

# **An Inside View of Autism**

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## **Introduction**

I am a 44-year old autistic woman who has a successful international career designing livestock equipment. I completed my Ph.D. in Animal Science at the University of Illinois in Urbana and I am now an Assistant Professor of Animal Science at Colorado State University. Early intervention at age 2 1/2 helped me overcome my handicap.

Two of the subjects covered in this chapter are the frustration of not being able to speak and sensory problems. My senses were oversensitive to loud noise and touch. Loud noise hurt my ears and I withdrew from touch to avoid over-whelming sensation.

I built a squeezing machine which helped me to calm my nerves and to tolerate touching. At puberty, horrible anxiety "nerve" attacks started and they became worse with age. Antidepressant medication relieved the anxiety. In the last section of the chapter directing my fixations into constructive activities and a career will be discussed along with the importance of a mentor. My skill and deficit areas are covered in detail. All my thinking is visual, like videos played in my imagination. Even abstract concepts such as getting along with other people are visualized through the use of door imagery.

## **Lack of Speech**

Not being able to speak was utter frustration. If adults spoke directly to me I could understand everything they said, but I could not get my words out. It was like a big stutter. If I was placed in a slight stress situation, words would sometimes overcome the barrier and come out. My speech therapist knew how to intrude into my world. She would hold me by my chin and made me look in her eyes and say "ball." At age 3, "ball" came out "bah," said with great stress. If the therapist pushed too hard I threw a tantrum, and if she did not intrude far enough no progress was made. My mother and teachers wondered why I screamed. Screaming was the only way I could communicate. Often I would logically think to myself, "I am going to scream now because I want to tell somebody I don't want to do something."

It is interesting that my speech resembled the stressed speech in young children who have had tumors removed from the cerebellum. Rekate, Grubb, Aram, Hahn, and Ratcheson (1985) found that cancer surgeries that lesioned the vermis, deep nuclei, and both hemispheres of the cerebellum caused temporary speech loss in normal children. Vowel sounds were the first to return, and receptive speech was normal. Courchesne, Yeung-Courchesne, Press, Hesselink, and Jernigan (1988) reported that 14 out of 18 high- to moderate- functioning autistics had undersized cerebellar vermal lobules VI and VII. Bauman and Kemper (1985) and Ritvo et al. (1986) also discovered that brains from autistics had lower than normal Purkinje cell counts in the cerebellum. In my own case an MRI scan revealed cerebellar abnormalities. I am unable to tandem walk (the standard "walk the line" test done by the police for drunken drivers). I end up toppling sideways, but my reactions are normal for other simple motor tests of cerebellar dysfunction.

Vestibular stimulation can sometimes stimulate speech in autistic children. Slowly swinging a child on a swing can sometimes help initiate speech (Ray, King, & Grandin, 1988). Certain types of smooth, coordinated movements are difficult for me, even though I appear normal to the casual observer. For example, when I operate hydraulic equipment that has a series of levers, I can operate one lever at a time perfectly. Coordinating the movement of two or three levers at once is impossible. This may explain why I do not readily learn a musical instrument, even though I have innate musical talent for pitch and melody. The only musical instrument I mastered is whistling with my mouth.

## **Rhythm and Music**

Throughout elementary school my speech was still not completely normal. Often it took me longer than other children to start getting my words out. Singing, however was easy. I have perfect pitch and I can effortlessly hum back the tune of a song I have heard only once or twice.

I still have many problems with rhythm. I can clap out a rhythm by myself, but I am unable to synchronize my rhythm with somebody else's rhythm. At a concert I am unable to clap in time with the music with the rest of the people. A lack of rhythm during autistic piano playing is noted by Park and Youderian (1974). Rhythm problems may be related to some autistic speech problems. Normal babies move in synchronization with adult speech (Condon & Sander, 1974). Autistics fail to do this. Condon (1985) also found that autistics and, to a lesser extent, dyslexics and stutterers have a defective orienting response. One ear hears a sound sooner than the other. The asynchrony between ears is sometimes over one second. This may help explain certain speech problems. People still accuse me of interrupting. Due to a faulty rhythm sense, it is difficult to determine when I should break into a conversation. Following the rhythmic ebb and rise of a conversation is difficult.

## **Auditory Problems**

My hearing is like having a hearing aid with the volume control stuck on "super loud." It is like an open microphone that picks up everything. I have two choices: turn the mike on and get deluged with sound, or shut it off. Mother reported that sometimes I acted like I was deaf. Hearing tests indicated that my hearing was normal. I can't modulate incoming auditory stimulation. Many autistics have problems with modulating sensory input (Ornitz, 1985). They either overreact or under-react. Ornitz (1985) suggests that some cognitive deficits could be caused by distorted sensory input. Autistics also have profound abnormalities in the neurological mechanisms that control the capacity to shift attention between different stimuli (Courchesne, 1989).

I am unable to talk on the phone in a noisy office or airport. Everybody else can use the phones in a noisy environment, but I can't. If I try to screen out the background noise, I also screen out the phone. A friend of mine, a high-functioning autistic, was unable to hear a conversation in a relatively quiet hotel lobby. She has the same problem I have, except worse.

