baars, 1988).

The next problem that arises from studying the brain-mind connection is one that directly includes the teaching profession. What is intelligence? As teachers, we are exposed to the minds of our students, listen to and read their thoughts, and by the very nature of a marking system, estimate intelligence. Working with brain injured individuals, I test them to see at what level they function at, via grade levels. How can people whose brain tissue has been damaged, whose neural pathways have been torn, possibly be intelligent? The definition of intelligence has been a difficult one to agree upon, no one is really certain of what intelligence is, or what we are really meaning. Two themes seem to be prevalent in most definitions, the capacity to learn from experience, and the ability to adapt to the environment you exist in.

The clients I work with are able to learn at a normal or slower rate, and they adapt to the cognitive changes they face and the 'new' world they now live in. Therefore, the intelligence aspect may be altered but it is not non-existent in the brain injured individual.

In order to understand the connections between the biology of the brain,

consciousness, and intelligence, we need to see how they are all linked to learning. What exactly does it mean to learn? The biology experts of the brain have their view.

Learning, argues Gazzangia (1992), is that all we do in life is discover what's already built into our brain. Learning, he hypothesizes, is a search through our brain's basic networks and combining them to respond to immediate challenges. We are born with a basic developmental program that allows the neurons within the brain to have different functions and be able to interconnect. All humans are born capable of speaking any language on the planet, but we are not born proficient in a language. So learning is a possible connection between our genetics and our social environment, the knowledge gained from tens of thousands of years past in our species and with our own personal lived experiences. Experiences create complex connections between the neural networks, so there are cultural learned experiences, and personal ones depending on what each individual decides to retain. Parenting and teaching then, act as facilitating agents for learning. (Hubel, 1988).

What is difficult for us to understand or remind ourselves of is that the biological evolution of our brain is much slower than our cultural evolution. The cognitive challenge we faced so long ago, basic survival, physical danger, etc., have little to do with current problems such as population growth or pollution. Our brain's basic engineering is not really designed for these types of problems. The learning problems we face now are a result, to a great extent, of our technology. The biological evolution of our brain and the modern technology we live in, can be in conflict. As

teachers, we need to reevaluate the educational system in terms of what we know about the brain, in order for solutions to technological problems to be more in tune with possible biological solutions. Learning, and what it is to learn, will have to be redefined to allow this unification to take place.

So we know we are not born with a blank brain waiting for the environment to shape it. It is set up to deal with general human problems and solutions, though not functional as infants. New theories as to how we learn, on a biological predisposed basis are already being studied. Howard Gardner's Theory of Multiple Intelligences, for example, talks about innate cognitive approaches to learning. (Gardner, 1993).

The best way to understand the biological evidence of what learning and cognition is about, is to know that people the world over have the same basic equipment for survival. Humans everywhere see, talk, and think about the world basically the same way. What allows one person to utilize his brain more or less than the next person seems to be the result of stimuli offered to it. Triggering the neurons in the brain and to fire and make connections is critical to learning. We know this about children, and now we are also learning that it is true about brain injury. Recovery depends, like learning at critical periods of development, on the amount and type of triggering input offered.

Does learning ever stop because the brain is unable to take in more information, or because of an injury? The answer seems to be no because of something called brain plasticity. This means there is an alteration in structure or

function of a part of the brain due to development or experience and in some cases, injury. The number of neurons in the human brain are there, for the most part, shortly after birth. The connections that process cognitive information develop later on due to environment and personal experiences. The networks continue through adult life as the brain processes memory and learning experiences. Studies on laboratory animals show that those that receive more stimuli produce thicker and heavier cortex, larger neurons, more interneural connections and more glial cells. These animal's brains were better at learning and remembering. (Diamond, 1988). The brain of Albert Einstein, which has been preserved and compared to other human brains, shows it has significantly more glial cells in an area responsible for sensory data and conceptual and symbolic thought.

Neurons thrive when the environment stimulates them. The role for all teachers is to create and maintain an emotionally and intellectually stimulating environment. My work with the brain injured individuals and the biological evidence I have found and worked with tend to prove this theory.

Evolution and learning seem to go hand in hand, the structure of the neural networks change as an animal learns. So both the environment that led to change on a biological level for our ancestors and influenced how we learn, and what we learn, create new pathways for neurons, thus creating change through evolution where both possible. Therefore, we must look at learning as not the top of the evolutionary scale that only man has reached, all animals learn. Which is why simpler animals, as has

been mentioned, are being studied by neuro-scientists to find the neural incarnation of learning.

One key to learning and intelligence is emotion. The reason we have emotions is that we need to make choices, especially with so much stimuli coming at us. They give us a quick assessment of a situation based on needs. An emotion is a mechanism that helps to establish a high level goal in the brain. This allows thinking about and acting upon the goal to occur. (Tooby, 1990).

Human emotions allow mind and body to meet the challenges the world presents for survival. Emotions then, are basic to learning as well, and the use of emotional stimuli in curriculum allows memory to become far more entrenched in our brain, and quite possibly, allows learning to take place at a faster rate.

There are various models of the brain's biological structure. The idea of a whole brain responsible for all of the functions gave way to the two cerebral hemispheres approach, or left brain - right brain. As mentioned earlier, the importance of understanding that some brain activity is divided hemispherically is important, but it does not explain all aspects of brain function. Research does seem to indicate that individuals seem to rely on one hemisphere over the other, therefore leading us to believe that this reflects the person's 'cognitive style'. (Zalewski, 1992). However, knowing what each hemisphere can do does not tell us why the brain has hemispherical specialization in the first place.

In Paul MacLean's model of the triune brain, the brain's evolutionary

development from survival, to emotional, to rational functions is also significant. Depending on the situation or environment we find ourselves in, the brain will 'downshift' from one level to the next. For example, if we are threatened, our brain will rely on the survival elements, fight or flight, and disregard the higher functions.

One of the more recent theories is that of Howard Gardner, who believes the brain is divided into modules, with the neurons connecting each area. (Gardner, 1993). The mind, therefore, works as a result of coordinated activity of the many modules. The modules work independently of the others, engaging in their own forms of information processing. Therefore, if a brain injured individual has a specific type of injury, this will allow an understanding of the nature of the problem he now faces. However, individuals vary in terms of performance, and it is rare that only one area is damaged, usually many of the modules are affected. If the vision centre of the brain is damaged, the person will have vision problems. True, but they differ because it appears that vision, memory, and cognition are widespread through the brain. Many complex cerebral interactions allow us to see, process, and store information. The tests we use to make the decisions on what area is damaged, are limited themselves. I have worked with many clients with site specific injuries, yet the rate of recovery, cognitive functions, and memory skills can differ greatly. It would seem that even a slight injury, or a small damaged area, can cause deficits in a number of areas throughout the brain.

The plasticity of the brain seems to allow the brain to 'rewire' itself around

damaged areas. The brain adjusts itself to the damage, so the biological construction of the brain changes, altering some areas to compensate for the damage. Recovery of function occurs over time in most brain injured individuals. This view of how the brain works, due to damage, has neuro-psychologists wondering still, exactly how does the brain operate?

So, there are two basic approaches to studying brain function. One is on the biological level and the other involves studying people, specifically people who have suffered a traumatic brain injury. Memory and learning have been damaged, and we can learn a great deal from these individuals. As teachers, it can allow us to better understand the workings of the brain, and how to better develop curriculum to enhance learning.

I looked at the basic premise of my classroom to see if what I was teaching and doing was the best approach to helping my students. I was providing academic upgrading from grades six to twelve in math and language arts following the Alberta Curriculum via Alberta Advanced Education. The tests for these courses as well as for G.E.D. certification for a number of my students was also regulated through the Edmonton offices in Barrhead, Alberta. That area of the curriculum seemed to be working, the students progressed, some very quickly, whole grade levels in months, others more slowly, but progress was evident after testing.

However, nearly all brain injuries had a few disturbing and difficult obstacles in common. Firstly, headaches were of major concern. I don't mean the kind most of

us experience, where you pop a couple of aspirin and wait an hour or so for it to go away. These headaches are a result of neural tearing at a microscopic level during their injuries. The brain tissue has been ripped and the pain is often 'chronic and excruciating'. Many of the clients were on Tylenol 3 with codeine, as well as pain management programs offsite. I have often seen clients fighting back the pain in my classroom, their faces as white as a sheet, beads of sweat running down their faces, trying to do their academic workbooks.

Secondly, fatigue is a major problem, often a result of the pain they are facing from the headaches. I tried to schedule breaks about once every sixty minutes or so, any less affected their ability to stay on task.

Thirdly, attention concentration was affected, again as a result of the injury causing headaches and fatigue. You could literally see many of the group fighting to stay with me as I discussed something, but the injury, the fatigue, and the headaches kept blocking much of their efforts.

To give a better idea of what I, as a teacher, was up against, let me list the symptoms that are acquired from brain injuries. Four major categories are used to show the levels of impairment. (Acorn, 1998).

A. Cognitive Symptoms

- attention, concentration difficulties
- memory loss
- problems following instructions

- impaired decision making

- processing information problems

- language problems, expressing thoughts or understanding others.

B. Perceptual Symptoms

- loss of sense of self, "Who am I?"

- balance problems

- loss of sense of time

- vision, hearing difficulties

C. Physical Symptoms

- persistent headache

- fatigue

- paralysis, muscle spasms, weakness

- epileptic seizures

- impaired fine motor control (holding a pen or pencil)

- sleep disorders

- speech articulatory disorders - weird pronunciation

D. Behavioral/Emotional Symptoms

- irritability

- impatience

- problems with stress management

- apathy, lack of initiative

- dependence on others

- denial of problems

You can see why there is a multi-disciplinary team approach. However, as I mentioned, the clients spent most of their time with me in the classroom. Lyla and I had to develop means of dealing with all four of these problem areas on a regular basis. I knew the 'nuts and bolts' part of teaching, the book work was helping but something else was needed. I wanted to teach English because of my love of the emotional experience that life offers through books. I began to investigate what science and medicine knew about emotion and what role parts of the brain played in regulating it. In other words, I knew the mind loved emotion from my own personal view. perhaps how the brain played a role in its creation could be the dimension I needed to add to the curriculum.

