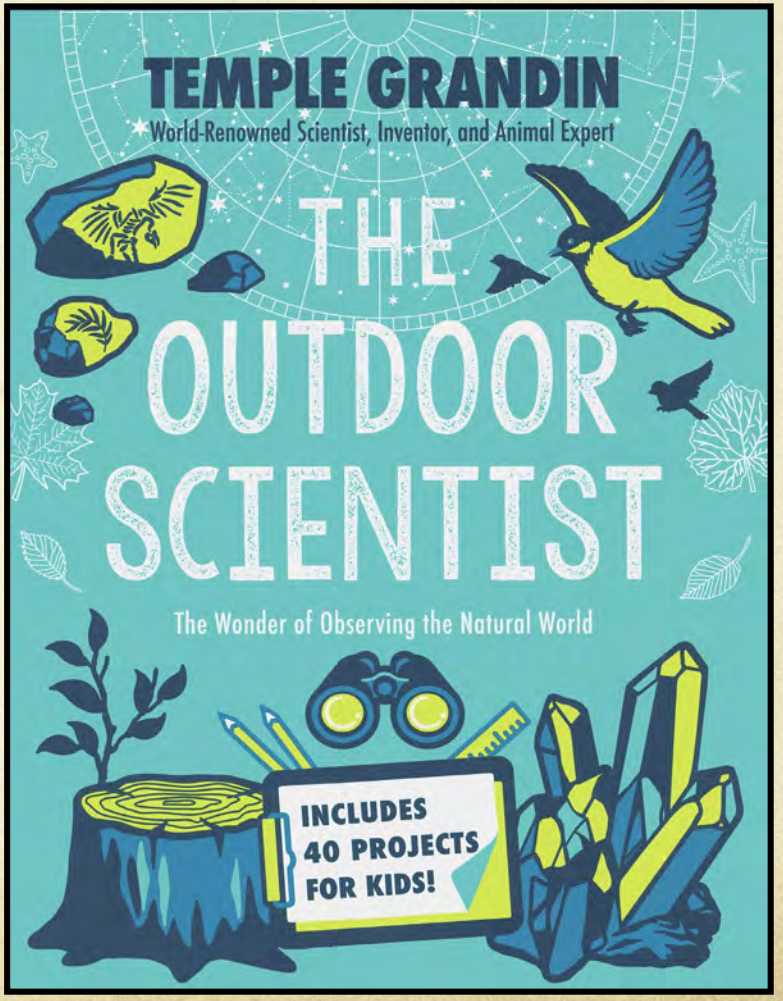
Developing Different Kinds of Minds

Temple Grandin, Professor of Animal Science

Colorado State University



- What would happen to top innovators in today's educational system?
- Many of them had an unconventional educational path
- If born today, would their lives have been less successful?

- Grandparents and parents often tell me they have autism after a child was diagnosed
- Most had successful careers. Learned work skills as children
- Diagnosis helps fully verbal teens and adults with relationships

One of the Greatest Achievements of my Generation

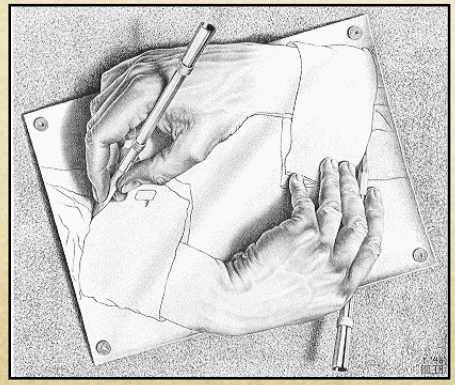
Credit: NASA

Visiting the Vehicle Assembly Building was an Emotional Experience

Today The Right Stuff Rides the Rockets to the Moon The Geeks, Misfits, and Kids with Labels Build the Stuff

Four Different Types of Thinking

1. Photo Realistic Visual Thinking Object Visualizer – Poor at algebra
2. Pattern Thinker Spatial Visualizer Music and Math – Poor in reading
3. Verbal Facts Language Translation – Poor at drawing
4. Auditory Thinker – Visual perception fragmented