Autistics must be protected from noises that bother them. Sudden loud noises hurt my ears like a dentist's drill hitting a nerve. A gifted, autistic man from Portugal wrote, "I jumped out of my skin when animals made noises" (White & White, 1987). An autistic child will cover his ears because certain sounds hurt. It is like an excessive startle reaction. A sudden noise (even a relatively faint one) will often make my heart race. Cerebellar abnormalities may play a role in increased sound sensitivity. Research on rats indicates that the vermis of the cerebellum modulates sensory input (Crispino & Bullock, 1984). Stimulation of the cerebellum with an electrode will make a cat hypersensitive to sound and touch (Chambers, 1947).

I still dislike places with confusing noise, such as shopping malls. High-pitched continuous noises such as bathroom vent fans or hair dryers are annoying. I can shut down my hearing and withdraw from most noise, but certain frequencies cannot be shut out. It is impossible for an autistic child to concentrate in a classroom if he is bombarded with noises that blast through his brain like a jet engine. High, shrill noises were the worst. A low rumble has no effect, but an exploding firecracker hurts my ears. As a child, my governess used to punish me by popping a paper bag. The sudden, loud noise was torture.

Even now, I still have problems with tuning out. I will be listening to a favorite song on the radio, and then realize I missed half of it. My hearing just shuts off. In college, I had to constantly keep taking notes to prevent tuning out. The young man from Portugal also wrote that carrying on a conversation was very difficult. The other person's voice faded in and out like a distant radio station (White & White, 1987).

## **Tactile Problems**

I often misbehaved in church, because the petticoats itched and scratched. Sunday clothes felt different than everyday clothes. Most people adapt to the feeling of different types of clothing in a few minutes. Even now, I avoid wearing new types of underwear. It takes me three to four days to fully adapt to new ones.

As a child in church, skirts and stockings drove me crazy. My legs hurt during the cold winter when I wore a skirt. The problem was the change from pants all week to a skirt on Sunday. If I had worn skirts all the time, I would not have been able to tolerate pants. Today I buy clothes that feel similar. My parents had no idea why I behaved so badly. A few simple changes in clothes would have improved my behavior.

Some tactile sensitivities can be desensitized. Encouraging a child to rub the skin with different cloth textures often helps. The nerve endings on my skin were supersensitive. Stimuli that were insignificant to most people were like Chinese water torture. Ayres (1979) lists many good suggestions on methods to desensitize the tactile system.

## **Approach-Avoid**

In my book *Emergence: Labeled Autistic* (Grandin & Scariano, 1986), I describe craving pressure stimulation. It was an approach-avoid situation. I wanted to feel the good feeling of being hugged, but when people hugged me the stimuli washed over me like a tidal wave. When I was 5 years old, I used to daydream about a mechanical device I could get into that would apply comforting pressure. Being able to control the device was very important. I had to be able to stop the stimulation when it became too intense. When people hugged me, I stiffened and pulled away to avoid the all- engulfing tidal wave of stimulation. The stiffening up and flinching was like a wild animal pulling away. As a child, I used to like to get under the sofa cushions and have my sister sit on them. At various autism conferences, I have had 30 or 40 parents tell me that their autistic child seeks deep pressure stimuli. Research by Schopler (1965) indicated that autistic children prefer (proximal) sensory stimulation such as touching, tasting, and smelling to distal sensory stimulation such as hearing or seeing.

## **Squeeze Machine**

At age 18 I built a squeezing machine. This device is completely lined with foam rubber, and the user has complete control over the duration and amount of pressure applied. A complete description of the

machine is in Grandin (1983, 1984), and Grandin and Scariano (1986). The machine provides comforting pressure to large areas of the body.

It took me a long time to learn to accept the feeling of being held and not try to pull away from it. Reports in the literature indicate that autistics lack empathy (Bemporad, 1979; Volkmar & Cohen, 1985). I feel that the lack of empathy may be partially due to a lack of comforting tactual input.

One day about 12 years ago, a Siamese cat's reaction to me changed after I had used the squeeze machine. This cat used to run from me, but after using the machine, I learned to pet the cat more gently and he decided to stay with me. I had to be comforted myself before I could give comfort to the cat (Grandin, 1984).

I have found from my own experiences with the squeeze machine that I almost never feel aggressive after using it. In order to learn to relate to people better, I first had to learn how to receive comfort from the soothing pressure of the squeeze machine. Twelve years ago I wrote, "I realize that unless I can accept the squeeze machine I will never be able to bestow love on another human being" (Grandin, 1984). During my work with livestock, I find that touching the animals increases my empathy for them. Touching and stroking the cattle makes me feel gentle towards them. The squeeze machine also had a calming effect on my nervous system.

Squeeze machines have been in use in clinics working with autistic and hyperactive children (Figures 6-1 and 6-2). Lorna King, an occupational therapist in Phoenix, Arizona, reports that it has a calming effect on hyperactive behavior. Therapists have found that deep pressure stimulation has a calming effect (Ayres, 1979). Both animal and human studies have shown that pressure stimulation reduces nervous system arousal (Kumazawa, 1963; Melzack, Konrad, & Dubrofsky, 1969; Takagi & Kobagasi, 1956). Pressure on the sides of the body will induce relaxation in pigs (Grandin, Dodman, & Shuster, 1989).