## Chapter Eleven

## War of the Worlds Revisited

Art does not reproduce what is visible, it makes

things visible.

- Paul Klee (Swiss Painter)

The emotional unconscious is where much of the emotional action is in the brain." (LeDoux, 1993).

Remember the story of me going to the Tivoli Theatre as a child? I haven't forgotten about it and I'll show how, years later, that became relevant to this paper. The preceding statement by LeDoux sums up much of the current literature on the link between brain function and emotion. Emotion plays a key role in much of what we store in memory. As I read more on the affects of brain injury on the healthy mind and brain, I kept coming across the debate psychology and neuro-psychology have between cognition and emotion. One good example is stated by LeDoux, who says, "The brain mechanisms through which memories of the emotional significance of stimuli are registered, stored, and retrieved are <u>different</u> from the mechanisms through which cognitive memories of the same stimuli are processed." (LeDoux, 1996).

As I have mentioned, many of the students in my class were very bright, degrees, diplomas, and much of their long term memories were intact. Processing the information, short term memory, and often the inability to react in an emotional way to others were affected. Using a traditional curriculum was effective, but one could not

help but notice that depressive states of mind, emotional confusion about people or events seemed to be blocking their cognitive healing. To explain how I made the connection between cognition and emotion, I would again like to take you back with me to the few days where I noticed a breakthrough was about to begin.

One Friday afternoon, I decided to show a film to the class as a break from regular classroom activities. I had gone over to the local video store and by chance, spotted a film I had not seen for years, but remembered what a powerful effect it had on me, it was , of course "War of the Worlds." Now that I had been reading on emotion and memory and I thought that a visually exciting film, with a good story may, at the very least, help keep their interest. I had quite a diverse range of students, remember, from oil workers to teachers and police officers so I needed something that could reach a wide audience.

I paid for the video and drove back to the Life Skills Unit just as everyone had returned from, or just finished lunch.

Gary and Bruno pulled up in the parking lot next to me in Gary's car. They disliked each other, but both found a commonality in gambling with the VLT's at the local Boston Pizza. Gambling is often a major problem with some of my clients, but as adults, you have to watch what you say when discouraging them.

"Hey, Roy!" said Gary climbing out of his car.

"Hi, guys," I said.

"Guess how much I won today?" he asked, a smile beamed across his face.

"How much?"

"Two hundred and fifty-five bucks!" he flashed a wad of money at me.

"How much did you spend to get it?" I asked walking into the building.

Gary looked at me, startled and confused. "I made two hundred and fifty-five," he said.

Bruno smirked and Gary mumbled to himself. Many times the guys had dropped far more than they took home, part of their problem with impulsivity control and memory.

We walked down the hall past Peggy who gave us her "I run the building look" and into the Life Skills Unit.

"Stalag 17," mumbled Bruno, glancing back at her. Lyla had the TV and VCR all set up in the classroom and everyone was busy chatting or sipping coffee.

"Today, I thought we'd take a break from the books and watch a movie." I told them.

A chorus of cheers and alrights burst forward. "Hey, Thruston, should the girls stay for this one?" shouted Arnold, the trucker. The men all laughed while the women called him a pig or a jerk.

"You wish," I joked back. "No, actually, I brought in an oldie but a goodie. Who has seen or read "War of the Worlds?"

Gerry, the cop raised his hand, "I took it in a Lit course at U of A a long time ago."

"Did you like it?" I asked.

"Yeah, it was great!"

No one else had seen or read it and they busily asked Gerry about it. I listened while Gerry gave a pretty good account of what it was about. I was amazed at how Gerry's degree was intact, but five minutes after discussing something in class, he would forget what he had talked about.

Everyone settled in and Lyla came up to me whispering, "You know at least half of these guys have problems with attention concentration, think they can follow it?"

"Yeah, I think so, let's give it a try."

She raised her eyebrows, "OK, you're the boss."

I know what Lyla meant, many times after about thirty or forty minutes, many of the students had problems concentrating due to the injury or headache pain. The difference between lack of interest from school age children and an inability to concentrate was biological damage for my students.

"When an injury of the brain kills neurons, a cascade of events take place, disturbing the fine balance of neuronal functioning. Although the damage may be limited to only a small region of brain tissue, the effects are quite widespread, so that, eventually, the whole brain participates in the repair process that, in turn, may continue for months or even years after the initial injury." (Stein, 1995).

As Stein states, the injuries are often widespread and I wished to find a commonality for learning for all of my students. The visual centres of the brain bring

in to play many areas of the brain, processing, visual recognition, memory, etc. I reasoned that if visual stimuli could have a dramatic edge to it, it may cause more areas of the brain to be stimulated.

I turned off the lights and started the video, the students were all focused on the screen, as the movie began to unfold. I sat in such a position in the classroom that I could watch every student's reaction to the film. With a notebook and pen, I wrote down the student's names and next to each one I wrote the following: duration before break required, signs of fatigue, signs of headache, and if they seemed to be concentrating and following the story or not. Since the movie was about an hour and a half long, this would really be a test of endurance for some of them.

Not one of the students left the room! Lyla and I couldn't believe it, even the students with the most attention deficit problems, stayed. Bruno, Gary, Arlene, and Steve were all quiet and attentive, and made none of their usual critical comments or frequent trips for coffee. Dana, with his severe global damage, was also following the story, reacting to the screen at appropriate times, as was the rest of the class. Few signs of extreme fatigue or headaches, those that did seemed to be coping far better than with traditional reading and writing exercises that I used in the classroom.

I recalled the Tivoli Theatre and how we kids were mesmerized by the events unfolding on the screen, and as I looked at my students, they too were transfixed by the story and the glittering images before them. The emotion of the scenes had captured their attention like it had done for me years earlier and since, through different films.

As the film ended and I turned on the lights, a flurry of questions came at me. "Great movie, Roy, when was that made?" asked Louise. "When that Minister was killed, that really was upsetting," said Gerry.

For the next half hour, we discussed the film and what had unfolded from it. It was like talking with a group of excited fourth graders, bright, attentive eyes, laughing, joking, it had really made the class more attentive and involved than I had seen since I started working there. But the most fascinating results were yet to come.

The following Monday, I arrived at work, still trying to wake up as I sipped my coffee, while walking down the hall. Alan walked towards me, heading for breakfast in the cafeteria.

"Morning, Roy!" he said.

"Morning, Al, how are you?"

"Fine, you know, I was thinking, do you think the Martians killed the Minister because he was a Minister, or because he was just a human?"

I stopped sipping my coffee, "What?"

"You know, in the movie on Friday," Alan clarified.

"You remember that?"

"Yeah, sure," Alan looked at me, puzzled, "Why?"

"Well, for one thing Al, you usually have problems remembering anything from the classroom the next day, let alone three days later."

A smile beamed across his face, "Hey, you're right, how did I remember that

film?"

I was about to offer some sort of answer when Gerry and Dana came down the hall, both limping on opposite sides from each other, due to their injuries. "Hey, Roy," said Dana, "Gerry and I were just talking about the movie on Friday."

"Wait a minute," I said, "You guys, too?"

"Yeah," said Gerry, "that was quite a film, considering it was made in the fifties."

I talked with the three of them about it for a few minutes, then rushed down to the office. Lyla was sitting at her desk marking some tests.

"Lyla!" I burst into the room barely containing my excitement.

"What is it?" she asked.

"They remembered."

"Remembered what?"

Jill came into our office, hearing my excitement.

"The movie, "War of the Worlds," they remembered it. Something triggered their memories, and they retained it!"

Lyla's smile was nearly as big as mine. "Now we have something we can really work with!"

The effect of the film "War of the Worlds" on me as a child was an emotional one as well as evoking new thoughts and ideas about the world. These many years

later, as I researched how the mind-brain connection worked in order to help my students, many key factors and theories began to show why that film impacted me so long ago, and how memory was tied into emotion. Let me now explain how this appears to happen.

One of the key areas of interest in neuro-psychology for the past fifteen years or so is the exploration of cognition versus emotion. Some views express that the two are different and separate. " Emotions, up until the 1960's were viewed as bodily reactions to stimuli, not part of thinking at all, they simply allowed you to later reflect on the particular emotional situation." (Schacter and Singer, 1962). The cognitive approach to how emotions worked stayed in place until the early 1980's. I would agree with Joseph LeDoux who states, "Given that a major failing of cognitive science as a science of mind is its lack of concern with emotion, it is not too surprising that the cognitive approach to emotion suffers from the same problem - in emphasizing cognition as the explanation of emotion, the unique aspects of emotion that have traditionally distinguished it from cognition are left behind." (LeDoux, 1993).

My work in the classroom, for example, versus the medical model I worked in, showed how this was indeed still the view of the mind-brain connection. I was facing emotional expressions every day, both good and bad, yet the medical staff was explaining these as symptoms of cognitive difficulties. True to some extent, I agree, however the teaching professions allows, even nurtures, emotion as the expression of the individual. The reactions to the films emotional images was affecting cognition,

something the medical team at the Life Skills Unit and other professionals in the field did not understand as part of the healing process.

As I continued to study the brain and explanations of emotional states, the work of a social psychologist by the name of Robert Zajanc came up. Basically, his work states that "emotion is not just a cognition, that emotional states can occur without conscious awareness." (Zajanc, 1980). Another way of looking at it would be the emotional unconscious. Much has been studied of subliminal perception for example, being able to manipulate people without their knowing it. However, most of the information has shown this is not really the case, you may be able to plant an idea, but the thinking areas of the brain can still overpower it. What these types of studies do tend to show is, "It now seems undeniable that the emotional meanings of stimuli can be processed unconsciously. The emotional action is in the brain." (LeDoux, 1993).