There can be mixtures of these thinking types

Mission Critical Math Expertise

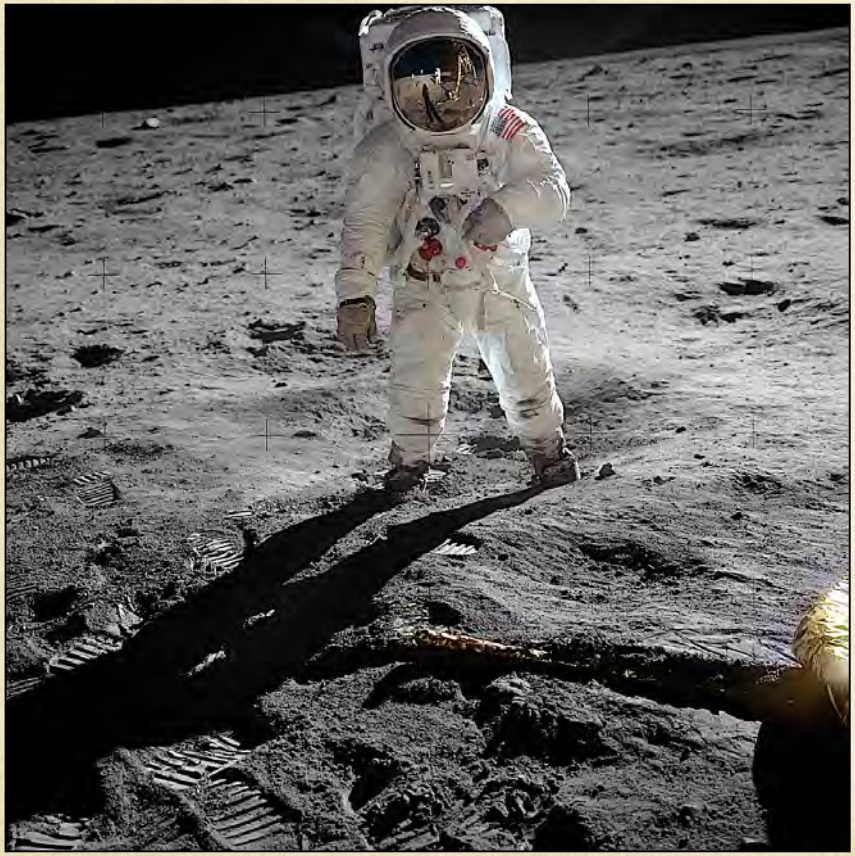
Katherine Johnson

Childhood Teachers Moved Her
Into Advanced Math

Hal Laning

Algebra Equations
Lunar Lander Computer

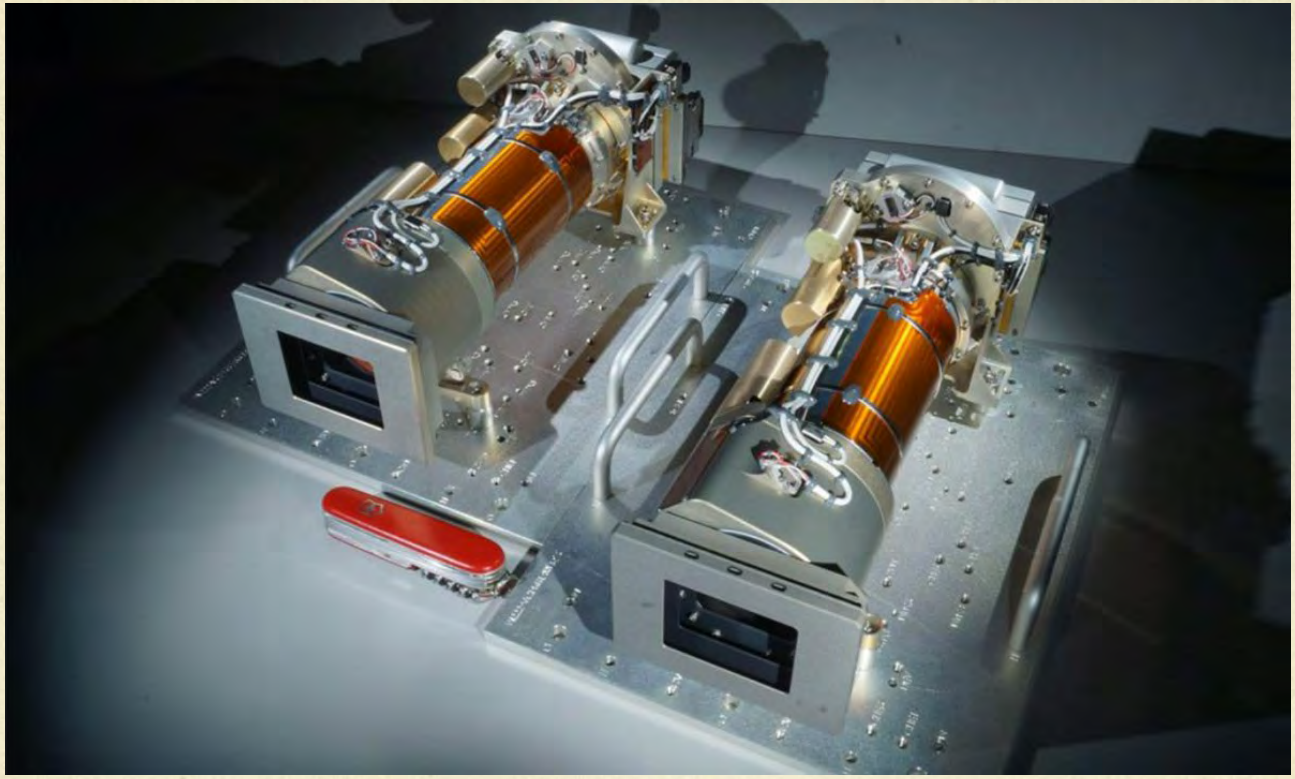
Visual Thinking Mission Critical



Credit: NASA

Sewn by the best bra seamstresses at Playtex

Today's Generation Mars Rover Camera



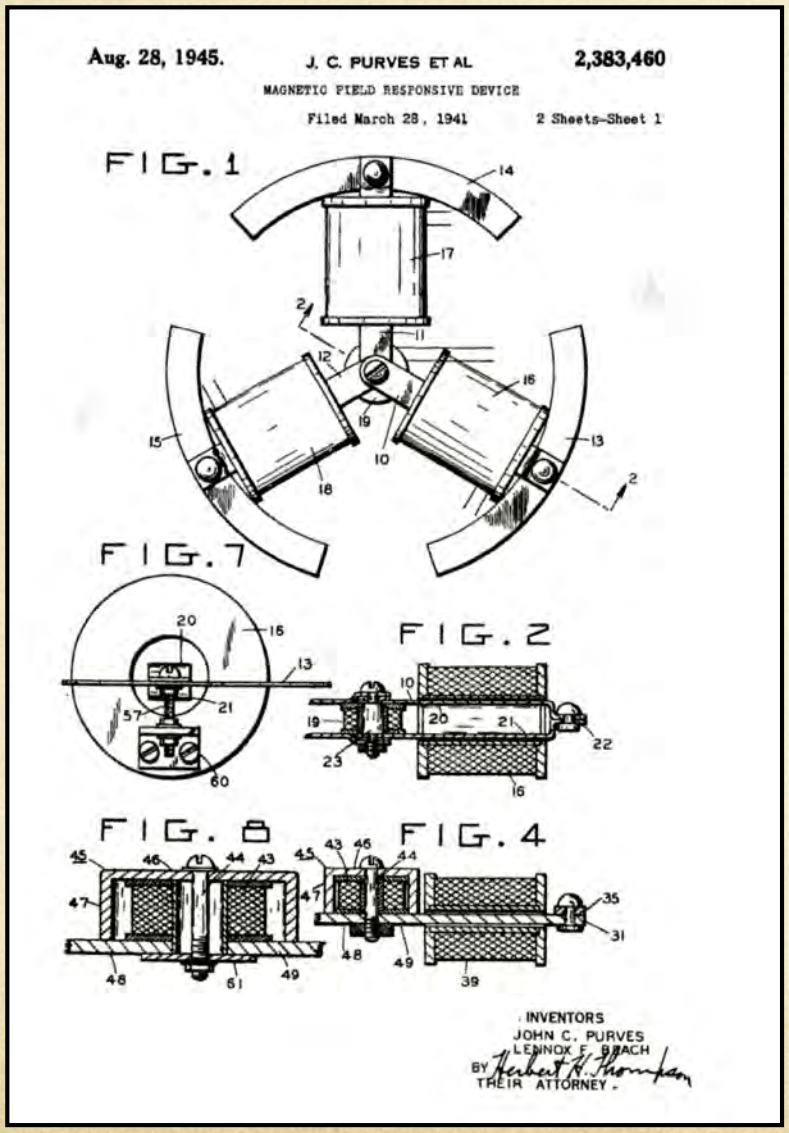
Credit: NASA.gov

Meticulous Hand Wiring

Perseverance View of Mars

Credit: NASA.gov

Grandfather Co-Invents Auto Pilot


Aug. 28, 1945. J. C. PURVES ET AL 2,383,460

MAGNETIC FIELD RESPONSIVE DEVICE

Filed March 28, 1941 2 Sheets-Sheet 1

FIG. 1

FIG. 7

FIG. 2

FIG. 8

FIG. 4

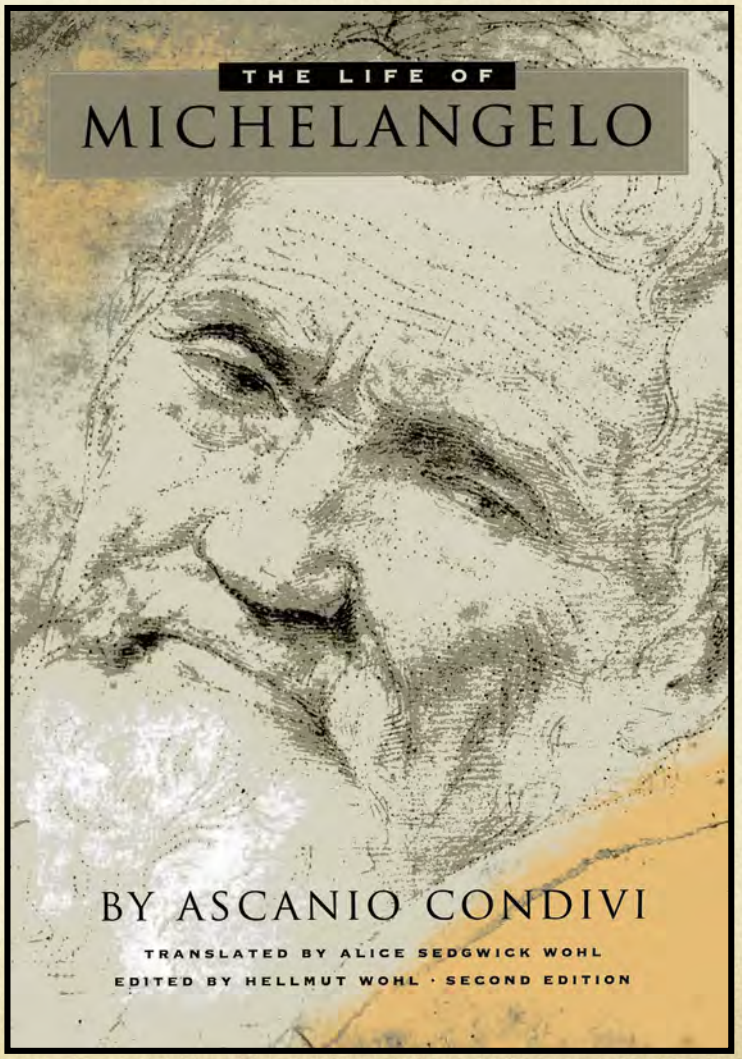
INVENTORS
JOHN C. PURVES
LENNOX F. BEACH
BY Herbert A. Thompson
THEIR ATTORNEY.

Different Kinds of Minds Complemented Each Other

- **Visual Thinker**
- **Mathematical Engineer**

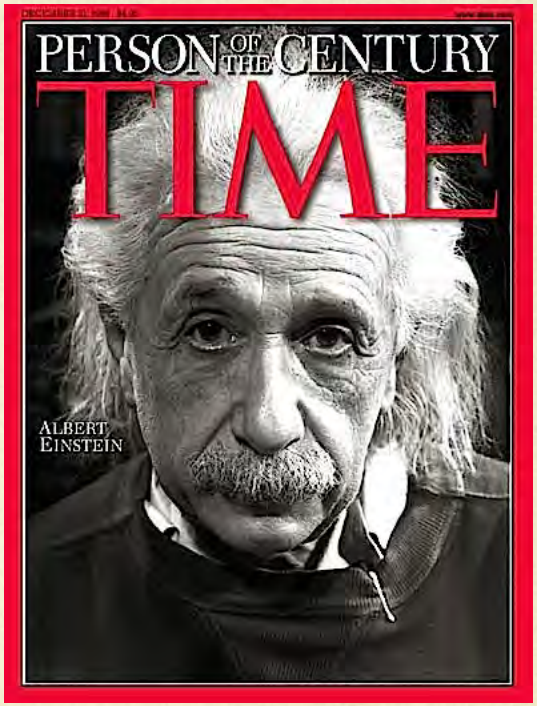
Michelangelo

- Dropped out of school at age 12
- Exposed to both art and stone cutting tools



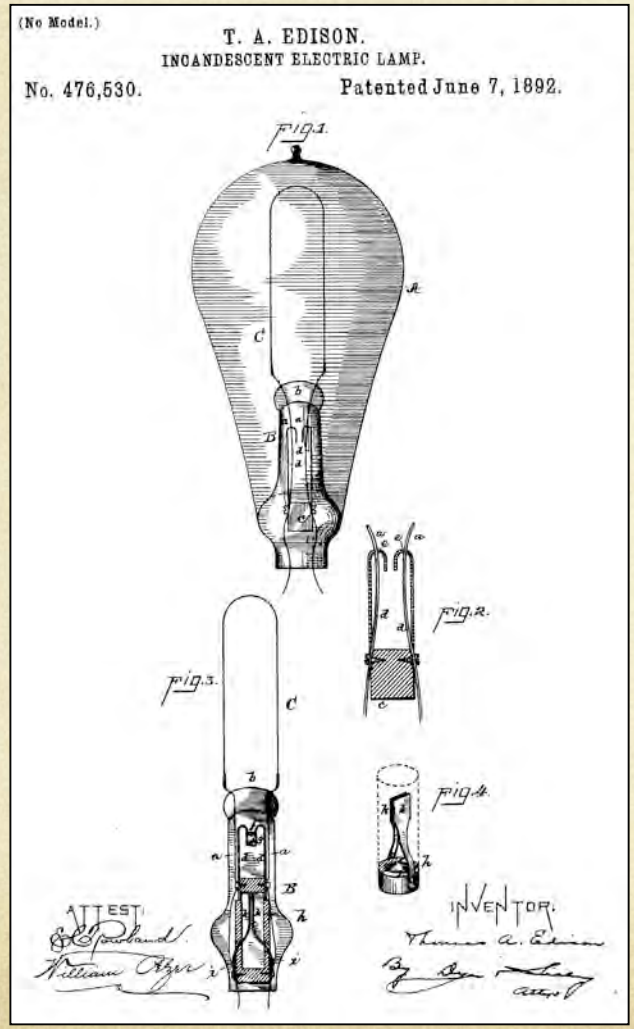
These Innovators Had Creative Hobbies

Bullied in school
Learned calligraphy



No speech until age 3
Played the violin

Thomas Edison


(No Model.)