## **Anxiety at Puberty**

As a child I was hyperactive, but I did not feel "nervous" until I reached puberty. At puberty, my behavior took a bad turn for the worse. Gillberg and Schaumann (1981) describe behavior deterioration at puberty in many autistics. Shortly after my first menstrual period, the anxiety attacks started. The feeling was like a constant feeling of stage fright all the time. When people ask me what it is like I say, "Just imagine how you felt when you did something really anxiety provoking, such as your first public speaking engagement.

Now just imagine if you felt that way most of the time for no reason." I had a pounding heart, sweaty palms, and restless movements.

The "nerves" were almost like hypersensitivity rather than anxiety. It was like my brain was running at 200 miles an hour, instead of 60 miles an hour. Librium and Valium provided no relief. The "nerves" followed a daily cycle and were worse in the late afternoon and early evening. They subsided late at night and early in the morning. The constant nervousness would go in cycles, with a tendency to be worse in the spring and fall. The "nerves" also subsided during menstruation.

Sometimes the "nerves" would manifest themselves in other forms. For weeks I had horrible bouts of colitis. When the colitis attacks were active, the feeling of "stage-fright" nerves went away.

I was desperate for relief. At a carnival I discovered that riding on the Rotor ride provided temporary relief. Intense pressure and vestibular stimulation calmed my nerves. Bhatara, Clark, Arnold, Gunsett, and Smeltzer (1981) have found that spinning in a chair twice each week reduces hyperactivity in young children.

While visiting my aunt's ranch, I observed that cattle being handled in a squeeze chute sometimes relaxed after the pressure was applied. A few days later I tried the cattle squeeze chute, and it provided relief for several hours. The squeeze machine was modeled after a squeeze chute used on cattle. It had two functions: (1) to help relax my "nerves" and (2) to provide the comforting feeling of being held. Prior to building the squeeze machine, the only other way I could get relief was strenuous exercise or manual labor. Research with autistics and mentally retarded clients has shown that vigorous exercise can decrease stereotypies and disruptive behavior (McGimsey & Favell, 1988; Walters & Walters, 1980). There are two other ways to fight the nerves: fixate on an intense activity, or withdraw and try to minimize outside stimulation. Fixating on one thing had a calming effect. When I was livestock editor for the *Arizona Farmer Ranchman*, I used to write three articles in one night. While I was typing furiously I felt calmer. I was the most nervous when I had nothing to do.

With age, the nerves got worse. Eight years ago, I had a stressful eye operation that triggered the worst bout of "nerves" in my life. I started waking up in the middle of the night with my heart pounding and obsessive thoughts about going blind.

## Medication

In the next section, I am going to describe my experiences with medication. There are many autism subtypes, and a medication that works for me may be useless for another case. Parents of autistic children should obtain medical advice from professionals who are knowledgeable of the latest medical research.

I read in the medical library that antidepressant drugs such as Tofranil (Imipramine) were effective for treating patients with endogenous anxiety and panic (Sheehan, Beh, Ballenger, & Jacobsen, 1980). The symptoms described in this paper sounded like my symptoms, so I decided to try Tofranil. Fifty mg of Tofranil at bedtime worked like magic. Within a week, the feelings of nervousness started to go away. After being on Tofranil for four years I switched to 50 mg Norpramin (desipramine), which has fewer side effects. These pills have changed my life. Colitis and other stress-related health problems were cured.

Dr. Paul Hardy in Boston has found that Tofranil and Prozac (fluoxetine) are both effective for treating certain high-functioning autistic adolescents and adults. Both Dr. Hardy and Dr. John Ratey (personal communication, 1989) have learned that very small doses of these drugs must be used. These doses are usually much lower than the dose prescribed for depression. Too high a dose can cause agitation, aggression, or excitement, and too low a dose will have no effect. My "nerve" attacks would go in cycles, and I have had relapses while on the drug. It took will power to stick with the 50 mg dose and let the relapse subside on its own. Taking the medicine is like adjusting the idle screw on a car's carburetor. Before taking the drug, the engine was racing all the time. Now it runs at normal speed. I no longer fixate, and I am no longer "driven." Prozac and Anafranil (clomipramine) have been very effective in autistics who have obsessive-compulsive symptoms or obsessive thoughts which race through their heads. The effective doses for Prozac have ranged from two 20 mg capsules per week to 40 mg per day. Too high a dose will cause agitation and excitement. If an autistic person becomes agitated the dose should be lowered. Other promising drugs for aggressive autistic adolescents and adults are beta blockers. Beta blockers greatly reduce aggressive behavior (Ratey et al., 1987).

## Slow Improvement

During the eight years I have been taking antidepressants, there has been a steady improvement in my speech, sociability, and posture. The change was so gradual that I did not notice it. Even though I felt

relief from the "nerves" immediately, it takes time to unlearn old behavior patterns.