The damage to the brain my students had incurred as a result of their injuries can be diagnosed and pinpointed. I have stated earlier that they would indeed suffer similar problems based on their injury sites - left frontal lobe injury, language difficulties, for example. But that was what was so interesting about them remembering the film, despite their different problems, all of them were reacting emotionally to that stimuli, and remembering and encoding the information. Why, and even more of a mystery, how? The traditional route of education for memory recovery was working, but suddenly it was accelerated at a tremendous rate. I continued to research.

The idea of the conscious and the unconscious mind has been around since the early philosophers from Aristotle to Descartes, and because psychology is pretty much a new field (nineteenth century), it was up to philosophy to understand the mind. "I think, therefore I am," stated Descarte, a good view of the mind-consciousness dilemma. As science entered the race to understand the mind, the bulk of study has been directed to cognition, revealing only part of the mind's function. Science is also limited, in that it does not really study subjective awareness, and that goes hand in hand with emotion and the process of emotional response.

Certain elements of life are universal to all people. Love, fear, sex, food - the basics for survival. If those elements have been around and desirable or frightening to us through millions of years of evolution, it seems likely they are tied to our conscious and unconscious mind. One of the key differences between these states of mind seems to be language. We use language to express our conscious self, which we consider to be the highest form of cognition, the expression of concepts. Yet there have been numerous physical stimuli, pain for example, but higher conceptual information as well. (Greenwald, 1992). This includes recognition of physical features and reactions to them as well as some processing of conceptual meanings, food, danger, etc. To link this to what I was experiencing in my classroom, I quote LeDoux, "We may not have a very accurate picture of the sophistication of unconscious processing. Most of the work done so far has used verbal stimuli to analyze conceptual processing, but the unconscious mind may work more fluently in nonverbal modalities." (LeDoux, 1993).

Think for example how we have tried to express what love is into words, whether it's Shakespeare,

"What is love? 'tis not hereafter;
Present mirth hath present laughter;
What's to come is still unsure:
In delay there lies no plenty;
Then, come kiss me, sweet and twenty,
Youth's a staff will not endure."

- (Oh Mistress Mine.)

Or Tennyson,

"I hold it true, whate'er befall;
I feel it, when I sorrow most,
'Tis better to have loved and lost
Than never to have loved at all."

- (In Memorian A.H.H.)

Now ask someone to recall the image of Scarlet O'Hara kissing Rhett Butler in "Gone with the Wind." A picture is worth a thousand words, is the old saying, and it seems our brain can process images into memory far more easily than words into memory. Not surprising, since language is the new kid on the block, in terms of our evolutionary past (Pinker and Prince, 1995), that is to say, how we use words to express emotion, let alone writing it down. If emotion was the key to help these

individuals to learn and in effect 'heal', there was surely no shortage of emotion in the Life Skills Unit.

## Chapter Twelve

## Fountain of Youth

Fortune Favors the Brave.

- Terence (Roman)

The classroom activities continued as I researched how the brain and mind worked. Language arts, math, and the other traditional learning practices were still being used. One particular day, as everyone was working on their reading exercises, I noticed Steve seemed a bit more agitated than usual. He was restless and shifting in his seat, he rubbed his forehead with his hand. Steve suffered, like most of my students, from excruciating headaches, but this didn't seem like pain but more like agitation. Lyla was sitting beside me, marking some tests and I tapped her shoulder, pointing at Steve. She looked at him, then at me, shaking her head as if to say, "I don't know what is wrong with him."

"Steve," I whispered.

He looked up at me wearily.

"Can I see you a moment." I pointed at the computer room across the hall, which was vacant at the moment.

He got up, he was a big man, over six feet and well over two hundred pounds, but today he looked tired and frightened like a little boy. I had known Steve for over a year now, and as his key worker, I knew he was worried about his ability to look after his wife and two teenage daughters.

We walked over to the computer room, where I asked him to sit down and closed the door.

"Are you okay today?" I asked.

Steve rubbed his head, his hand tracing the scar on his forehead where the surgeon had operated.

Steve looked at me, his eyes filled with tears. "No, I'm not."

"What's up?" I asked.

His eyes darted around the room, the tears spilling down his face, he nervously played with his fingers.

"I - ," he began, "I want my life back," he whispered.

I bit my lip and looked at him, "I know you do man, but things change."

"I know, but I want to go back, please," he looked deeply into my eyes. "Help me go back," the tears continued to fall.

This type of talk had happened with many of my students as the realization of their injuries began to hit home. Sometimes it took only a few months, other times a year of so. But when the reality of what happened to them stares them in the face, the roles of teacher and care giver begins to blur and you really need to pull from both disciplines as best you can. It's a high wire act with no net at the best of times.

"Steve, you know the staff is here to help you, don't you?" I asked.

He nodded his head, staring at the table top. I knew he was embarrassed, crying in front of another man.

"And you know that the classroom is the key to your fighting the problems you face, right?"

"Yeah, I just find it really hard. I can't remember things very well," he rubbed his eyes, still looking at the table.

"I know, I know, but you've gone up nearly three grade levels in a year, that's pretty exceptional."

He straightened up, "Yeah, you're right, it still seems so slow and I still get these damn headaches and memory problems."

"I know Steve, but you've got to trust me, I'm working on some new ideas that I'm sure will help. Remember, this is a new field, my training as a teacher didn't prepare me for these types of learning problems, but the more I learn about brain injuries, the better I can improve the classroom and your recovery."

He looked at me and smirked, "Yeah, I know you're trying your best for all of us."

"Well, ten years ago, there was no programs like this. We can all work together as staff and clients to lick these obstacles to recovery, but we all need to be strong and keep positive."

Steve looked at me and smiled, "Thanks, Roy, I appreciate your faith in me," he shook my hand.

"Hey, you've got a great wife and two good kids. Steve, you just keep fighting."

He nodded and went back to the classroom.

I never really knew what to say to the students when these things happened. Like may of them had said to me over the years, "You just don't know what it's like until it happens to you," and they are right, of course. What is it like to lose part of yourself, to look in a mirror and not really see the same person looking back. From the most personal point of view, do you lose a part of your soul when you lose a part of your mind? We, as healthy individuals, can reassure them that is not so, but do they see it that way? And who wouldn't worry about that, facing death, staring into the abyss and coming back with less than you had. I have often wondered just how strong I would be, don't you?

Incidents like Steve's are also a clear indicator of an emotion that plagues many brain injured individuals and has a severe impact on memory and intellectual ability, depression. Most of us can relate to the feeling of depression and are aware of how it affects our day to day functioning. Our efficiency at home or at work can be impacted, our attention to what others say to us as well as normal routines can be affected. I noticed quite often that my students would be constantly battling depression. We tend to think of depression as someone who is slowed down, tearful, apathetic, perhaps staring off into space. Many of my students felt hopeless and that the world is crashing down on them. Often sleep disturbances are linked to depression, and the staff would have to find ways to get them up in the morning.

Many times the general practitioners our clients would see would prescribe

tranquilizers and sleeping pills because they would seem more anxious than depressed. Then we would have an awful time with them, and their ability to concentrate and remember would be worsened.

The depression the students in my classroom had affected memory in a number of ways. Firstly, they would often have hyper-distractibility, a term that I learned from our psychologist. So much had happened to them so quickly, their injury, job loss, family problems, etc. that they just had too much on their minds. As a result, they had great difficulty focusing and concentrating on the classroom activities. What appears to happen, as I researched into memory loss, is that new information is less likely to be processed into memory engrams because of a less focused environmental stimuli. (McEwen and Sapolsky, 1995). This is called a shallow memory trace by neuro-psychologists, and because the information is not as permanently encoded because of distraction, in this case brought about by depression, the person is more likely to forget. Secondly, a person's ability to retrieve a memory is affected. To retrieve and reconstitute a memory can be difficult at the best of times, damage to the brain compiled with depression makes it even more difficult. The person is trying to concentrate on what is being taught, for example, but the other problems on his or her mind are interfering with the task at hand.

I had to be aware of either a biological memory problem or a memory problem that was manifesting itself as a result of depression. A depressed person may simply not be paying attention to events or care enough to be bothered to remember what was

being taught. The only way to establish which was which, was by studying their medical file on the injury site, know what that type of injury can do to memory, and consult with the psychologist to see what was happening in their personal life. This is called dual-diagnosis, and it can be extremely frustrating to deal with as a front line teacher, believe me. Yet, as I learned about problems such as depression, it helped justify and validate my use of emotional based film imagery to help the students recover. Anyone who is depressed needs to get their mind off of what is causing the depression. If they are watching a powerful piece of filmmaking, that element of their problem, depression, can at least be alleviated for a couple of hours. Now, what types of films to use was the next step.

I decided to use film on a weekly basis as a way to get the classroom to relax and enjoy something a bit different and perhaps help with their mood affect and depression. I thought comedy might work well because of its very nature, and indeed it seemed to help in the short term to lift their spirits. However, after about a month and a half, I saw no real improvement in the students' moods or memory retention of the film. Remember, they had talked to me a number of days later about "War of the Worlds" imagery, but I noticed they did not recall to any great extent, any of the string of comedies that I had shown. I looked into this and found some possible explanations. First of all, humor seems to be one of the newer inventions of the mind in terms of evolutionary biology. It often is used as "a prized tactic of rhetoric and intellectual argument." (Chapman, 1977). Not exactly required through our evolution

until our most recent history and probably not stored in memory as a result. It is literally not at the core of our survival. Voltaire once stated, "A witty saying proves nothing."

Secondly, the nature of humour is at a higher cognitive level (tell your dog a joke and see if he gets it), and therefore requires far greater concentration and dissemination of what is happening. The images that roll over the mind can be picked up or discarded at will, and on personal preference. If a bear rears its head on the screen and growls, fear is universal and everyone in the theatre reacts to it. It seems that emotions such as fear are adaptations to survival, not just reactions in our nervous systems. The things we fear are a result of dangers we often were wary of as we evolved, certain animals, snakes, poisonous spiders, etc., were very real dangers to us, and the areas of our brain that instinctively react to them are still with us. Humor seems to be a luxury for domesticated man who now has more leisure time and relative safety.