T. A. EDISON.

INCANDESCENT ELECTRIC LAMP.

No. 476,530. Patented June 7, 1892.

Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

ATTEST:

INVENTOR:

- Labeled addled by a teacher
- Hyperactive High School drop out
- Probably had autism

Schools Need to Keep Classes that Foster Creativity and Problem Solving

- Art, sewing, cooking
- Playing musical instruments
- Woodworking
- Theater
- Welding
- Auto Shop
- Creative writing

How to Determine Types of Thinkers in Children

- Visual Thinker – Art, building things, and mechanical ability
- Math Thinker – Mathematics, building things, computer programming, music
- Verbal Thinker – Love facts, history

Students Need to be Exposed to Possible Careers

- Visual Thinker – Graphics, art, AV technician, mechanics, skilled trades or training animals
- Math Thinker – Engineering, computer programming, musician, chemist, physics
- Verbal Thinker – Specialized retail selling, cars or financial products, corporate record keeping, special education, teacher, lawyer

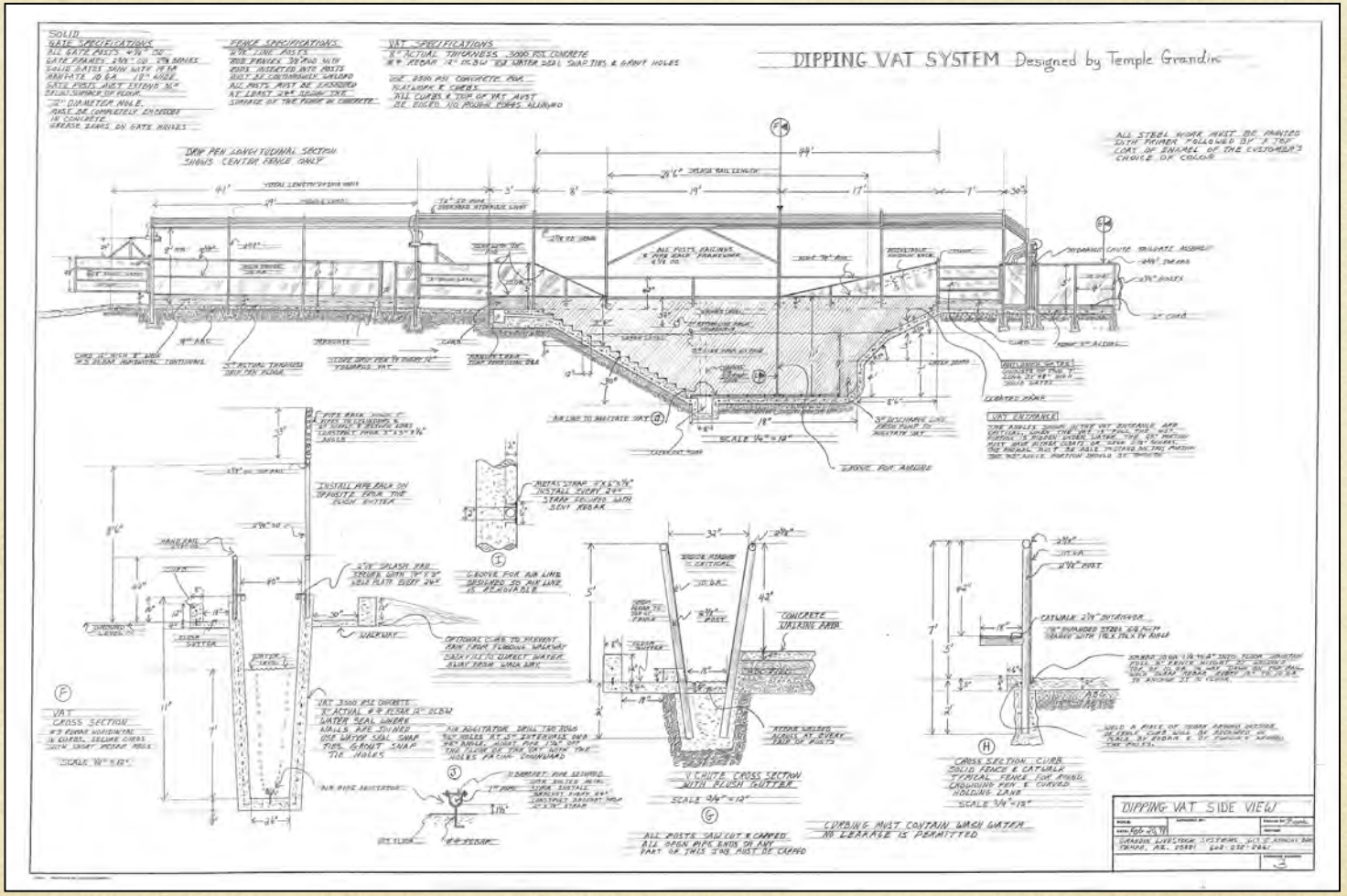
Arts Foster Scientific Success

- Nobel prize winners 50% more likely to have an arts and craft hobby compared to other scientists
- Painter, musician, actor, dancer, composer, poet, photographer or craftsman

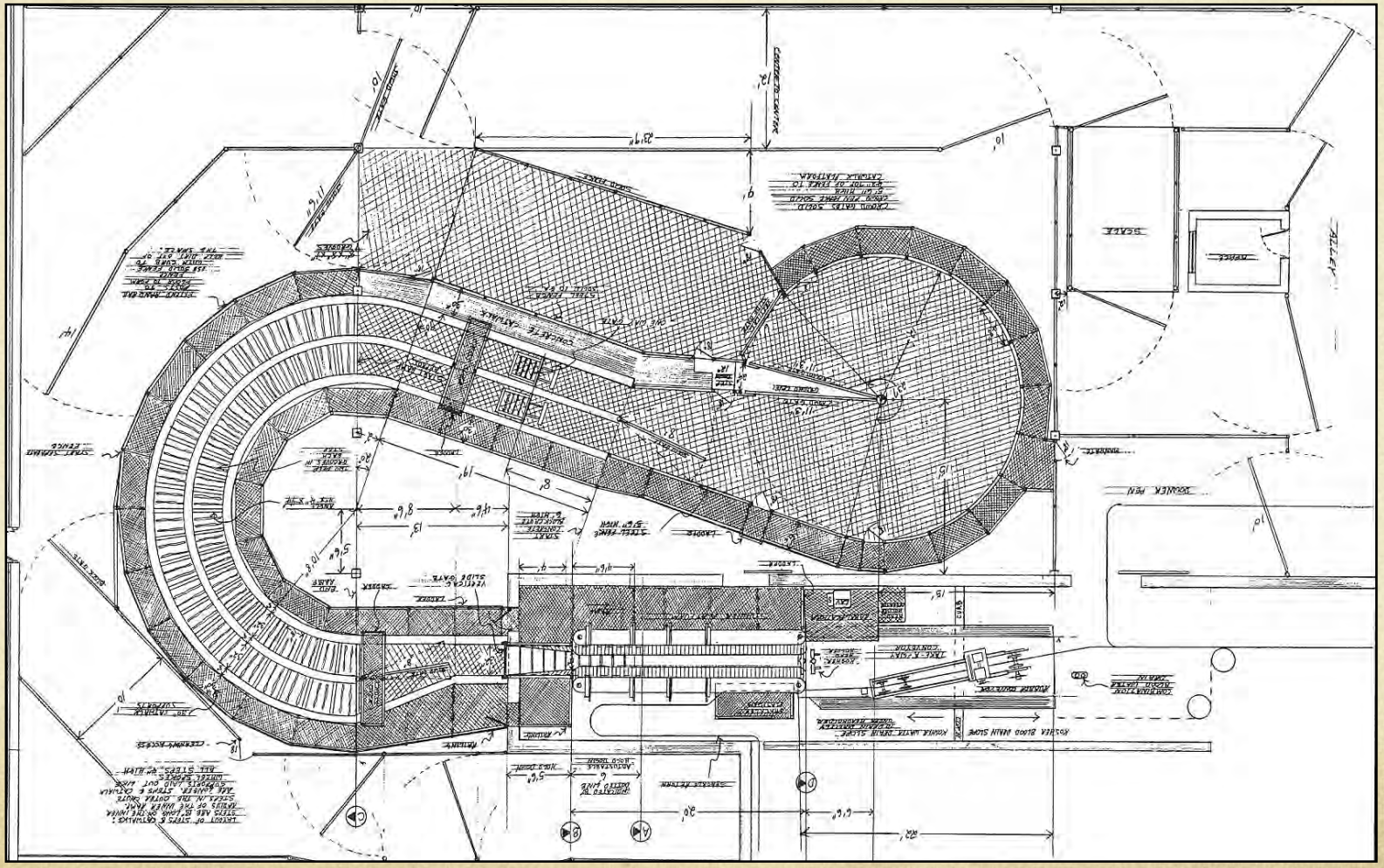
Robert Root Bernstein et al., 2008

Since I was weird, I learned how to impress potential customers by showing a portfolio of my work

Sold my work by showing my portfolio



People Need to Touch in Order to Perceive



Picture From My Original Portfolio

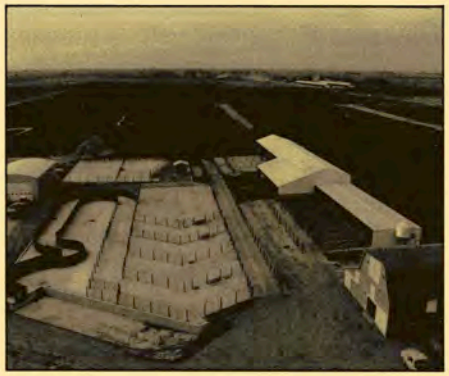
Replica Used in HBO Movie *Temple Grandin*

Put it on your phone

30 Second WOW

LIVESTOCK HANDLING SYSTEMS

A Well Designed Facility will help make your Livestock Operation More Profitable.