Within the last year, I had an opportunity to visit an old friend who had known me before I started taking antidepressants. My friend, Billie Hart, told me I was a completely different person. She said I used to walk and sit in a hunched-over position and now my posture is straight. Eye contact had improved and I no longer shifted around in my chair. I was also surprised to learn that I no longer seemed to be out of breath all the time, and I had stopped constantly swallowing.

Various people I have met at autism meetings have seen steady improvement in my speech and mannerisms throughout the eight-year period I have taken the medicines. My old friend, Lorna King, also noticed many changes. "Your speech used to seem pressured, coming in almost explosive bursts. Your old tendency to perseverate is gone" (Grandin & Scariano, 1986).

I had a odd lack of awareness of my oddities of speech and mannerisms until I looked at videotapes. I think videotapes could be used to help many high-functioning autistics with speech and social skills.

## **Family History**

There is much that can be learned from family history. During my travels to autism conferences, I have found many families with affective disorder in the family history. The relationship between autism and affective disorder has also been reported in the literature (Gillberg & Schaumann, 1981). Family histories of high-functioning autistics often contain giftedness, anxiety or panic disorder, depression, food allergies, and learning disorders. In many of the families I have interviewed the disorders were never formally diagnosed, but careful questioning revealed them.

My own family history contains nervousness and anxiety on both sides. My grandmother has mild depression, and Tofranil has also worked wonders for her. She is also very sensitive to loud noise. She told me that when she was a little girl, the sound of coal going down the chute was torture. My sister is bothered by confusing noise from several sources. On my father's side there is explosive temper, perseveration on one topic, extreme nervousness, and food allergies. Both sides of my family contain artists. There are also signs of immune system abnormalities in myself and my siblings. I had shingles in my thirties, and my brother had them at age 4. My sister had serious ear infections similar to the ear infections in many young autistics. My dad, brother, and myself all have eczema.

## **Sensory Deprivation Symptoms**

Animals placed in an environment that severely restricts sensory input develop many autistic symptoms such as stereotyped behavior, hyperactivity, and self-mutilation (Grandin, 1984). Why would an autistic and a lion in a barren concrete zoo cage have some of the same symptoms? From my own experience I would like to suggest a possible answer. Since incoming auditory and tactile stimulation often overwhelmed me, I may have created a self-imposed sensory restriction by withdrawing from input that was too intense. Mother told me that when I was a baby I stiffened and pulled away. By pulling away, I did not receive the comforting tactile input that is required for normal development. Animal studies show that sensory restriction in puppies and baby rats has a very detrimental effect on brain development. Puppies raised in a barren kennel become hyper-excitable, and their EEGs (brain waves) still contain signs of overarousal six months after removal from the kennel (Melzack & Burns, 1965). Autistic children also have a desynchronized EEG, which indicates high arousal (Hutt, Hutt, Lee, & Ounstead, 1965). Trimming the whiskers on baby rats causes the parts of the brain that receive input from the whiskers to become oversensitive (Simons & Land, 1987). The abnormality is relatively permanent; the brain areas are still abnormal after the whiskers grow back. Some autistics also have

overactive brain metabolism (Rumsey et al., 1985).

I often wonder, if I had received more tactile stimulation as a child would I have been less "hyper" as an adult? Handling baby rats produces less emotional adults who are more willing to explore a maze (Denenbert, Morton, Kline, & Grotta, 1962; Ehrlich, 1959). Tactile stimulation is extremely important for babies and aids their development (Casler, 1965). Therapists have found that children who withdraw from comforting tactile stimulation can learn to enjoy it if their skin is carefully desensitized. Rubbing the skin with different cloth textures often helps. Deep pressure stimulation also reduces the urge to pull away.

I was born with sensory problems (due to cerebellar abnormalities), but perhaps secondary neurological damage is caused by withdrawal from touching. Autopsies of five autistic brains indicated that cerebellar abnormalities occur during fetal development, and many areas of the limbic systems were immature and abnormal (Bauman, 1989). The limbic system does not fully mature until two years after birth. Maybe withdrawal from touching made some behavior problems worse. In my book, I describe stupid "bathroom" fixations that got me into a lot of trouble. An interesting paper by McCray (1978) shows a link between a lack of tactual stimulation and excessive masturbation. Masturbation stopped when the children received more affection and hugging. Perhaps the "bathroom" fixation would never have occurred if I could have enjoyed affection and hugging.

Lately there has been a lot of publicity about holding therapy, where an autistic child is forcibly held and hugged until he stops resisting. If this had been done to me I would have found it highly aversive and stressful. Several parents of autistic children have told me that a gentler form of holding therapy is effective and it improved eye contact, language, and sociability. Powers and Thorworth (1985) report a similar result. Perhaps it would be beneficial if autistic babies were gently stroked when they pulled away. My reaction was like a wild animal. At first touching was aversive, and then it became pleasant. In my opinion, tactual defensiveness should be broken down slowly, like taming an animal. If a baby could be desensitized and learn to enjoy comforting tactile input, possible future behavior problems could be reduced.