Film is not just motion, it is emotion. When we watch a movie, we get caught up in something that is not real, but appears real. Images fly past our eyes, words evoke mental images and tug at our emotional underpinnings. Why is this medium so powerful? Well, we get to see fantastic places, real or imagined, be in the presence of famous or powerful people, feel that we are overcoming fantastic odds and winning, win the girl (or guy), and defeating our enemies. (Tan, 1996). The filmmaker Martin Scorsese said of his love of movies, "I may never entirely get beyond the simple

amazement of watching still pictures move and come to life."

I decided to use visually and emotionally powerful films as part of my regular classroom activities. The research I was looking into was continuously emphasizing that emotion appears to be the key to remembering and storing memory. The little ten year old boy in the Tivoli Theatre kept coming back to me and staring at me in the mirror with innocent eyes in an adults' face. I was sure that was the key, to recapture that type of powerful memory, and share it with my class in the hope of helping them heal. It is interesting that childhood has such vivid memories for all of us and that we try and recapture that exuberance for life, that 'fountain of youth'. Memories and experiences in youth seem so powerful and alive and perhaps that is why movies have such an affect on us. For a few hours, we turn back the hands of time and we are young again, like when the world was new.

A famous modern day writer (who was once a High School English teacher, by the way), Stephen King was being interviewed once and I remembered something he said. He was asked where he got his imagination for his stories from. He said that when we're young we have a marvelous third eye, imagination, and as children imagination sees with twenty/twenty clarity. As we grow older, it dims and the boundaries of imagination begin to close and become tunnel visioned. We lose our ability to think around corners and the world becomes only what we focus on and pursue, career, family, etc. and we lose that ability to imagine. Artists break open that tunnel and allow you to look at the world in a different way, if only for an instant.

I thought about what he had said and how he had also mentioned that many artists, authors, and filmmakers have the dreamy eyes of a child. Orsen Welles once said about filmmaking, "It's the best set of electric trains a boy ever had." The students in my classroom were, in a sense, like children again. They had lost the trappings of adulthood and were now enthusiastic about rebuilding their lives, they wanted to go back to being an adult, but they could never really be the same 'adult' again. The opportunity for a whole 'new' person was there, and as a teacher I think I had found the key to awakening the child in them again. That childlike wonder and awe could be rekindled and used to help with memory, learning, and discovering their own new path.

## Chapter Thirteen

### Point of View

A child of five would understand this. Send someone to fetch a child of five.

- Groucho Marx

On a bright sunny day in July I was marking some tests in the classroom and getting ready for the afternoon class. The sun danced off the windows and the desks in the room shone with light. As I sat at my desk, a shadow passed before me and I was aware of someone sitting down. I looked up at the stern uncompromising face of Eleanor, the head nurse of the building and of our unit. Her starched, white, spotless uniform showed just how she ran her end of the building. With her and Peggy, the manager, Stalag 17 wasn't too far a stretch as an analogy.

"Can I have a word with you, Roy?" she asked, her voice cold and to the point.

"Sure," I said, readying myself for another onslaught of stories about my students. Although adults, the guys often behaved in inappropriate ways, especially around the seniors in the rest of the building like the time Gary snuck some cigarettes to an old guy, who was dying for a smoke. Unfortunately, he almost did, since he was hooked up to an oxygen unit. Luckily, Gary forgot the matches. I had to admit some of my students, truckers and oil rig workers, were thirty going on seventeen, and that was before their accidents. I held my breath and waited for the blow.

"I just wanted to say," she began fumbling with a pen, "I think you're doing a

hell of a job in this classroom."

I'm sure my jaw hit the table. Ever since I had worked here, the staff in the other units rarely gave us the time of day, let alone any accolades. The brain injury unit frightened many of the senior residents, and some of the men, Armand, Gerry, Charlie, were well over six feet tall and heavy built. "Oh, well, thanks, Eleanor, but Lyla and I are just doing our jobs -."

"No, let me finish," she said in a very quiet but forceful voice, "before you came here, that classroom was in trouble. The other teacher lasted six months and quit. I never saw so many chairs and tables flying then since the last twister in the area. But these people respect you, and I think you treat them with real dignity and caring, not like handicapped people, but people with a problem that you are including them in trying to find a solution to." She smiled a rare smile, "It sure makes my job easier, too. See you later." and she walked out of the room. I was stunned, a nice stun, but stunned nevertheless. Lyla walked in and past Eleanor in the doorway and smiled at her.

"Now what happened?" Lyla asked.

"Nothing, she just came in to tell us what a great job we were doing."

"You're kidding," Lyla looked as shocked as I felt.

"Yeah, I guess she has noticed the clients are enjoying our non-medical approach to healing," I sarcastically joked back.

"Hey," said Lyla, "believe me, the medical people don't often admit that can

happen, we must be on to something."

I nodded and thought that small accolade might just very well be a nod from the medical world, at least it was a start.

A key factor to remember, and I can't emphasize this enough is, a brain injury does not make a person stupid. Certain areas of the brain are damaged and depending on the severity of the damage, the persons' ability to process and retrieve information is affected. Now our facility generally kept to the strict guidelines as to who we would allow in, therefore allowing the person to benefit the most from our particular program. For example, if I tested a person entering the program on math and language arts skills and they were below a grade four level, they would be referred to the brain injury program at Ponoka. Also, the person had to be able to self-medicate, so if they had to take X number of pills per day, they had to have the mental facilities to do so. These types of criteria had to be followed, and as the teacher in the program, I agreed that standards needed to be established. Any school board does the same sort of thing.

Now, back to my point about intelligence. As I have said, the students were from various backgrounds and ages. Once they had passed the criteria to get in, you realized you were working with intelligent people suffering mild to moderate physical and intellectual obstacles. That is why long term memory is often intact, while short term memory is the one often affected and causing the problem for relearning.

A persons' memory is his identity. If you can't access old memories or bring in new ones, you lose all sense of who you are. Past experiences help us make decisions.

It really becomes an exercise in frustration. So, in effect, what I was doing in the classroom, and that Eleanor had noticed, was to rebuild self esteem through learning as Howard Gardner talks about in his most recent book, "Fact Based Learning Does Not Mean Intelligence". (Gardner, 1999). I would agree with that, based on what I was seeing in the classroom. Doing page after page of math exercises or language arts books is needed to help the brain to learn to process information, but it does not in itself help the student to function in the world, brain injured or not. Being able to apply what you have learned to your own personal needs and views is, to me, where intelligence resides. The students in my classroom had learned the basic information I was teaching them years ago, and their struggle and frustration was because they had to do it again, and that it was harder to retain. I needed to find a way to keep them on task doing the basics of education while allowing them to feel they were also involved with learning totally new and applicable knowledge. The best analogy I came up with and shared with them was this. Think of the basic class work as a way of exercising your brain, like a muscle. Once we get the brain strong enough, we will start playing the 'game'. The 'game' was the use of the films and to talk about all of the issues that Gardner believes as well that "understanding makes memory possible." (Gardner, 1999). I was finding that emotion was allowing understanding to take place, and therefore memories to be processed.

To give a better idea of what these students face after their brain injury and in turn what I was facing as a teacher, I would like to let a survivor tell his story in his

own words. The following is a brief excerpt from Charles Ottewell's, "A Patient's Point of View." Charles suffered a brain injury after being tackled playing rugby in high school. He was in a coma for three and a half weeks, and also contracted spinal meningitis. This required a shunt to be placed on his skull to relieve the pressure that builds up in the brain tissue. This type of infection in his brain was causing more and more damage on top of the initial injury. After leaving the hospital, Charles has tried to cope with his injury over the years that followed.

"I'm still only able to mentally and physically take one or two courses a semester at University, which leaves me more than a little discouraged about my progress in working towards a degree in school. I hope to find a career job of some sort for I know I cannot change jobs and careers very easily, so it's best I try finding something in a field of work that I like and can handle. After my rugby accident, I did not receive any insurance settlements so I am living on a disability pension from the government which pays my rent and not much more. So to save some money and pay my enrollment at school is not an easy task, but I do manage somehow.

The obvious and not so obvious stress that I live with day to day: just trying to walk when my left side of my body does not respond to my commands, my hands shaking with ataxia when I get tired, (ataxia is an inability to co-ordinate muscle movement or having irregular muscle movements), which makes everyday routines like trying to tie my shoes or pouring a cup of coffee, a demanding task. It is hard for me to accept, when my brain is telling my hands to do something, like to hold a cup of

coffee, yet my battle with the ataxia continues on.

It is a real struggle for me at times to be positive and feel good and happy about what I have accomplished and what I'm trying to succeed at. I have a tremendous amount of guilt about myself, about not doing as well as other normal peers. With my abilities, I can't keep up to so-called normal people with studying and school and just everyday activities. It is a big deal to me just to get my left hand to work so it can open the front door. So with my concentration just doing common everyday 'tasks' at times is a major achievement for me.

I have had limited support from organizations to assist and counsel me towards my long-term goals. The organizations that were, that are supposed to help the brain injured individual at least in my own case, have been of little or no help at all in organizing support for school and/or retraining. I think more funding and proper direction is needed for these groups to become totally useful in the functions in which they were supposed to be intended for. That is, trying to assist the brain injured person with living as independently as possible and succeeding in whatever endeavour they strive for in life. I wish I had more support, to make my transition in post secondary education a lot less burdensome." (Ottewell, 1994).

Mr. Ottewell's views about his difficulties and the supports available are very typical of most brain injured persons. What was unique about the Life Skills program was our in-house educational program. No other brain injury rehabilitation program in Canada offered academic upgrading and cognitive rehabilitation at the junior to high

school levels. The programs available elsewhere offer elementary levels, and only for the severely brain injured who comprise a very small number of the total brain injured population. My classroom was always comprised of Charles Ottewells, bright individuals suffering from frustrating cognitive and physical challenges. The traditional 'rehab' approach from elementary trained teachers will not work, as shown by the previous teacher at our centre.