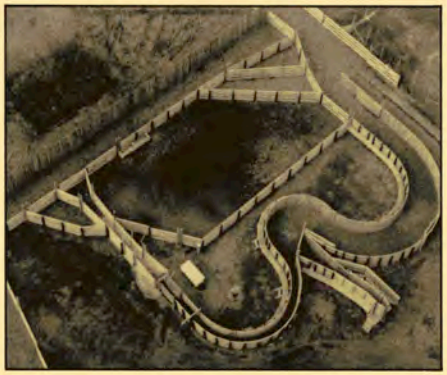


CUSTOM DESIGNED
To Fit Your Operation:

Working, sorting, loading and hospital facility at A. Glenn Kluck Feedlots in Richland, Nebraska. The system has a curved level loading chute, herringbone sorting pens, scale, covered hospital pens, working circle and horse pens. Curved chutes and smooth traffic flow reduce stress and improve efficiency. The covered working circle is designed for easy washdown. Employees will do a better job of processing in clean facilities which protect them from the weather. Careful gentle processing will improve cattle performance.

CURVED WORKING CHUTES
For Greater Efficiency:

A curved single file chute, round crowding pen and wide curved alley are labor saving and reduce stress at Alan Verishine's cow calf operation in Saskatoon, Canada. A handler working from the catwalk along the inner radius can move cattle easily into the round crowd pen and squeeze. Cattle can be sorted 3 ways after the squeeze chute. Grandin designs handling facilities for all types of ranch and feedlot operations.



Consultant & Designer of livestock handling facilities for feed lots, ranches, packing plants & auctions.

GRANDIN LIVESTOCK HANDLING SYSTEMS, INC.

Suite 3, 1401 Silver St.
Urbana, IL 61801 217-384-4815

NEW ADDRESS:
1205 W. Elizabeth Suite E122
Fort Collins, CO 80521

Half the Cattle in North America are Handled in Systems I Designed

Aerial Photo of Early Major Project

Who Builds Large Food Processing Plants?

- Visual thinkers – Design plant layout and build highly specialized mechanical equipment
- Math Thinkers – Engineers, boilers, refrigeration, calculate roof trusses
- Retiring Visual Thinkers - Not getting replaced

Twenty Percent of People I Worked With Were Either Autistic, Dyslexic or ADHD

- ✓ Owned metal companies
- ✓ Multiple patents
- ✓ Designed and built complex equipment

We Have Lost the Skills to Build This

A Visit to the Mother Ship

Mars Landing Parachutes

- ✓ Fabric made in the U.K., Sewn in the U.S.
- ✓ High tech looms from Europe

Dare Mighty Things

- Visual thinkers, AI, and some people with autism, ADHD or dyslexia are all bottom up thinkers.
- Concepts are formed from specific examples
- Top down verbal thinkers tend to overgeneralize
- Sensory Based *not* Word Based notices detail

Tips for Working with Minds That are Different

- ✓ Never overload working memory
- ✓ Provide Pilot's Checklist for tasks with multiple steps
- ✓ Stretch them slightly out of their comfort zones
- ✓ Limit screen time
- ✓ Provide choices of hands-on activities

Ultimate Goal of Education

- Where is a student ten years after high school graduation?
- Learn to be a life-long learner

Get Lots of Exercise

I do 100 sit-ups every night

My Work Experience

- 13 years of age - Sewing job
- 15 years of age – Cleaning horse stalls
- 16 years of age – Aunt’s ranch
- 16 years of age – Roofing
- 17 years of age – Sign painting
- College – Research Lab – Rent houses
- College – Aid Child With Autism

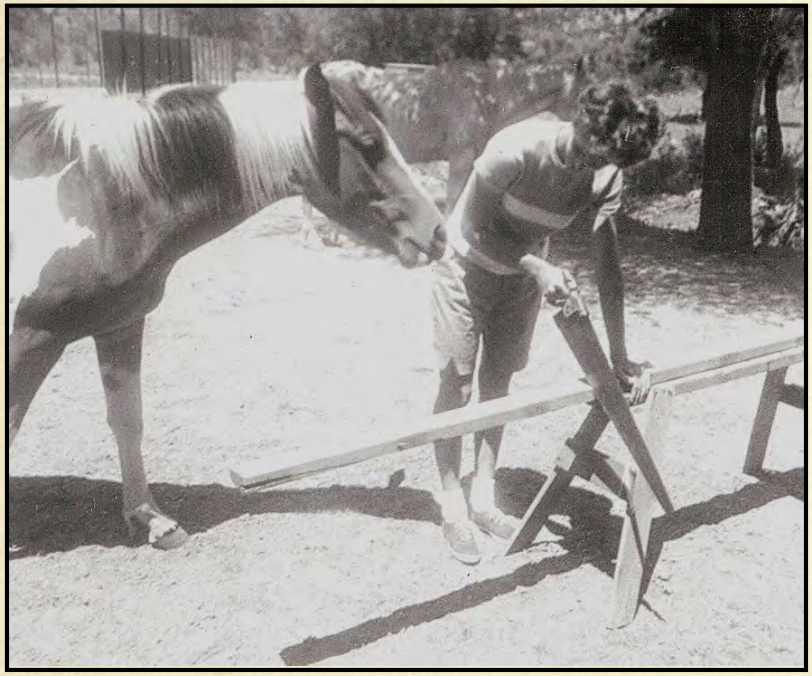
Find Back Doors to Jobs

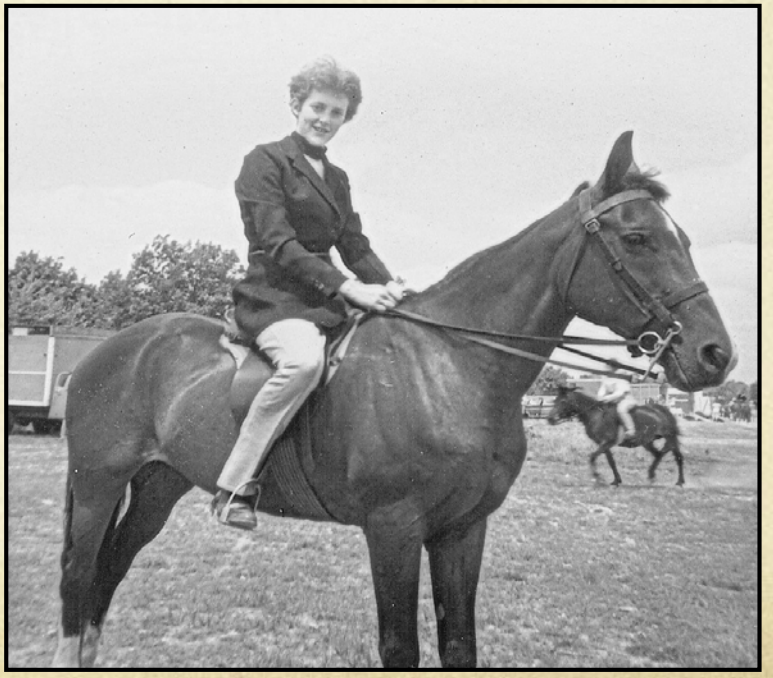
- ✓ Friend's Business
- ✓ Contacts in Your Industry
- ✓ Half of All Good Jobs Back Door

My Elementary School Life Skills Training

- Party hostess at family parties and shake hands with guests
- Sold candy to neighbors for charity
- Shopped by myself for small toys and snacks
- Learned saving money

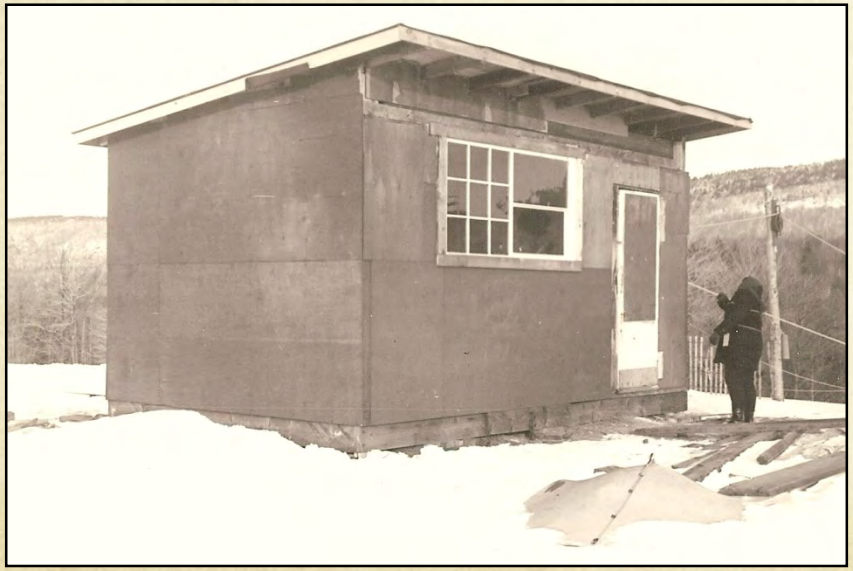
Friends Through Shared Interests in Art, Carpentry, and Horses