## **Direct Fixations**

Today I have a successful career designing livestock equipment because my high school science teacher, Mr. Carlock, used my fixation on cattle chutes to motivate me to study psychology and science. He also taught me how to use the scientific indexes.

This knowledge enabled me to find out about Tofranil. While the school psychologist wanted to take my squeeze machine away, Mr. Carlock encouraged me to read scientific journals so I could learn why the machine had a relaxing effect. When I moved out to Arizona to go to graduate school, I went out to the feedlots to study the reactions of the cattle in squeeze chutes. This was the beginning of my career.

Today I travel all over the world designing stockyards and chutes for major meat-packing firms. I am a recognized leader in my field and have written over 100 technical and scientific papers on livestock handling (Grandin, 1987). If the psychologists had been successful in taking away my squeeze machine, maybe I would be sitting somewhere rotting in front of a TV instead of writing this chapter.

Some of the most successful high-functioning autistics have directed childhood fixations into careers (Bemporad, 1979; Grandin & Scariano, 1968; Kanner, 1971). When Kanner (1971) followed up his original 11 cases, there were two major successes. The most successful person turned a childhood fixation on numbers into a bank teller's job. The farmer who reared him found goals for his number fixation; he told him he could count the corn rows if he plowed the field.

Many of my fixations initially had a sensory basis. In the fourth grade, I was attracted to election posters because I liked the feeling of wearing the posters like a sandwich man. Occupational therapists have found that a weighted vest will often reduce hyperactivity.

Even though the poster fixation started out with a sensory basis, I became interested in the election. My teachers should have taken advantage of my poster fixation to stimulate and interest in social studies. Calculating electoral college points would have motivated me to study math. Reading could have been motivated by having me read newspaper articles about the people on the posters. If a child is interested in vacuum cleaners, then use a vacuum-cleaner instruction book as a text.

Another one of my fixations was automatic glass sliding doors. Initially I was attracted to the doors because I liked the sensation of watching them move back and forth. Then gradually the doors took on other meanings, which I will talk about in the next section. In a high-functioning adolescent, and interest in sliding doors could be used to stimulate science interests. If my teacher had challenged me to learn how the electronic box that opened the door worked, I would have dived head first into electronics. Fixations can be tremendous motivators. Teachers need to use fixations to motivate instead of trying to stamp them out. A narrow, fixated interest needs to be broadened into constructive activities. The principle can also be used with lower-functioning children; Simons and Sabine (1987) list many good examples.

Fixations need to be differentiated from stereotypes, such as hand flapping or rocking. A fixation is an interest in something external, such as airplanes, radio, or sliding doors. Engaging in stereotypic behavior for long periods of time may be damaging to the nervous system. In one experiment, pigs in a barren pen that engaged in large amounts of stereotyped rooting on each other had abnormal dendritic growth in the somatosensory cortex (Grandin, 1989).

## Visualization

All my thinking is visual. When I think about abstract concepts such as getting along with people I use visual images such as the sliding glass door. Relationships must be approached carefully otherwise the sliding door could be shattered. Visualization to describe abstract concepts is also described by Park and Youderian (1974). As a young child I had visualizations to help me understand the Lord's Prayer. The "power and the glory" were high-tension electric towers and a blazing rainbow sun. The word "trespass" was visualized as a "No Trespassing" sign on the neighbor's tree. Some parts of the prayer were simply incomprehensible. The only non-visual thoughts I have are of music. Today I no longer use sliding doors to understand personal relationships, but I still have to relate a particular relationship with something I have read - for example, the fight between Jane and Joe was like the U.S. and Canada squabbling over the trade agreement. Almost all my memories relate to visual images of specific events. If somebody says the word "cat," my images are of individual cats I have known or read about. I do not think about a generalized cat.

My career as a designer of livestock facilities maximizes my talent areas and minimizes my deficits. I still have problems handling long strings of verbal information. If directions from a gas station contain more than three steps, I have to write them down. Statistics are extremely difficult because I am unable to hold one piece of information in my mind while I do the next step. Algebra is almost impossible, because I can't make a visual image and I mix up steps in the sequence. To learn statistics I had to sit down with a tutor and write down the directions for doing each test. Every time I do a t-test or a chi-square, I have to use the notes. I have no problem understanding the principles of statistics, because I can see the normal or skewed distributions in my head. The problem is I cannot remember the sequence for doing the calculations. I can put a regression line on a graph full of dots visually. The first time I tried it, I was off only a few degrees. I also have many dyslexic traits, such as reversing numbers and

mixing up similar-sounding words such as "over" and "other." Right and left are also mixed up.

Visual thinking is an asset for an equipment designer. I am able to "see" how all parts of a project will fit together and see potential problems. It never ceases to amaze me how architects and engineers can make so many stupid mistakes in buildings. The disastrous accident where the catwalks at the Hyatt Regency fell and killed 100 people was caused by visualization errors. All the calculations were correct, but the architect's original design was impossible to build. Further visualization errors made during construction resulted in doubling the load on poorly designed fasteners. Academic requirements probably keep many visual thinkers out of these professions. Designing a piece of equipment with a sequential mind may be just as difficult for an engineer as statistics equations are for me. The sequential thinker can't see the whole. I have observed many incidents in industry where a brilliant maintenance man with a high school education designs a piece of equipment after all the Ph.D. engineers have failed. He may be an unrecognized visual thinker. There may be two basic kinds of thinking, visual and sequential. Farah (1989) concluded that "thinking in images is distinct from thinking in language." I have also had the opportunity to interview brilliant people who have very little visual thought. One professor told me that facts just come out of his mind instantly. To retrieve facts, I have to read them off a visualized page of a book or "play a video" of some previous event.