I had the basic curriculum covered via Alberta Advanced Education, grade six to twelve curriculum, functional academics, G.E.D. programs, etc. In effect, a one room school house in the traditional method. I had discovered that visual imagery seemed to be stimulating memory, especially when it was emotionally laden. Since I was working in a medical based facility, with mostly medical staff, I could access scientific based information to back my observations. Remember, in order to make gains in this field with the people paying the bills, I needed to show improvement in the cognitive realm by using an 'artistic' from of treatment, but one that could be proven or at least backed up by current scientific claims. Think of the dilemma the way Swift did when he wrote "Gullivers Travels". Lilliput, the land of six inch tall people, were battling another small race of people over the proper way to open an egg. One nation believed you opened it from the small end, the other nation believed you opened it from the big end. Either way would work, but they were so convinced that only one way was the right way that they fought a war over it. As a teacher, I am trained to deal with the mind, as medical people, they are trained to deal with the brain.

My approach was to show that if I learned how they were approaching the cognitive problems, and showed how I approached these same problems, there might be a way for both opposing sides to reach an understanding. The winner would be the client (war would be averted, ha, ha).

The dilemma of making an assertion, in this case that emotional visual stimuli (films) can affect memory, is that it can be viewed philosophically and physiologically. This has been with us since Plato and Aristotle and has yet to resolved. Science criticizes an assertion by showing the logical consequences that result from it or unacceptable outcomes. Philosophical criticism attempts to show that the assertion is not really demonstrable at all. The reason being that it is not intuitive, intuitive in this case meaning infallible insight that guarantees truth. There are no intuitively certain premises. (Popper, 1995). Here we are back to the mind versus brain dilemma that has been fueling the debate over who we are as individuals for about the last half century. If I, as a teacher, approach the student only from the humanistic side, do I run the risk of negating the problems that arise from the biological injury? If I pull myself over to the scientific side to study the students problem, do I run the danger of negating the uniqueness of the individual?

Ken Wilber, in his book, "A Brief History of Everything", makes a point about how the brain versus mind debate can negate the individual. "Let's look to an expert on the brain itself - say, a brain physiologist. The brain physiologist can know every single thing about my brain, he can map the physiology, determine the levels of

neurotransmitters - he can know what every atom of my brain is doing, and he still won't know a single thought in my mind. "So I can study your brain forever, and I will never know your mind. I can know your brain by objective study, but I can only know your mind by talking to you." (Wilber, 1996).

I would agree, but what about the people I work with who 'change' after their accidents. Damage to the biology of the brain causes the personality quite often to change, the mind is affected by the state of the brain. You can see how complicated it is, to show that the 'I' is affected by the gray matter in our skulls treads on dangerous ground. After all, we have been studying man philosophically much longer than we have scientifically. Now, I am not saying science has the answers, far from it. My point is both sides need to know where the other is coming from in order to 'open the egg' and find out what is inside.

Let me give an example this time from the scientific community of how they see the human condition, the mind/brain debate. Neuro-psychologist, Steven Pinker states, "I am partial to a different solution, defended by McGinn and based on speculations by Noam Chomsky, the biologist Gunther Stent, and before them David Hume. Maybe philosophical problems are had not because they are divine or irreducible or meaningless or workaday science, but because the mind of Homo Sapiens lacks the cognitive equipment to solve them. We are organisms, not angels, and our minds are organs, not pipelines to the truth." (Pinker, 1996).

This is a tough approach to the dilemma, and a difficult one to argue with. Yet,

science quite often struggles with concepts such as compassion and love, elements of the human condition that we have devoted great works of art to, literature, the building of democratic societies on, etc.

The basis of what I want to share with both trains of thought needs to acknowledge both views in order for it to be understood. The philosophical stance needs to remain true to its wonderful approach to ideas, emotions, lust for life, compassion while science and medicine needs to look at my findings, not as a way of explanation so much, but as a way of describing the workings of mind and brain.

## Chapter Fourteen

## The Outer Limits

My mind to me a kingdom is,

Such present joys I find -.

- Edward Dyer

Teaching this particular group of students proved to be very different than teaching mainstream education, and it allowed me the opportunity to learn what an education is. These individuals had already received traditional forms of education from public school to graduate school in some instances. Also they had experienced 'real life' learning at their jobs, raising children, paying bills, etc. What I was seeing was that the disciplines I was teaching in my classroom, math, language arts, primarily, were having the effect of reactivating long term memory. Let me give you an example.

Gerry, the RCMP officer had a degree in sociology prior to his training in the police force. One day during current events, I had asked the class to read an article about the reasons the suicide rate was so high at a number of Native Reserves in the Calgary area. Everyone was reading the article when Gerry put up his hand.

"Yes, Gerry?" I queried.

Gerry put his paper down and spoke in his usual eloquent fashion and deep booming voice, "You know Roy, this article reminds me of the work that was being pioneered by Emile Durkheim, specifically about the sociological factors in some native communities."

The class stopped reading and focused their attention on Gerry.

"Please go on, Gerry," I insisted.

Gerry continued for about five minutes about contributing factors to suicide, quoting other sociologists he had learned about at least ten years ago. When he had finished and the class had taken a break for coffee, I walked over to Gerry. "That was really interesting information you gave us, Gerry," I said.

Big Gerry held his frail left arm, due to his hemi-palligia and gave me a lost and quizzical look.

"You know, when you talked about Durkheim."

Gerry have me the look of embarrassment so many of the clients did when they had forgotten.

"Did I?" he offered me a nervous smile, and slowly walked down to the cafeteria.

You see, what was happening, and Gerry was a good example of this, is the class work was stimulating some areas of long term memory, which was good. However, the short term memory, and the ability to store new information into long term memory was still a struggle.

I found that what an 'education' meant was the ability to study and talk about it in depth and transfer that information to other areas of life. So you take in information, short term, and pull from long term knowledge you have that allows you to discuss the situation or solve the problem. If you can get the student to be able to

approach a problem in life by the methods used in various disciplines you have taught them, science, the arts, etc., then you have a knowledgeable person who can deal with the various issues life presents.

The injuries to my students did not take away their intelligence, ie: Gerry, but it altered the two components that need to work together to have the necessary skills to live. I feel the key to get around this problem is to stimulate the brain emotionally, particularly visual stimuli, to allow the plasticity of the brain (the ability to rewire itself around the damaged areas) to occur, allowing working memory to function.

Working memory, or short term memory, is an active processing areas in thinking and reasoning (the frontal lobe, as has been mentioned). This area has a limited ability to take in information which is why, for example, you would be hard pressed to remember this number 846725. Close your eyes, repeat it, then count backward from 99 to 9 by 2 and repeat the number. (LeDoux, 1995). This working memory and what we have in it is what we are currently thinking about or concentrating on. It also depends on long term memory from past experiences. What Gerry was having problems with was remembering new information (in this case, the classroom discussion) and storing it into long term memory. Also, Gerry had instigated the discussion, so cerebrally, he was interested in it enough to talk about, but it did not trigger areas of the brain responsible for retaining it. Yet, Gerry would remember a highly visual emotional film, not every frame, but enough of the film to recall it much later. Something had been stimulated, causing the connection and

allowing the information to be kept in long term memory.

To understand how emotional feelings can be retained more easily than conscious thoughts, we need to understand the workings of the brain. First of all, emotional feelings and thoughts are generated by different subsymbolic systems in the brain. Also, emotional feelings involve more brain systems than thoughts do. (LeDoux, 1995).

An emotion is stirred in us because something important is happening - fear, for example, and more of the brain resources are needed to deal with the problem. The activities in the body and mind required to deal with the emotion are all brought to bear. Thoughts do not do this unless linked to an emotional response. That is why we can daydream when we do a particular task like reading, and return to the activity when we wish as neuro-psychologist Klaus Scherer believes, "Emotions cause a mobilization and synchronization of the brains activities." (Scherer, 1993).

What I am hypothesizing is that by using specific types of visual images, in this case, film, it can generate areas of the brain to work in conjunction with other areas, and that can have a tremendous impact on memory and the ability to retain it. Again, remember, part of me is still the ten year old boy replaying "War of the Worlds" in my mind. The emotion those images caused are able to be replayed at will and reflected upon.

"What are we watching today, Roy?" asked Bruno, while sipping his coffee as he sat down, the rest of class following in behind him. I was busy setting up the TV

and VCR, anxious to observe the student's reaction to what they were about to see.

"Wait until everyone is in," I said.

Bruno cupped his face into his hands.

"Another headache, Bruno?" I asked.

Bruno smiled and nodded. He rarely complained but like so many others in the class, the headaches were a constant reminder of their problem. As well, their ability to concentrate, as I have mentioned, was severely put to the test.

Everyone had settled into their seats and were waiting to see what I had planned to show them today.

"Finally brought in some porno, hey, Roy?" Gary smiled at me, the women in the class rolled their eyes.

"Give it a rest, Gary," I shot back. Everyone began giving Gary snide comments, laughing and joking back and forth.

"Well-," I began.

"Deep hole!" shouted Dana to a few chuckles.

I smiled and continued, "Today I've got an episode of a TV series that some of you older students may remember, and you younger ones, I'm sure, will be blown away by it."

"Oh, great, I get to be reminded how old I'm getting, thanks Roy," joked Louise.

"Now, now, I think you'll all really like this."

Everyone listened up as I began to explain the selection. "It's from the early to mid 60's, so it's in black and white, but in some ways that makes it even more powerful. When the first episode was released, it caused quite a lot of controversy."

"Why was that, Roy?" asked Alan, looking intently at me.

"Well, for one thing, some people were so frightened by what they were watching, it induced at least two reported heart attacks, let alone the thousands of calls ABC received in Los Angles, complaining of its content."

"Cool!" whispered Bill, one of the younger students.

"So, what's the name of the series?" a few students asked in unison.

"The series," I paused for dramatic effect, "is The Outer Limits."

A number of the older students began talking. "I remember that, I couldn't sleep for weeks-."