I was a poor student but I learned lots of valuable work skills in high school. I did building projects that other people appreciated

Before



After

Freelance Sign Painting at the Carnival

Photo by Leo

Driving Slow and Gradual Approach

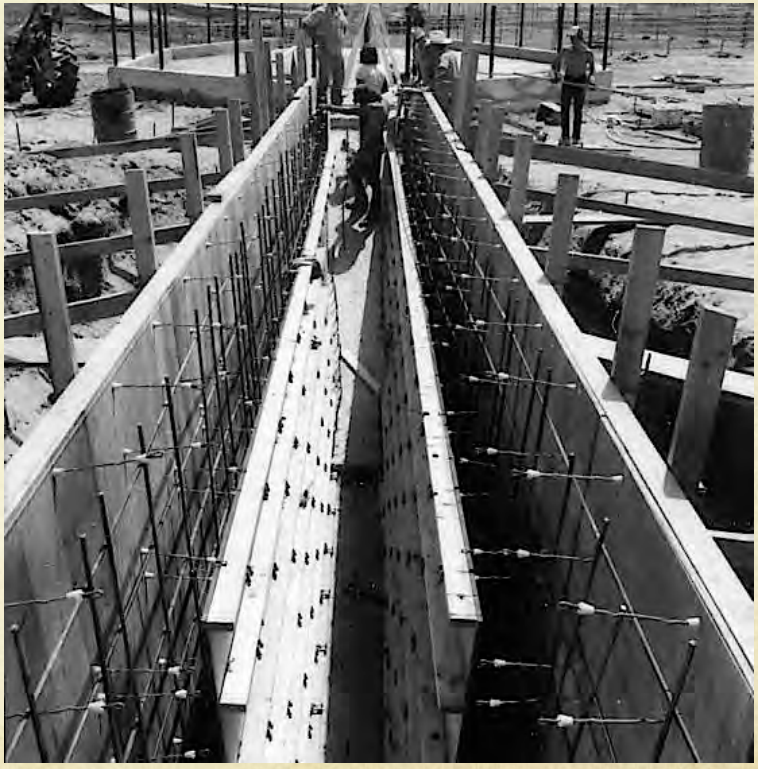
Kristina et al., 2018

Slow Transition to the World of Work

- Jobs on a schedule outside the home at age 11 to 12
- Learn basic life skills such as shopping
- Do not overprotect or over accommodate
- Learn to keep a real job before graduation from high school

Jim Uhl, the Contractor – An Important Work Mentor

Got on the Phone Fast to Find the Drawings for This



Finding Mentors and Teachers

- My Mother – Taught me to read at age 8
- Elementary School Teachers
- Mr. Carlock, High School Science Teacher
- Jim Uhl – Agate Construction

Sensory Over Sensitivity

- Highly variable
- Give the individual control of the sound
- Try not to wear the headphones
- Thrift shops have soft clothing
- Autism Environmental Enrichment

Signs of Visual Processing Problems in Autism, Dyslexia, and Sensory Processing Disorder

- ✓ Hates escalator
- ✓ Print jiggles on the page during reading
- ✓ Eye exam may be normal

Visual images break up and fragment similar to migraine headaches

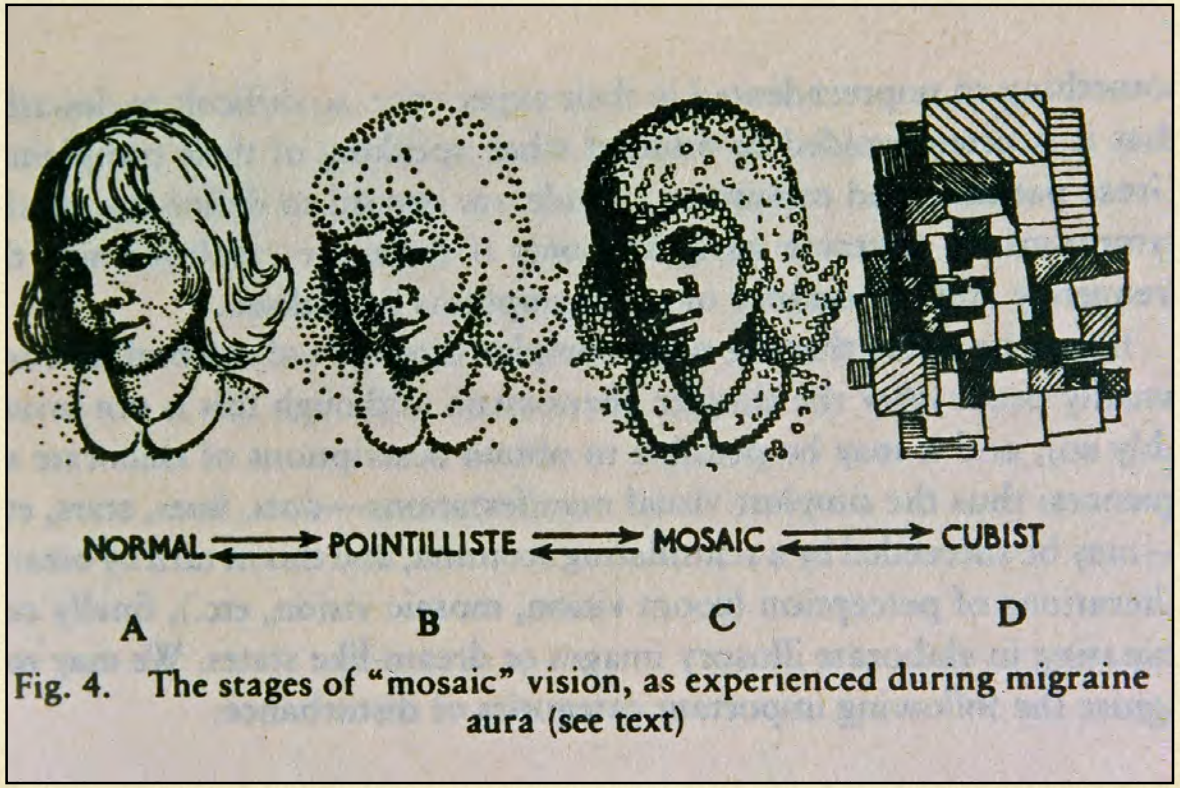


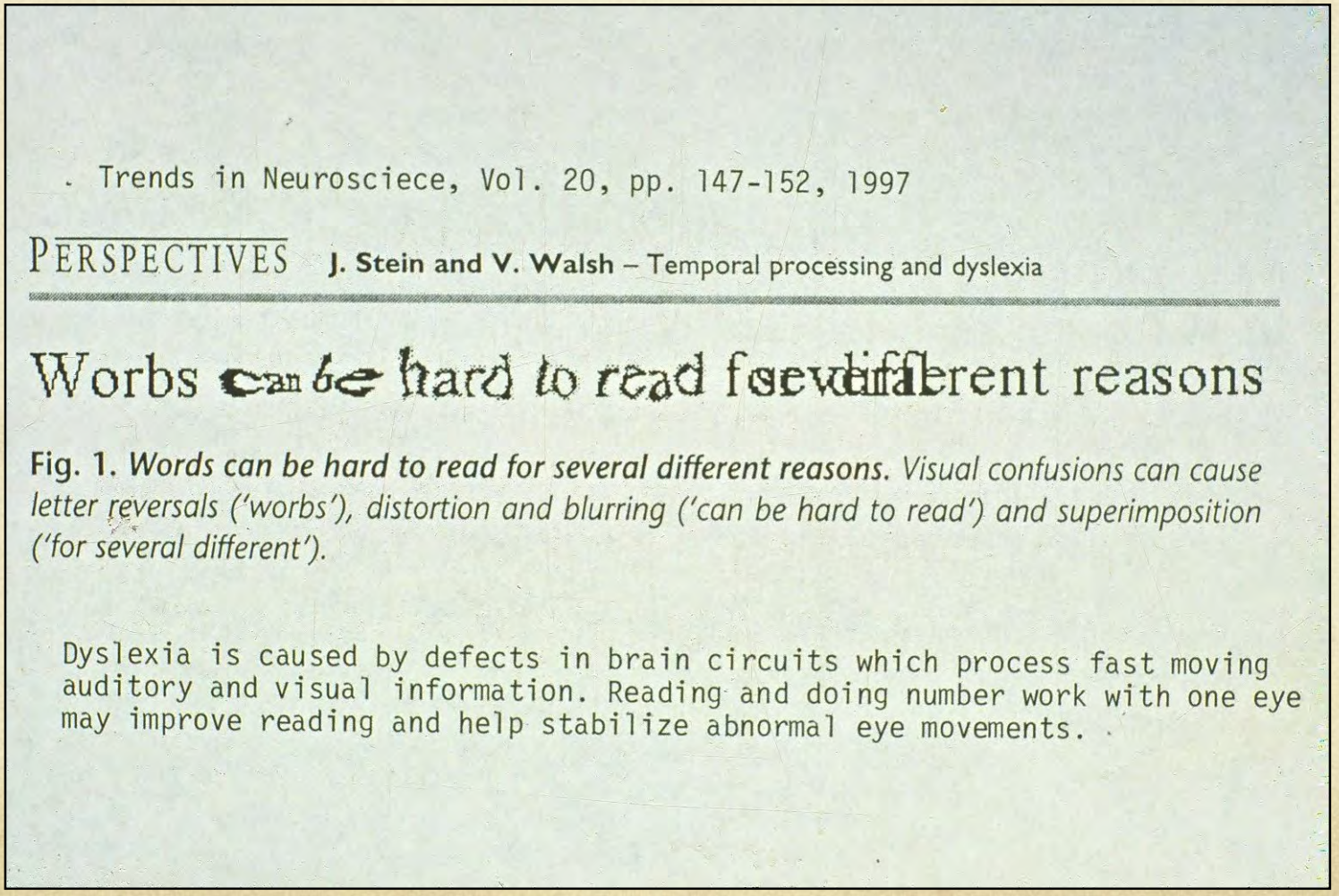
Fig. 4. The stages of "mosaic" vision, as experienced during migraine aura (see text)