There is however, one area of visualization I am poor in. I often fail to recognize faces until I have known a person for a long time. This sometimes causes social problems, because I sometimes don't respond to an acquaintance because I fail to recognize them. Einstein was a visual thinker who failed his high school language requirement and relied on visual methods of study ((Holton, 1971-1972). The theory of relativity was based on visual imagery of moving boxcars and riding on light beams. At an autism meeting I had the opportunity to visit some of Einstein's relatives. His family history has a high incidence of autism, dyslexia, food allergies, giftedness, and musical talent. Einstein himself had many autistic traits. An astute reader can find them in Einstein and Einstein (1987) and Lepscky (1982).

In my own family history, my grandfather on my mother's side was co-inventor of the automatic pilot for airplanes, and on my father's side my great-grandfather was a maverick who started the largest corporate wheat farm in the world. My two sisters and one brother are all visual thinkers. One sister is dyslexic and is brilliant in the art of decorating houses. My brother can build anything but had problems with calculus when he tried to major in engineering. He is now a very successful banker and did well in all other subjects in college. My youngest sister is a sculptress and did well in school. My mother and grandparents on the mother's side were all good at higher math, and many people on my mother's side were well-known for intellect.

Drawing elaborate drawings of steel and concrete livestock stockyards is easy (Figure 6-3). I am able to visualize a motion picture of the finished facility in my imagination. However, drawing realistic human faces is very difficult. Figure 6-4 illustrates a buffalo-handling facility I designed. Since it was a government low-bid contract, every piece of steel had to be visualized and drawn on 26 sheets of detailed drawings. I am very proud of this job because I was able to accurately visualize everything prior to construction except for one little ladder. When I was a child, my parents and teachers encouraged my artistic talent. It is important to nurture talents.

Discussions with other high-functioning autistics have revealed visual methods of thinking on tasks that are often considered non-visual. A brilliant autistic computer programmer told me that he visualized the program tree in his mind and then just filled in the code on each branch. A gifted autistic composer told me that he made "sound pictures."

I was good at building things, but when I first started working with drawings it took time to learn how the lines on a drawing related to the picture in my imagination. When I built a house for my aunt and uncle, I had difficulty learning the relationship between symbolic markings on the drawings and the

actual construction. The house was built before I learned drafting. Now I can instantly translate a drawing into a mental image of a finished structure. While agonizing over the house plans, I was able to pull up pictures out of my memory of a house addition that was built when I was eight. Mental images from my childhood memory helped me install windows, light switches, and plumbing. I replayed the "videos" in my imagination.

## Savant Skills

Studies have shown that when autistic savants become less fixated and more social they lose their savant skills such as card counting, calendar calculation, or art skills (Rimland & Fein, 1988). Since I started taking the medication I have lost my fixation, but I have not lost my visualization skill. Some of my best work has been done while on the medication.

My opinion is that savants lose their skill because they lose the fixated attention. Card counting (shown in the *Rain Man* movie) is no mystery to me. I think savants visualize the cards being dealt onto a table in a pattern, like a series of clocks or a Persian rug pattern. To tell which cards are still in the deck, they simply look at their patterns. The only thing that prevents me from card counting or calendar calculation is that I no longer have the concentration to hold a visual image completely steady for a long period of time. I speculate that socialized savants still retain their visualization skills. I still have the perfect pitch skill, even though I don't use it. If I had greater concentration, I could sing back much longer songs after hearing them once.

In my own case the strongest visual images are of things that evoked strong emotions, such as important big jobs. These memories never fade and they remain accurate. However, I was unable to recall visual images of the houses on a frequently traveled road until I made an effort to attend to them. A strong visual image contains all details, and it can be rotated and made to move like a movie. Weaker images are like slightly out-of-focus pictures or may have details missing. For example, in a meat-packing plant I can accurately visualize the piece of equipment I designed but I am unable to remember things I do not attend to, such as the ceiling over the equipment, bathrooms, stairways, offices, and other areas of little or not interest. Memories of items of moderate interest grow hazy with time.

I tried a little memory experiment at one of my jobs. After being away from the plant for 30 days, I tried recalling a part of the plant that I had attended to poorly, and another part I had attended to intently. I had not designed either of these places. The first place was the plant conference room, and the other was the entrance to the room that housed my equipment. I was able to draw a fairly accurate map of the office, but I made major mistakes on conference-room furniture and ceiling covering. The room I visualized was plain and lacked detail. On the other hand, I visualized the entrance door to the equipment room very accurately, but made a slight mistake on the door-handle style. The visualized door had much greater detail than the visualized conference room. The conference room was not attended to even though I negotiated with the plant managers in that room.