"Man, that was a really wild show."

The younger ones could hardly wait to see it.

"Well, let's see it, Roy!" said Dana.

"OK now, just sit back, follow the story and let the images roll over you."

Lyla turned off the lights and I started the VCR.

The classic science fiction series would start with the omnipresent, yet never seen Control Voice, a 'host' who might be a ghost or a machine, or even an alien. I watched the students who sat mesmerized by the images and the powerful narrative that followed:

"There is nothing wrong with your television set. Do not attempt to adjust the picture. We are controlling the transmission. If we wish to make it louder, we will bring up the volume. If we wish to make it softer, we will tune it to a whisper. We will control the vertical. We can roll the image; make it flutter. We can change the focus to a soft blur, or sharpen it to crystal clarity. For the next hour, sit quietly and we will control all that you see and hear. We repeat: There is nothing wrong with your television set. You are about to participate in a great adventure. You are about to experience the awe and mystery which reaches from the inner mind to, The Outer Limits." (United Artists Corporation, 1965).

As the episode entitled "The Galaxy Being," began, I watched the reaction of the class to the visual onslaught that confronted them. At the time, this was the most expressive television series ever produced, and the visual effect's teams working on it would later be responsible for the Star Trek TV series and many feature films, both Steven Speilberg and George Lucas have acknowledged the tremendous impact this show and the Twilight Zone had on their creative imaginations. I had picked this particular series for its visual grandeur and narrative intensity, two elements that I believed would affect areas of the brain on a base level, emotions such as fear, and at higher, more cerebral levels, morality plays, if you will. The Outer Limits does both very effectively.

The pilot film for the Outer Limits was Galaxy Being, in which Cliff Robertson transported this creature from Andromeda to Earth.

Another visually striking alien in the Counterweight episode of Outer Limits.

(Rovin, 1975)

The "Galaxy Being" concerns man's first contact with an alien from a distant galaxy. A problem with the radio equipment used to make contact results in the alien being teleported to Earth. It searches for a way to get back, causing much terror and confusion on Earth. The being is an archetype of Outer Limits episodes to follow, the humane quizzical alien who interacts with humans that reply by hastening its death.

At the end of the episode, the powerful writing is evident in the epilogue when the control voice offers:

> "The planet Earth is a speck of dust, remote and alone in the void. There are powers in the universe inscrutable and profound. Fear cannot save us. Rage cannot help us. We must see the stranger in a new light - the light of understanding. And to achieve this, we must begin to understand ourselves, and each other." (United Artists Corporation, 1965).

At the end of the video, I turned on the lights and stood in front of the class who sat quietly, faces staring up at me.

"Well, what did you think?"

A flurry of questions and comments came at me. Moral dilemmas raised by the episode, the nature of man's place in the universe, why the creature had no mouth, what did that represent? From a group of adults with the weight of the world on their shoulders, they were now as enthusiastic and full of life as a classroom full of giddy children. I spent a good hour with them talking about the story, the series, and what they got out of watching it. As we broke for coffee, I turned to Lyla. "I think they

liked it." I smirked.

"No kidding!" she joked back.

I began to use this series on a regular basis in the classroom, along with the "Twilight Zone" and numerous science fiction and fantasy films, not as a treat or a break from the daily part of classroom activities, but as part of the curriculum.

Everyone has a unique personality, and all teachers recognize this. As a result, many people learn in different ways, and certain information that seems more relevant to their own strengths, such as Howard Gardner's theories on multiple intelligences. For example, a student who is good at math will retain math knowledge and apply it more easily than someone who is very comfortable with artistic concepts. As I have mentioned, neuro-biologists and neuro-psychologists are trying to find out if there are areas of the brain that are part of the answer to understanding why this occurs.

What I am saying is that if you can stimulate an individual with a visual image that causes an emotional reaction, along with a powerful narrative that hits the student on a cerebral level, that will affect memory and cognition. Now, I am not saying the student will remember what he watched verbatim, what I am saying is that it causes areas of the brain to interact with other areas that it may normally have not interacted with. Howard Gardner talks about a similar type of learning and understanding that he calls "Direct confrontations of erroneous conceptions". (Gardner, 1999). He states, "One can actually confront students with ways in which their current conceptions are inadequate." (Gardner, 1999). He goes on to state, "For most individuals, a challenge

to a deeply held belief at least compels attention; and efforts to defend that belief, or to discover a better belief, line the most promising routes toward enhanced understanding." (Gardner, 1999).

Now, remember my students have significant brain injuries, injuries at different locations and severities, so I needed to find a way to reach them all, as well as work with their specific problem area. These people are quite bright, don't forget, but the damaged area causes certain types of cognitive 'blocks', if you will. The visual images used to tell powerful morality plays affected all of the students, and they were all able to follow and react to it. As a teacher, my job is to pick the films that do both, dramatic image coupled with dramatic stories, so not all films will work. Evidence of this is the recent Star Wars movie, good visuals, so-so story, or MTV videos, lots of visual images, no story, so your brain does not encode the information and you don't remember it.

Here is another way to look at it, the subjectivity of a person is what makes the individual unique, however, we all agree on certain moral codes and values to allow us to form social groups and societies so the thread of 'sameness' that we all agree upon is the area of the mind-brain connection that can be stimulated by certain artistic interpretations of this 'collective' understanding, deeply encoded emotions linked to conscious or subjective thought.

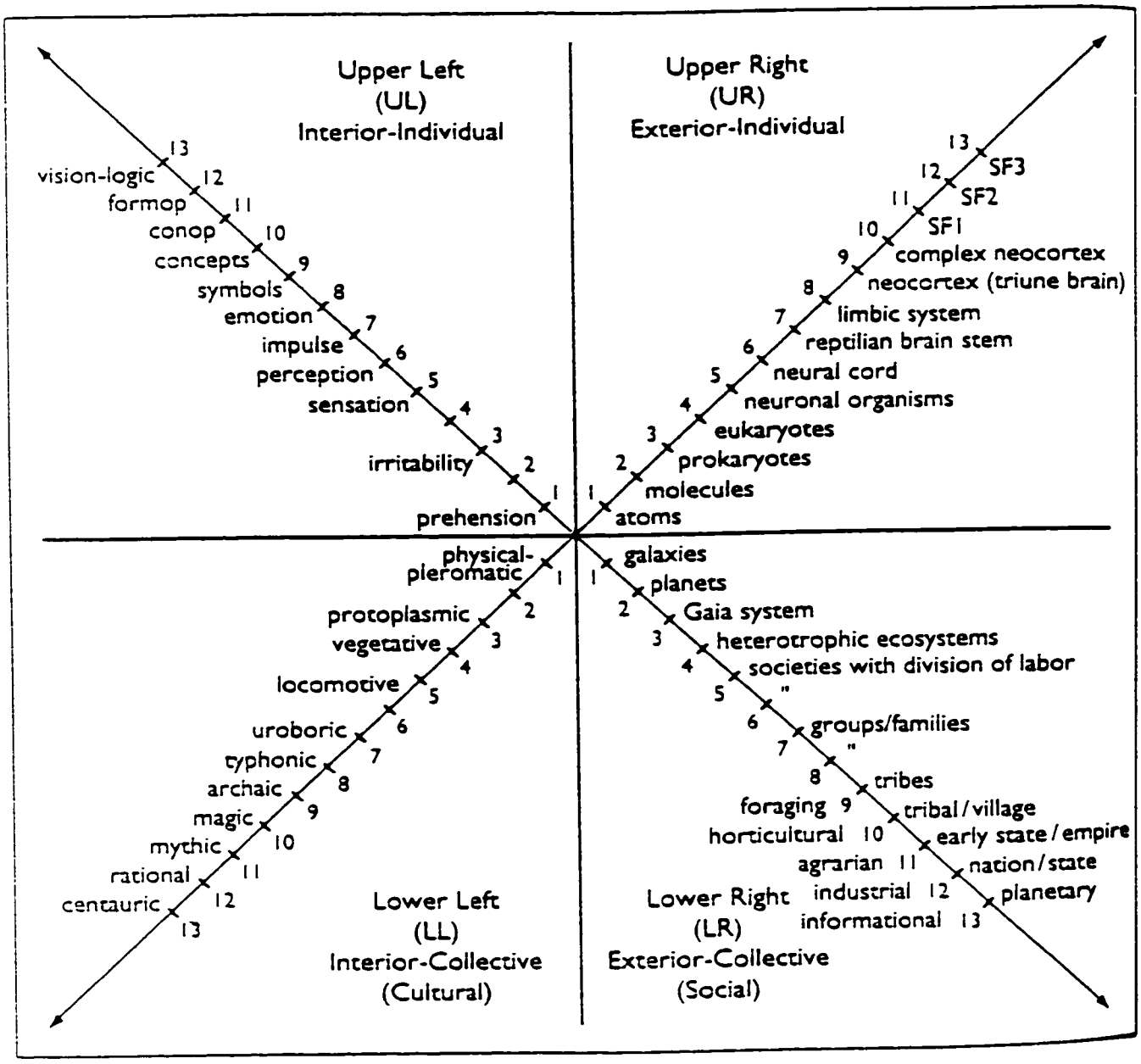
Ken Wilber's view of the human condition, for example, shows how the interior and exterior view of the individual must be taken into consideration - the

biological parts of man, neurons, limbic system, neocortex, and the mind of man, his subjective side, vision, logic, perception, concepts, etc. Wilber explains, "Occasionally, you find an approach that emphasizes both the left and right dimensions, which of course would be my recommendation, but mostly you find a bitter war between these two equally important, but rarely integrated approaches. So I think it's crucial to understand the contributions that both of these paths have made to our understanding of the human condition, because both of them are absolutely indispensable." (Wilber, 1996).

My view that the biology of the brain can be stimulated by pushing the mind to deal with new concepts that link with evolutionary based emotions is what I think both Gardner and Wilber are implying and if the biology of the brain is stimulated, then memory works more efficiently and therefore the mind, as the subjectivity of the brain injured individual, is embellished. The students in my classroom began to 'recover' more rapidly, and their uniqueness or 'self' was allowed to come forward once again post injury. Let me explain what I saw happen as the use of film in the classroom continued.