Oliver Sacks

Examples of Video Interference

Source: www.snug.com

Words vibrate and jiggle on page



. Trends in Neurosciece, Vol. 20, pp. 147-152, 1997

Worbs can be hard to read for several different reasons

Fig. 1. ***Words can be hard to read for several different reasons.*** *Visual confusions can cause letter reversals ('worbs'), distortion and blurring ('can be hard to read') and superimposition ('for several different').*

Dyslexia is caused by defects in brain circuits which process fast moving auditory and visual information. Reading and doing number work with one eye may improve reading and help stabilize abnormal eye movements.

Interventions for Visual Processing Problems

Incandescent lamp by desk or natural light

Block fluorescent lights or LED with a hat

Gray, tan, or pastel paper for reading

Irlen lenses or pale colored glasses

Severe Sensory Problems

- Extreme effort required to screen out background noise and visual distractions
- Needs frequent breaks to prevent sensory overload
- Mono-channel – Eye contact may be difficult
- Body boundary problems
- Often an auditory thinker

Environmental Enrichment is an Effective Treatment for Autism

- ✓ Stimulate two senses simultaneously
- ✓ Adjunct to ABA and speech therapy
- ✓ One of the senses is always smell or touch
- ✓ Novelty and keep changing the stimulation
- ✓ Use simple economical things. Two 15 minute sessions per day

Nonverbal Individuals who Type Independently Describe Severe Sensory Problems

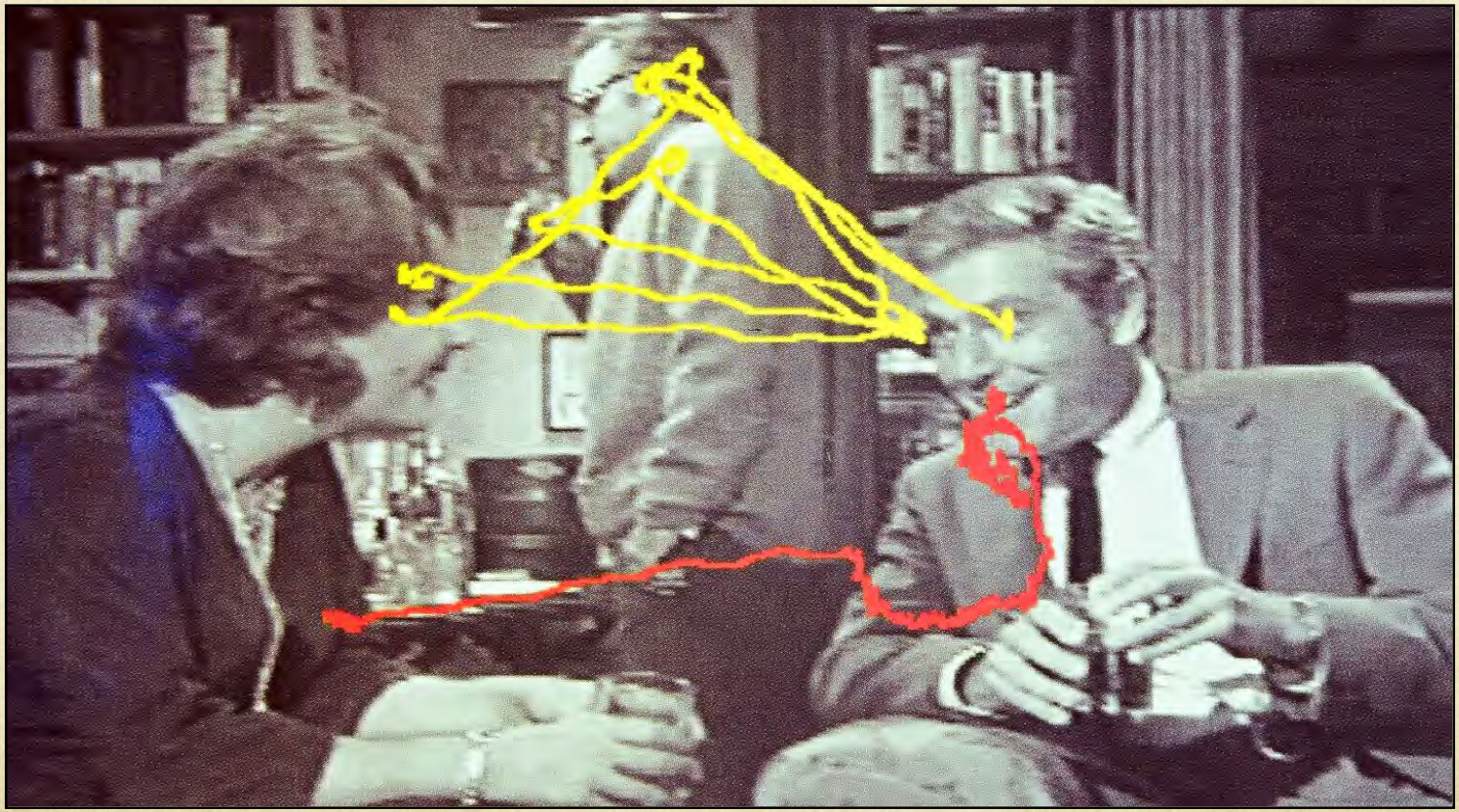
- *How Can I Talk if my Lips Don't Move* by Tito Rajarish Muhopadhyay
- *Carly's Voice* by Arthur Fleischmann with Carly Fleischmann
- *The Reason I Jump* by Naoki Higashida
- Fall Down 7 Times Get up 8 by Nooki Higashida

Attention shifting slowness occurs with many disorders

Takes longer to shift back and forth between two different things

Slow Processing Speed

Viewer with Autism (Red Line)
Normal Comparison Viewer (Yellow Line)
Shows Attention Shifting Slowness



Ami Klin

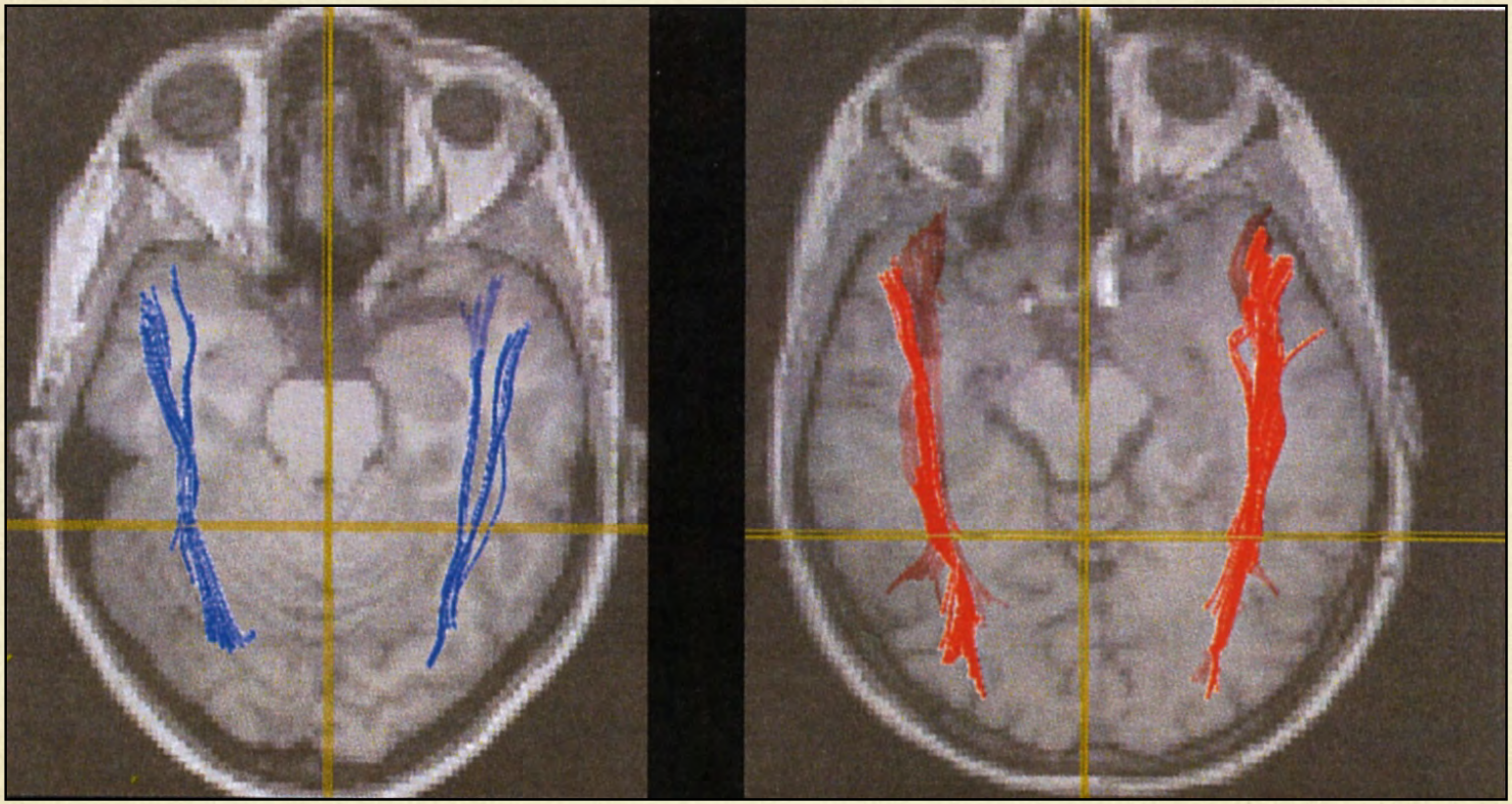
Teaching Young Kids

- Slow down when you talk
- Encourage use of words
- Give them more time to respond
- Use teachable moments
- Give instruction instead of saying *No*
- Teach turn taking