Talents need to be nurtured and broadened out into something useful. Nadia, a well-known autistic case, drew wonderful perspective pictures as a child (Seifel, 1977). When she gained rudimentary social skills, she stopped drawing. Possibly the talent could have been revived with encouragement from teachers. Seifel (1977) describes how Nadia drew pictures on napkins and waste papers. She needed proper drawing equipment. Treffert (1989) reported on several savants who did not lose their savant skills when they became more social. Use of savant skills was encouraged.

At the age of 28, my drafting drastically improved after I observed a talented draftsman named David. Building the house taught me how to understand blueprints, but now I had to learn to draw them. When I started drawing livestock facilities I used David's drawings as models. I had to "pretend" I was David.

After buying a drafting pencil just like David's, I laid some of his drawings out and then proceeded to draw a loading ramp for cattle. I just copied his style, like a savant playing music, except my ramp was a different design. When it was finished I couldn't believe I had done it.

## **Deficits and Abilities**

Five years ago I took a series of tests to determine my abilities and handicaps. On the Hiskey Nebraska Spatial Reasoning test, my performance was at the top of the norms. On the Woodcock-Johnson Spatial Relations test, I only got an average score because it was a timed speed test. I am not a fast thinker; it takes time for the visual image to form. When I survey a site for equipment at a meat-packing plant, it takes 20 to 30 minutes of staring at the building to fully imprint the site in my memory. Once this is done, I have a "video" I can play back when I am working on the drawing. When I draw, the image of the new piece of equipment gradually emerges. As my experience increased, I needed fewer measurements to properly survey a job. On many remodeling jobs, the plant engineer often measures a whole bunch of stuff that is going to be torn out. He can't visualize what the building will look like when parts of it are torn out and a new part is added.

As a child I got scores of 120 and 137 on the Wechsler. I had superior scores in Memory for Sentences, Picture Vocabulary, and Antonyms-Synonyms on the Woodcock-Johnson. On Memory for Numbers I beat the test by repeating the numbers out loud. I have an extremely poor long-term memory for things such as phone numbers unless I can convert them to visual images. For example, the number 65 is retirement age, and I imagine somebody in Sun City, Arizona. If I am unable to take notes I cannot remember what people tell me unless I translate the verbal information to visual pictures. Recently I was listening to a taped medical lecture while driving. To remember information such as the drug doses discussed on the tape I had to create a picture to stand for the dose. For example, 300mg is a football field with shoes on it. The shoes remind me that the number is 300 feet, not yards.

I got a second-grade score on the Woodcock-Johnson Blending subtest where I had to identify slowly sounded-out words. The Visual Auditory Learning subtest was another disaster. I had to memorize the meaning of arbitrary symbols, such as a triangle means "horse," and read a sentence composed of symbols. I could only learn the ones where I was able to make a picture for each symbol. For example, I imagined the triangle as a flag carried by a horse and rider.

Foreign languages were almost impossible. Concept Formation was another test with fourth-grade results. The name of this test really irks me, because I am good at forming concepts in the real world. My ability to visualize broad unifying concepts from hundreds of journal articles has enabled me to outguess the "experts" on many livestock subjects. The test involved picking out a concept such as "large, yellow" and then finding it in another set of cards. The problem was, I could not hold the concept in my mind while I looked at the other cards. If I had been allowed to write the concept down, I would have done much better.

## **Learning to Read**

Mother was my salvation for reading. I would have never learned to read by the method that requires memorization of hundreds of words. Words are too abstract to be remembered. She taught me with old-fashioned phonics. After I laboriously learned all the sounds, I was able to sound out words. To motivate me, she read a page and then stopped in an exciting part. I had to read the next sentence. Gradually she read less and less. Mrs. David W. Eastham in Canada taught her autistic son to read in a similar manner, using some Montessori methods. Many teachers thought the boy was retarded. He learned to communicate by typing, and he wrote beautiful poetry. Douglas Biklen at Syracuse

University has taught some nonverbal autistic people to write fluently on the typewriter. To prevent perseveration on a single key and key targeting mistakes the person's wrist is supported by another person.

A visualized-reading method developed by Miller and Miller (1971) would also have been helpful. To learn verbs, each word has letters drawn to look like the action. For example, "fall" would have letters falling over, and "run" would have letters that looked like runners. This method needs to be further developed for learning speech sounds. Learning the sounds would have been much easier if I had a picture of a choo-choo train for "ch" and a cat for hard "c" sound. For long and short vowels, long "a" could be represented by a picture of somebody praying. This card could be used for both "pr" and long "a" by having a circle around "pr" on one card and the "a" on another.

At first, reading out loud was the only way I could read. Today, when I read silently, I use a combination of instant visualization and sounding words. For example, this phrase from a magazine - "stop several pedestrians on a city street" - was instantly seen as moving pictures. Sentences that contain more abstract words like "apparent" or "incumbent" are sounded out phonetically.

As a child, I often talked out loud because it made my thoughts more "concrete" and "real." Today, when I am alone designing, I will talk out loud about the design. Talking activates more brain regions than just thinking.