Depression, as I mentioned, was an element that affected their personal well being, as well as their ability to improve academically. What the students were facing each day was to come to terms with their limitations and also to discover how they

Ken Wilber's Four Quadrants




(Wilber, 1996)

could now fit into the world. Grieving was initially the response both the individual and those around them faced first. The loss of who they once were affected them as well as family and friends. By the time I was working with the person, they had expressed the grief into many forms such as denial, despair and many times outrage. A number of times, a couple of clients would be ready to come to blows in the classroom. As adults, this was extremely dangerous for both themselves, other clients, and staff to deal with. I was able to de-escalate the situation and reason with them.

After an injury such as these people face, the loss of part of the self brings about a sense of bewilderment in their life. What was once taken for granted, a job, family, plans for the future, are now uncertainties. Part of my job was to show how the classroom activities could provide cognitive healing through learning and relearning, as well as provide an opportunity for rediscovering life.

The format of testing and retesting the students about every three months would allow the students an me to see how they were progressing. Usually, the first six months to a year are slow, which can add to the depression of the student. However, as I began using the films and television series on tape as part of the curriculum, the grade levels of the students began to show marked improvements at a faster rate, across all tested disciplines. At first, I wasn't sure if there was a correlation, but after about three months, the grade improvements showed something was stimulating academic performance.

To verify what was happening, I had one of our neuro-psychologists test a

number of students using his psychological tests on IQ and functional academic levels. He reported back and confirmed that the increase in cognitive functions had indeed improved. Also, I noted and passed along to our psychologist and social work team, that the mood affect had also improved. Now, I had no formal way of testing this but observations in the classroom and by support staff in the unit, showed that the students were happier, less irritable, and more optimistic about themselves and their futures, and the psychologist agreed.

There seems to be a biological reason that can partly explain why this occurs. LeDoux explains what happens, "One of the consequences of stress (or traumatic injury) is depression, and depressed persons often have poor memory. It is quite possible that the memory disturbances that occur in depression are closely tied up with the effects of stress on the hippocampus." (LeDoux,1993).

The students have had a traumatic accident which causes adrenaline to be released at a rate that can be dangerous to the brain. (LeDoux, 1995). I believe this is what happens with a brain injury, and why memory is badly affected. However, by using fantastic images that cause the brain to slowly release adrenaline, memory can be positively affected. LeDoux continues, "Sometimes stress helps in the formation of explicit memories, making them stronger, but it can also devastate memory. We now have a plausible explanation for this paradox. Memory is likely to be enhanced by mild stress, due to the facilitory effect of adrenaline, but may be interfered with if the stress is sufficiently intense to raise the level of adrenal steroids to the point where the

hippocampus is adversely effected." (Ledoux, 1996).

What I am saying is that if the biology of the brain can be used to enhance memory, then learning is more likely to occur. The individual is better able to apply himself if he feels stimulated, less depressed, and more empowered. The films I was using were interesting, cerebral, and emotional. So you have the areas of the brain not normally associated with learning, stimulated as a result of the image, and the higher functions of the brain being challenged by the morality play being conveyed through the story. I was able to see this occur because I was working with students who had areas of the brain literally damaged, and yet they began to show cognitive and emotional gains. I have to emphasize that it was not just a certain type of injured person who responded, say a left frontal lobe injury, but all of the students. The emotional link was causing the brain to work more efficiently on numerous levels.

Now one can see how the use of the subjective (in this case, film imagery) can have an effect on the objective (the biology of the brain). The result is the individual is better able to learn because of the stimulation that the art of film provides. As I stated earlier, the films I used, and still use, are very dramatic in nature and that, I believe, is why they are effective. Howard Gardner also talks about the input and use of art as an educational "pathway for understanding." As I have stated, many issues arise from imaginative films, as they did for me as a child in the Tivoli Theatre, and Gardner explains why many issues should arise. "Education in this pathway ought to be inspired by a set of essential questions: Who are we? Where do we come from? What

do we consider to be true or false, beautiful or ugly, good or evil? What is the fate of the earth? How do we fit in? What is the earth made of? What are we made of? Why do we live, and why do we die? Are our destinies under the control of God or some other 'higher power'? What is love? What is hatred? Why do we make war? Must we? What is justice and how can we achieve it?" (Gardner, 1999).

These questions would arise time and time again in the classroom, and the films were the perfect source of stimulation to get the ball rolling and have the students confront these questions and look at the world and themselves differently, and for many of them, perhaps for the first time. I feel these questions are essential to open pathways to learning, and film is a beautiful way to pose the questions. As Gardner states, "The questions are natural ones for young persons to pose. However, they are rarely articulated in explicit philosophical terms. Rather, they are posed in the language of fairy tales, myths, "pretend" play, and, in a cinematic age, films and video." (Gardner, 1999). I believe that by choosing well written, visually striking films, that the questions are presented and that the philosophical discussions arise as a result, combined with that downshifting biological rush in the brain. As I used the films over the years that followed, many great and interesting discussions would come up, and invariably, the questions that the film brought up would go full circle and be intertwined with their own lives. Who am I? Is there a God, do people still love me and why? Often, more times than I can count, Lyla and I would go back to our office at the end of the day, choking back tears or our own hearts filled with happiness and

soaring, as we watched and listened to our students step out of their shells and enter the land of the living once again.

It was the films, I knew it, and I was so thankful that those dedicated artists and technicians who had laboured long and hard to produce their art form, had affected a young boy sitting alone in a theatre so long ago, and later without even knowing it, had helped to heal minds so badly hurt.

## Chapter Fifteen

## Emotional Visions

Art is that in which the hand, the head, and the heart
of man go together.

- John Ruskin (Social Philosopher)

"To be sure, knowledge of the brain's structure and functioning might well hold interesting implications for learning and pedagogy. But the only way to know for sure whether something is possible is to try it. And should one succeed despite the predictions of neuroscience, that success becomes the determining fact. Success will cause us to change the ways in which we think about the brain, rather than revising the ways in which we think about pedagogy." (Gardner, 1999).

I was fortunate to be hired in this field. It's new and fascinating. As I developed part of the curriculum around the use of film and saw the improvements with the students, I knew I was on to something. I wanted to share with others, this good fortune and what doors it was opening in the educational field as well as in the field of brain injury. I wanted, and needed, an objective view. I got it when Bethany Care Society decided to have our program audited by a leader in neuropsychology, Dr. George Prigatano. Dr. Prigatano, it turns out, is the President of the National Academy of Neuropsychology, and he was coming to evaluate our small program and make recommendations. Well, here I was facing another medical/scientific based expert, and I was pretty nervous about what he would think of my educational component.

For the most part, I had always felt like the outcast in the field since so few teachers worked in it. So Lyla and I got our records and files in ship shape order, and had the classroom scrubbed and polished and then chewed our nails to the quick and waited.

Dr. Prigatano flew up from Phoenix and would go over our program from top to bottom for four days. He was a nice man, very professional, and he interviewed all of the staff and clients, read the files, checked our mandate, and prepared to make his recommendations. The students would joke with me or reassure me, but they knew we were all pretty nervous. A bad evaluation and we could lose our jobs.

On the third day, we had all had lunch with him and as we were finishing, he turned to me. "Roy, I'd like to see your classroom and have a talk, would you mind?"

"No, not at all," I replied. I looked at Lyla nervously and she tried to smile back.

We walked from the cafeteria and down the hall into the classroom.

"Show me what you're working on," he smiled.

I proceeded to show him the workbooks and readers I used, my documentation procedures, when he grabbed a book off the bookshelf. "'Slaughterhouse Five'" by Kurt Vonnegut!" he exclaimed. "Do you use this?"

"Well, yes I do," I gulped.

"I loved this book, how do your students like it?"

"They really liked it, we finished reading it last week, and now we are watching the film version."

He looked at me and smiled, "What a great idea. Do you use film often?"

I proceeded to tell him what I was doing and why. He sat down and gestured for me to do the same.

"You know, Roy, I've been all over the States, Canada, and most of Europe and no one is doing this type of cognitive rehab."

I was shocked, "You're kidding?" I asked.

"No, no, I'm not. Most of the educational components are at a very low grade level, and I'm sure you realized pretty soon that your students are no dummies," he smiled again and winked. "The majority of head injuries are mild to moderate, and that's where the problem comes in. Talk down to them and you'll lose them, am I right?"

I nodded in agreement.

He got up and walked around, looking at the maps and posters on the walls, and the books in the shelves.

"You're doing good work, Roy, the clients I talked to respect you and that's because you respect them. You push them and that's how they get back the dignity." He walked over to me, "Take my advice, get a graduate degree, you're onto something here. I'm not an expert in your field, but you're onto something."

I felt overwhelmed, relief, pride, disbelief, I suppose.

"Hey," he grabbed another book off the shelf, "you're teaching "The Illustrated Man" too?"

"And watching the film version," I added.

"You know, I wouldn't mind being in this class," he said.

We received a pretty good review from Dr. Prigatano overall, and when he talked about the educational component as being 'cutting edge', well, Lyla and I tried to shrink in our chairs with embarrassment. It certainly was nice to meet a neuro-psychologist that was supportive of the educational component. It gave me even more hope for my students, knowing there were people like him out there in such positions of authority who were open to new ideas.

## Chapter Sixteen

## The Adventure Begins

It is not from space that I must seek my dignity, but from the government of my thoughts. I shall have no more if I possess worlds. By space the universe encompasses and swallows me up like an atom; by thought I comprehend the world.

- Pensees, Blaise Pascal

There are many stories that I could have covered and used to convey this study's themes of visual stimulation and learning, memory, and above all, the human condition brought about from brain injury. I chose the ones I did to make my point, and to give you, the reader, a glimpse into the Life Skills Unit, the men and women in it, and of course, of me as a small boy and now as a teacher. I think, to give you a little more idea of what this field entails, I'd like to share with you what happened to some of my students as they left the program.