Brain Scans of Large Visual Thinking Circuit

Control

T. Grandin

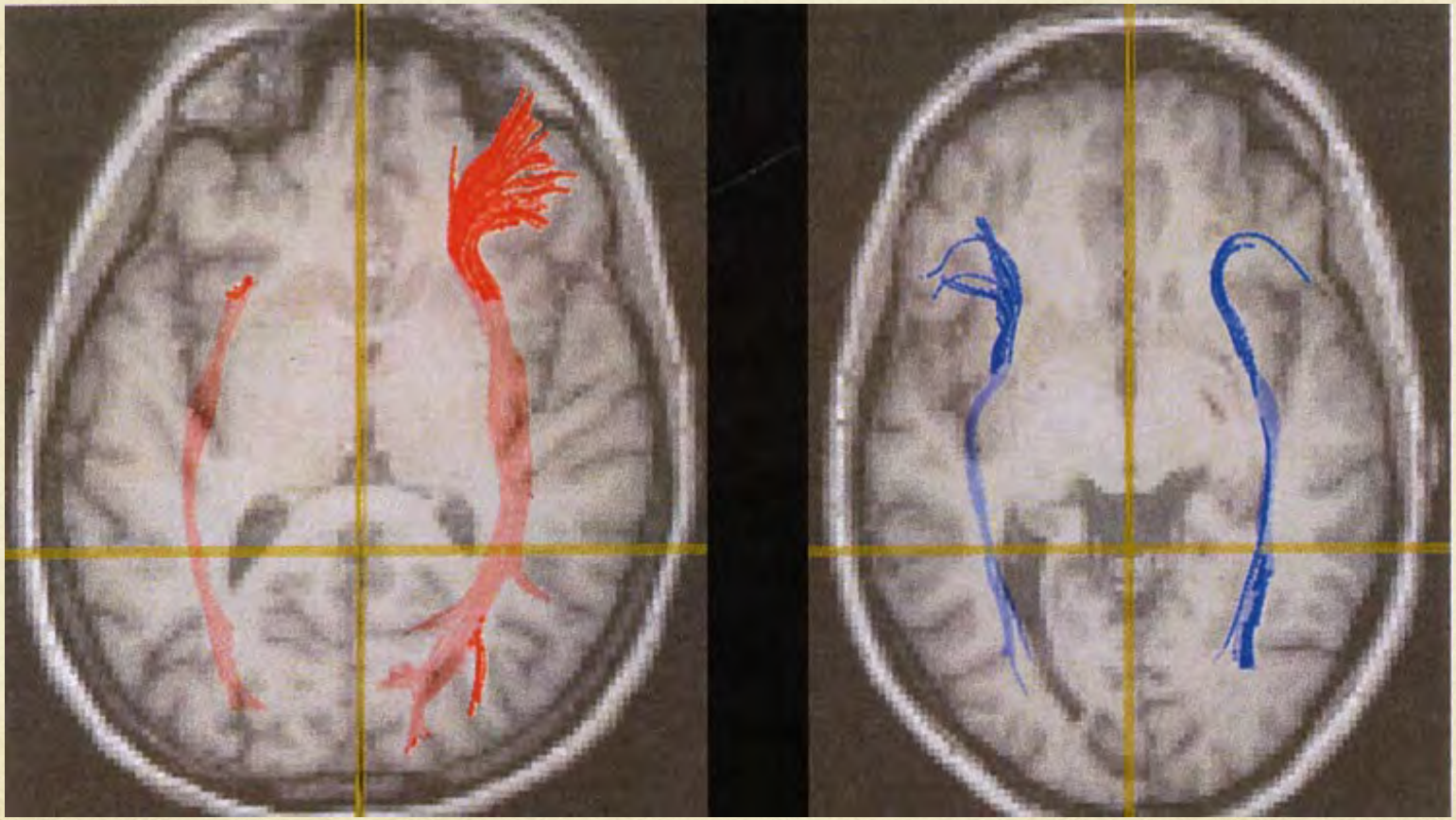


Humphreys, Minshew, Behrmann, and Cibu, 2006

Brain Scans

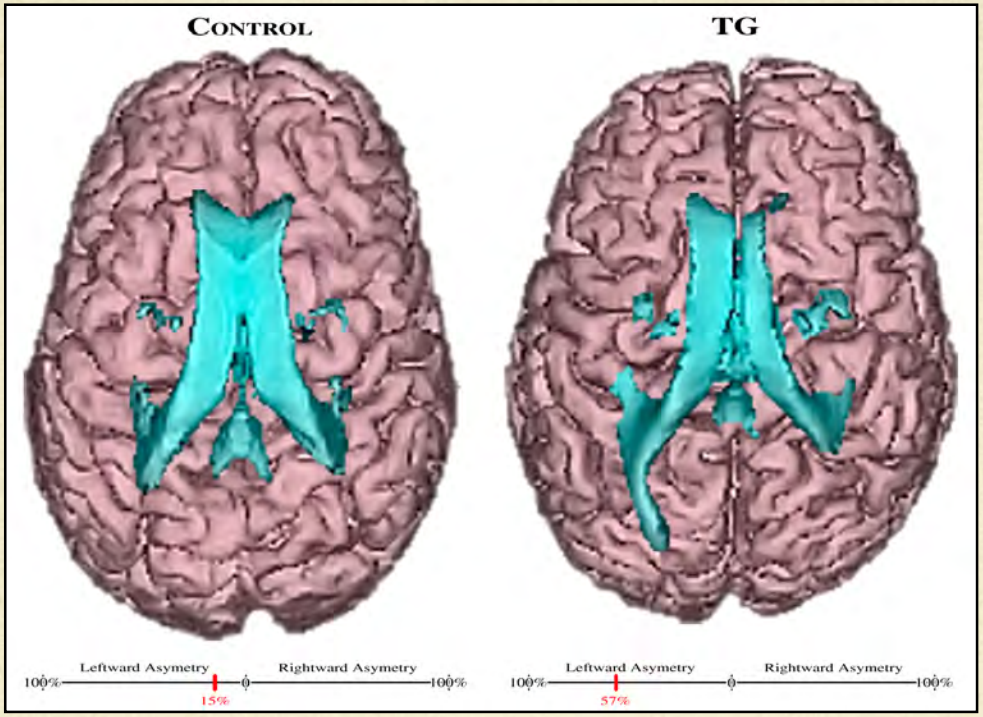
T. Grandin

Control



Humphreys, Minshew, Behrmann, and Cibu, 2006

Abnormalities in Left Hemisphere



Working Memory and Algebra Department Failed to Develop

University of Utah, 2010

Fear is the main emotion in Autism. My amygdala (fear center) is three times larger.