## **Mentor**

"A skilled and imaginative teacher prepared to enjoy and be challenged by the child seems repeatedly to have been a deciding factor in the success and educational placement of high-functioning, autistic children" (Newson, Dawson, & Everard, 1982). Bemporod (1979) also brings forth the mentor concept. My mentor in high school was Mr. Carlock, my high school science teacher. Structured behavior modification methods that work with small children are often useless with a high-functioning older child with normal intelligence.

I was lucky to get headed on the right path after college. Three other high-functioning autistics were not so fortunate. One man has a Ph.D. in math and he sits at home. He needed somebody to steer him into an appropriate job. Teaching math did not work out; he should have obtained a research position that required less interaction with people. The other lady has a degree in history and now works doing a boring telephone-sales job. She needs a job where she can fully utilize her talents. she al so needs a mentor to help her find an appropriate job and help open doors for her. Both these people needed support after college, and they did not receive it. The third man did well in high school and he also sits at home. He has a real knack for library research. If some interested person worked with him, he could work for a newspaper researching background information for stories. All three of these people need jobs where they can make maximum use of their talents and minimize their deficits.

Another autistic lady I know was lucky. She landed a graphic-arts job where she was able to put her visualization talents to good use. Her morale was also boosted when her paintings received recognition and were purchased by a local bank. Her success with the paintings also opened up many social doors. In my own case, many social doors opened after I made scenery for the college talent show. I was still considered a nerd, but now I was a "neat" nerd. People respect talent even if they think you are "weird." People became interested in me after they saw my drawings and pictures of my jobs. I made myself an expert in a specialized area.

High-functioning autistics will probably never really fit in with the social whirl. My life is my work. If a high- functioning autistic gets an interesting job, he or she will have a fulfilling life. I spend most Friday and Saturday nights writing papers and drawing. Almost all my social contacts are with

livestock people or people interested in autism. Like the Newson et al. (1982) subjects, I prefer factual, non-fictional reading materials. I have little interest in novels with complicated interpersonal relationships. When I do read novels, I prefer straightforward stories that occur in interesting places with lots of description.

The mentor needs to be somebody who can provide support on several different fronts. Employment is only one area. Many high-functioning autistics need to learn about budgeting money, how to make claims on health insurance, and nutritional counseling. As the person becomes more and more independent the mentor can be phased out, but the mentor may still be needed if the autistic loses his job or has some other crisis.

## **Who Helped Me Recover**

Many people ask me, "How did you manage to recover?" I was extremely lucky to have the right people working with me at the right time. At age 2, I had all the typical autistic symptoms. In 1949, most doctors did not know what autism was, but fortunately a wise neurologist recommended "normal therapy" instead of an institution. I was referred to a speech therapist who ran a special nursery school in her home. The speech therapist was the most important professional in my life. At age 3, my mother hired a governess who kept me and my sister constantly occupied. My day consisted of structured activities such as skating, swinging, and painting. The activities were structured, but I was given limited opportunities for choice. For example, on one day I could choose between building a snowman or sledding. She actually participated in all the activities. She also conducted musical activities, and we marched around the piano with toy drums. My sensory problems were not handled well. I would have really benefited if I had had an occupational therapist trained in sensory integration.

I went to a normal elementary school with older, experienced teachers and small classes. Mother was another important person who helped my recovery. She worked very closely with the school. She used techniques that are used today in the most successful mainstreaming programs to integrate me into the classroom. The day before I went to school, she and the teacher explained to the other children that they needed to help me.

As discussed earlier, puberty was a real problem time. I got kicked out of high school for fighting. I then moved on to a small country boarding school for gifted children with emotional problems. The director was an innovative man and considered a "lone wolf" by his psychologist colleagues. This is where I met Mr. Carlock. Another extremely helpful person was Ann, my aunt. I visited her ranch during the summer.

In high school and college, the people that helped me the most were the creative, unconventional thinkers. The more traditional professionals such as the school psychologist were actually harmful. They were too busy trying to psychoanalyze me and take away my squeeze machine. Later when I became interested in meat-packing plants, Tom Rohrer, the manager of the local meat-packing plant, took an interest in me. For three years I visited his plant once a week and learned the industry. My very first design job was in his plant. I want to emphasize the importance of a gradual transition from the world of school to the world of work. The packing plant visits were made while I was still in college. People with autism need to be gradually introduced to a job before they graduate. The autistics I discussed earlier could have excellent careers if they had a local businessperson take an interest in them.

## Autism Programs

During my travels I have observed many different programs. It is my opinion that effective programs for young children have certain common denominators that are similar regardless of theoretical basis. Early, intense intervention improves the prognosis. Passive approaches don't work. My governess was sometimes mean, but her intense, structured intervention prevented me from withdrawing. She and my mother just used their good instincts. Good programs do a variety of activities and use more than one approach. A good little children's program should include flexible behavior modification, speech therapy, exercise, sensory treatment (activities that stimulate the vestibular system and tactile desensitization), musical activities, contact with normal children, and lots of love. The effectiveness of different types of programs is going to vary from case to case. A program that is effective for one case may be less effective for another.

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