Gary, the tough, rough, oil worker, not only showed great improvement in his school work and cognitive abilities, but showed us a side of him that we had not expected.

One day, Jill, my boss, came into the classroom during lunch break and asked me, "Roy, quick, you've got to see this!" she exclaimed.

"What?" I asked.

"Just come with me to the cafeteria."

We walked down the hall and as we approached the dining room, she motioned me to peek around the corner.

I looked at the crowd of people and Jill whispered to me, "There, that table over there."

It was Gary, pushing a very old woman up to a table, and he began to set up her lunch before her. Then he began to feed her soup.

"I don't believe it, Gary?" I asked.

Jill smiled, "Oh, yes, Gary, he's been helping Mrs. Johanson for about a month now, takes her for walks, feeds her, they're great friends."

"Gary?" I said again.

Jill looked at me, "Have you noticed that often after someone experiences a little heartache in life they either get bitter or they soften. I'd say our group has suffered quite a bit, and I'd say Gary has responded with a little more caring and compassion for his fellow man, wouldn't you?"

Gary left our program with plans of returning to Grand Prairie and working with his father back in the oil patch.

Louise, the older teacher, completed our program at the high school level and was a bit more optimistic about life than when I first met her. Still plagued with some memory problems, her one eye never regaining sight, she retired back in Chase, British Columbia.

Christine, the shy, young teacher, finished my class and got a job working with special needs children as a teacher's aid. She told me she wished she could return to teaching on her own, but said she could live with the change in her career choice, and her life.

Alan kept his drive and love of life, returning to Edmonton, where he began training to drive ambulances. He and I have become good friends and I see him as often as our lives allow.

Gerry, big Gerry, with the heart of gold, saddens me the most after Dennis. His short term memory never really improved and his wife and children could not leave him alone at home for fear that he would cause a fire or get lost. He was placed in an auxiliary care home in Edmonton. I can't believe it still, all that personality and intelligence, yet the part of the brain that allows him to be independent couldn't be fixed. I don't know what feeling wins when I think of Gerry, anger at his situation, or despair. I still can't help but think I let him down. Alan and I take Gerry out for lunch when I go to Edmonton, his great sense of humor still there, no bitterness or resentment from him, just acceptance with his life.

Steve returned home to his wife and children, received his pension from the insurance settlement and builds wooden furniture to keep busy but he longs to work, he misses the camaraderie of fellow workmates and a purpose to get up every day.

I worked with nearly a hundred different students at the Life Skills Unit, all with their own stories and personalities to share. We had another suicide when I was

there, more stories of people finding great courage within themselves, great compassion for others after their injuries.

A poem by James Dickey suggests a metaphor for the life of a person,

"We fall from womb to tomb, from one
blackness and toward another,
Remembering little of the one and
knowing nothing of the other...except through faith,
That we retain our sanity in the face of the simple
Yet binding mysteries is nearly divine.
That we may turn the powerful intuition of imaginations
upon them and regard them in the glass of dreams -
that we may, however timidly, place our hands within
the hole which opens at the center of the column
of truth - that is..."

...well, it's hope, isn't it?

Hope is what I tried to give those men and women with the tools of my trade, and with the dream machine that a ten year old boy found and brought with him through the bumpy road of life. Working with people who have brain injuries has made me a better teacher, and a better person, of that I'm sure. It has allowed me to tackle problems, both philosophical and pedagogical, but it has never, ever let me forget what it is to be - just human.

Conclusion

The qualitative ethnographic approach used in this thesis allowed the unique stories of these brain injured individuals to be conveyed. These stories also have elements and issues to them that we all share as human beings. The ethnographic approach is a substantial mixing of the fields of anthropology and sociology. (Hamilton, 1994). The study of what happens in a classroom is a good example. The use of an anthropological method such as observation of a culture might seem a contradiction. Anthropology studies past cultures, while schooling is a feature of a modern society. However, the brain injured students in my classroom are a micro-culture. "This form of study has done much to remind educationists that there is more to education than schooling." (Hamilton, 1994, p.66).

The participant observations and the narratives used help to illustrate the personal contexts within which these unique classroom experiences occur. The complexity of the dilemma these students face is best explained by understanding their unique challenges. The biological and social obstacles constantly facing these students have a tremendous impact on their fight for dignity and wholeness. As a teacher, I found that my training as a conveyor of knowledge could help in their relearning. By using some basic strategies combined with an emotional laden curriculum, I was able to lead the students towards their goal of independence.

It is important to emphasize that the students in my classroom needed to succeed. For most individuals who have a brain injury, there are far more failures

daily than successes, both socially and mentally.

The problems that arise in the classroom again and again, are a result of memory problems. These result in a person's inability to plan things, carry them out and to problem solve. Also the brain injury can effect the person's ability to understand consequences for certain actions, and to consider other options. These deficits cause the individual to fail at things many times and often depression and lack of self-confidence result.

I found that the films I was using had a tremendous impact on the student's memory process. They were able to recall what they had viewed and this, in turn, had a positive impact on their self-esteem. The depression they faced after their injuries was often linked to their poor memories and mental processing abilities. The dramatic visual images appear to stick with the person, and as a result, the memory processing patterns in the brain functioned more efficiently. The students felt better about their situation, and they put more effort into other classroom activities.

Emotions have not been seriously studied by cognitive scientists until fairly recently. (Lazaraus, 1991). What has been learned is that emotions are often associated with motivation. Motivations is action in pursuit of a goal, emotions can hinder or help goal achievement. (Lazaraus, 1991). I believe that dramatic visual films help with motivation, in that new pathways of thinking are created. If a person is subjected to a new and visually exciting representation on film, the person reacts to it. This causes attention to be focused, memory to be stimulated, and foundation for new

learning to take place.

Most of the work done in the field of brain injury has been medically and behaviorally based. The medical information is valuable to the teaching field in brain injury, because injury sites in the brain do cause mental processing difficulties. The behavior modification approach has been used by some special education teachers working in the field. This approach was used by the teacher who held my position prior to my starting at the Life Skills program. It met with very little success. This is because the brain injured individuals have an acquired injury, not a congenital one. Attempting to use behaviorism techniques, a stimuli to achieve response with no mental activity taken into account, is a serious mistake. As a teacher in this field, the response you want, memory, can be triggered with a biological reaction in conjunction with conscious awareness. The student watches the film, understands its premise, and reacts to it physiologically. The memory connections are made at a basic cellular level, neurons, as well as understood and retained at a higher cerebral level. Emotion becomes the catalyst between brain and mind. Daniel Goleman, in his book, "Emotional Intelligence", believes that a high emotional quotient is more important than intellectual knowledge in succeeding in life. (Goleman, 1995). He states that emotions have a tremendous impact on how we process information and make decisions. I believe they also have a great deal to do with memory retention. The dramatic film images helped students improve in short and long-term memory retention.

If there is one thing we probably all remember about school, it was whether or not the teachers made learning fun. The teacher's primary task I believe, is to get and keep the students interested. "Arousal is important in all mental functions. It contributes significantly to attention, perception, memory, emotion, and problem solving. Without arousal, we fail to notice what is going on - we don't attend to the details." (LeDoux, 1996, p.289). I believe the use of dramatic visual films allows important aspects of brain function to be stimulated. This in turn helps the brain injured individual focus and maintains attention, which results in improved memory. Perhaps most importantly, this classroom activity is an enjoyable way to relearn or learn new things.

I used film as the core of my curriculum as time progressed. I found documentaries that linked up with history and science. I was able to use films that related to specific events that were discussed in class. The film version of Charles Dicken's "A Christmas Carol" starring Alister Sim for example, proved very successful with my students over the years. Mans inhumanity to man, greed, hope, and many other issues raised by the students, are beautifully conveyed in this visually striking and dramatic film. Films were now not viewed as a reward at the end of a regular classroom, but as part of the learning process.

My own love of this particular art form goes back to that small boy in the Tivoli Theatre. The sheer wonder of those moving images and what they spoke to me has impacted my career as a teacher. In their research, R. N. Caine and G. Caine found

that students perform better when they perceive the teacher as prestigious. (Caine, R. N., Caine, G., 1991). Two perceptions are needed by the students, that the teacher knows what he is talking about and that he is caring. For example, the teacher does not need notes to talk about the subject, except in keeping on track, and has practiced what is being preached. Caring is shown by the teacher accepting and valuing each student as a human being. I believe my interest in film, and the discussions of what we viewed as a class, reflected this view. I believe my enthusiasm for dramatic visual films proved contagious and helped in part, in their recovery.

My work with brain injured individuals centers around the use of dramatic visual imagery and its effect on memory. Does it work? Yes, I have seen the results with my students both academically and socially. I would wholeheartedly recommend the use of emotional based and visually striking films as a basis for memory stimulation and retrieval. I believe it is a way for challenging and enriching the human heart and the human mind. Often the philosophies of man are made more attainable through artistic expression. They become ideas, not distant from us, but something we can incorporate in our lives. I believe films often allow this to occur, and as a result they teach us something about life. Everyone loves a story, particularly one with a moral. As a teacher, I can choose such films, and allow the student to ask questions about his life and life in general. These types of questions can allow them to get in touch with the 'self'. It is those emotional inquiries that help them to define the 'self' once again. It is an honor to think I can contribute to this in some small way with my

teaching method.

I sincerely hope that other professionals from not only the teaching field, but other professions working with brain injured individuals will benefit from this thesis. There is much work and research to be done. I, for one, will continue to look at the impact of dramatic visual images on memory. I have just scratched the surface. There is also a need for more study on brain function and learning. Also the brain versus mind dilemma continues, and what constitutes awareness. As a teacher, I can contribute to our understanding of the human brain and mind by my observations and classroom methods. I hope other teachers will contribute what they can as well, to our understanding of ourselves. It is an exciting time. To quote the "Outer Limits" control voice, "You are about to participate in a great adventure."

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