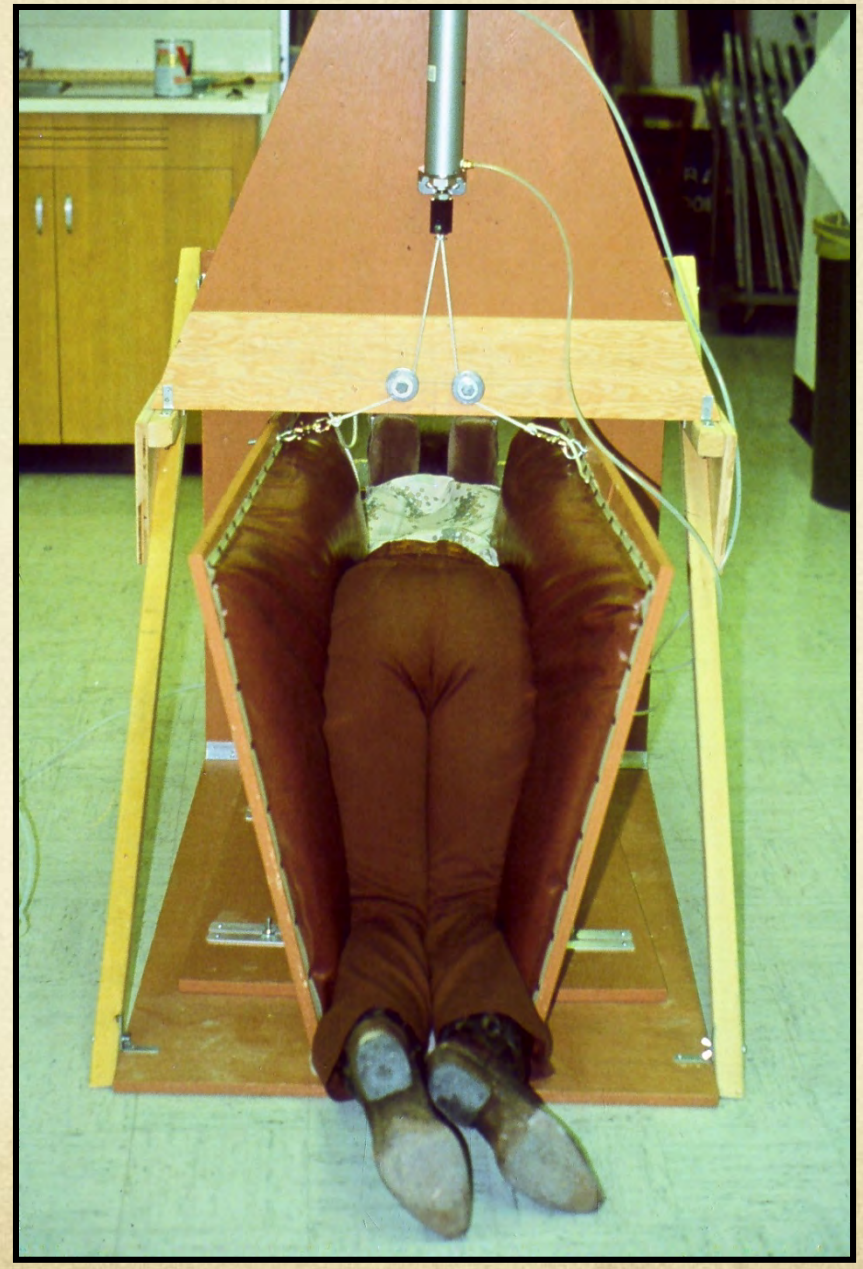
University of Utah, 2010

Things I was Afraid of in My 20's

- ✓ Airplanes
- ✓ Public speaking – walked out during my first talk

Got Over It When an Airplane Became Interesting

- Fear is the main emotion in autism. My amygdala (fear center) is three times larger (University of Utah, 2010)
- A low doses of antidepressant has controlled my anxiety – Started early 30's
- *Thinking in Pictures* – Chapter "A Believer in Biochemistry"
- High doses of antidepressants may cause insomnia or agitation

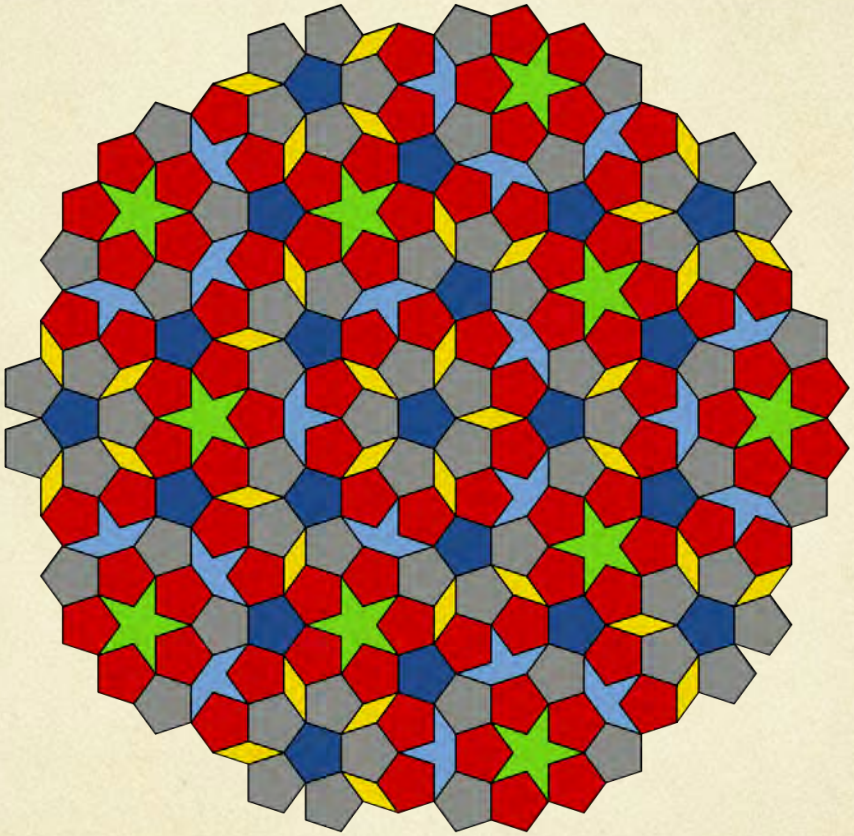


Using pressure to calm the nervous system during therapy

Show Kids Interesting Things

Put business and science magazines in the school library

Penrose Tiling



Credit: Wikimedia

Experimental Huntington drug brings rare hope *p. 742*

Tomorrow's Earth *pp. 748, 751, & 766*

Gene linked to immune dysfunction *pp. 756 & 810*

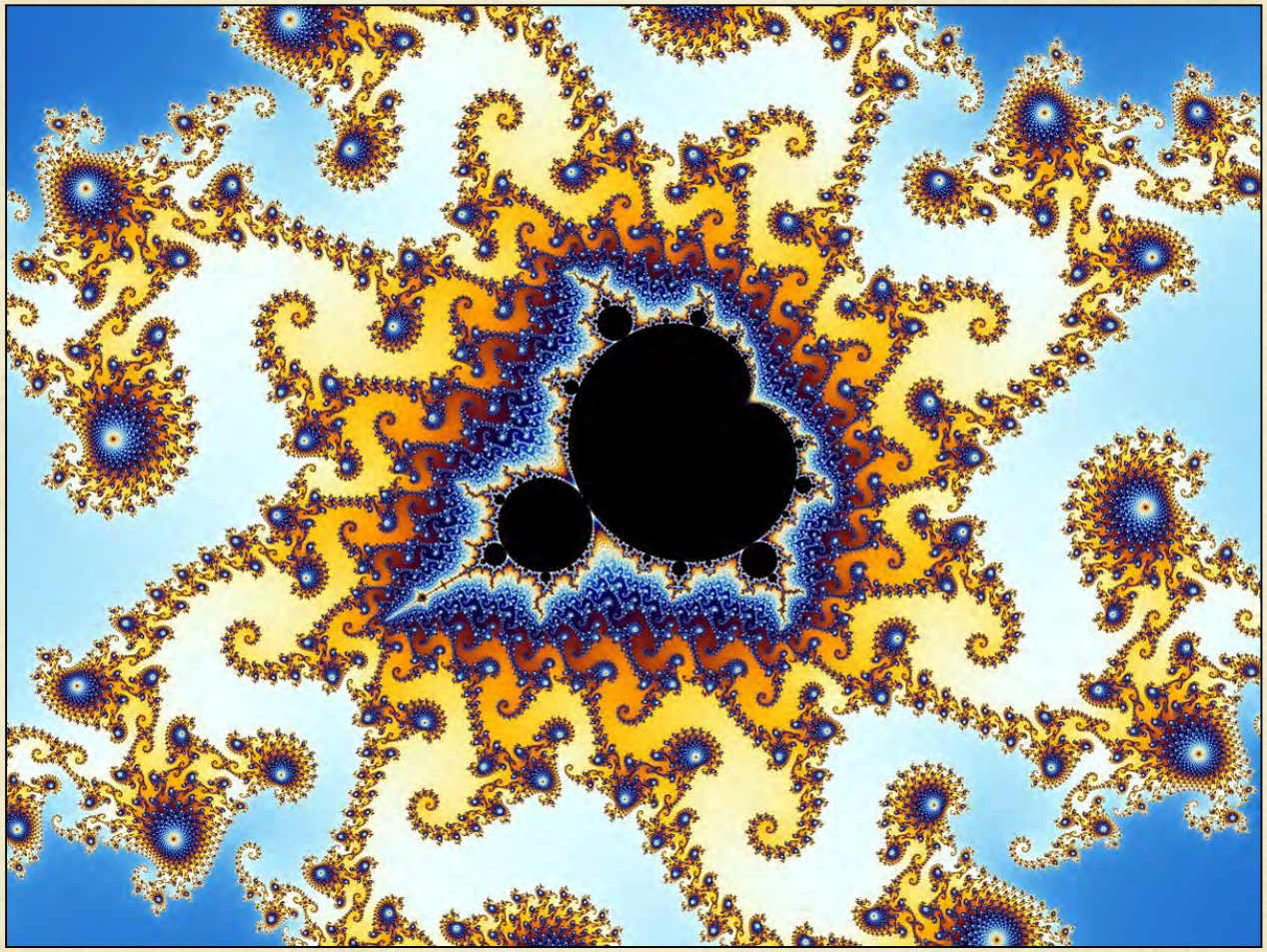
Science

$15
24 AUGUST 2018
sciencemag.org
AAAS

GRAPHENE QUASICRYSTALS

Twisted bilayer shows intriguing electronic properties *p. 782*

Fractals



Source: Mandelbrot-Wikipedia

The Mathematical Mind Finds Patterns in Everything

Aloe Plant Polyphylla Spiral, Wikimedia

Educational Materials

- Wolfram Mathematics
- Code.org
- Protein Symmetry
- Scratch Programming
- Khan Academy
- National Geographic Citizen Science