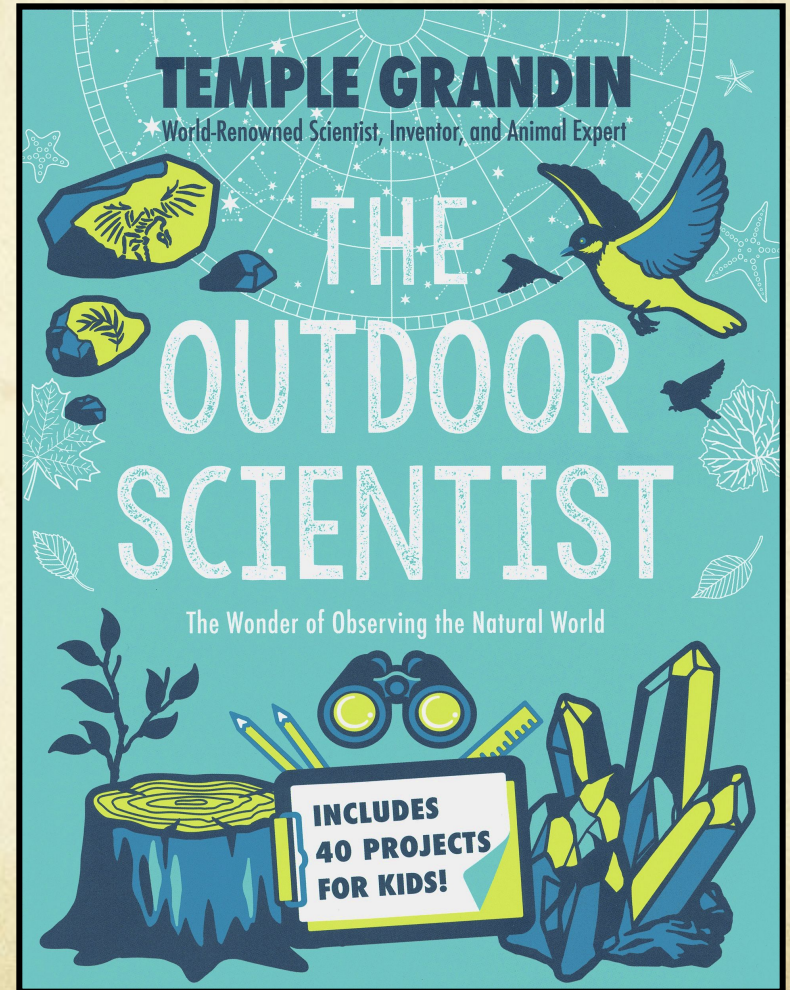


# Developing Different Kinds of Minds, 2<sup>nd</sup> Edition

**Temple Grandin,  
Professor of  
Animal Science  
Colorado State  
University**



# Child Learning How Water Flows



# Dad Explains How Water Comes Out the Other Side



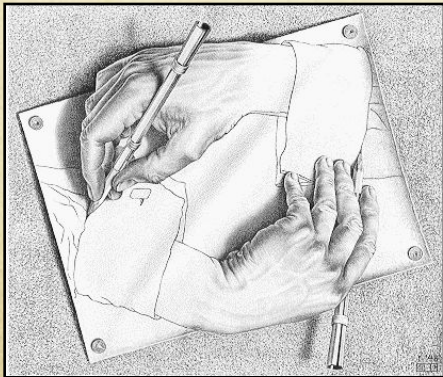
- 
- What would happen to top innovators in today's educational system?
  - Many of them had an unconventional educational path
  - If born today, would their lives have been less successful?
-

- 
- 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
-

# 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

- 
- **Verbal Thinker** – Top Down  
Overgeneralizes – Leaves  
Out Many Details
  - **Visual Thinker** – Bottom Up –  
Too Many Details
-

# Bottom Up Thinking

---

- Concepts are formed from specific examples grouped into categories
  - Differentiating dogs from cats by grouping into categories
    - Size
    - Smell
    - Nose shape
    - Sound
-



# 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



# Mission Critical Math Expertise

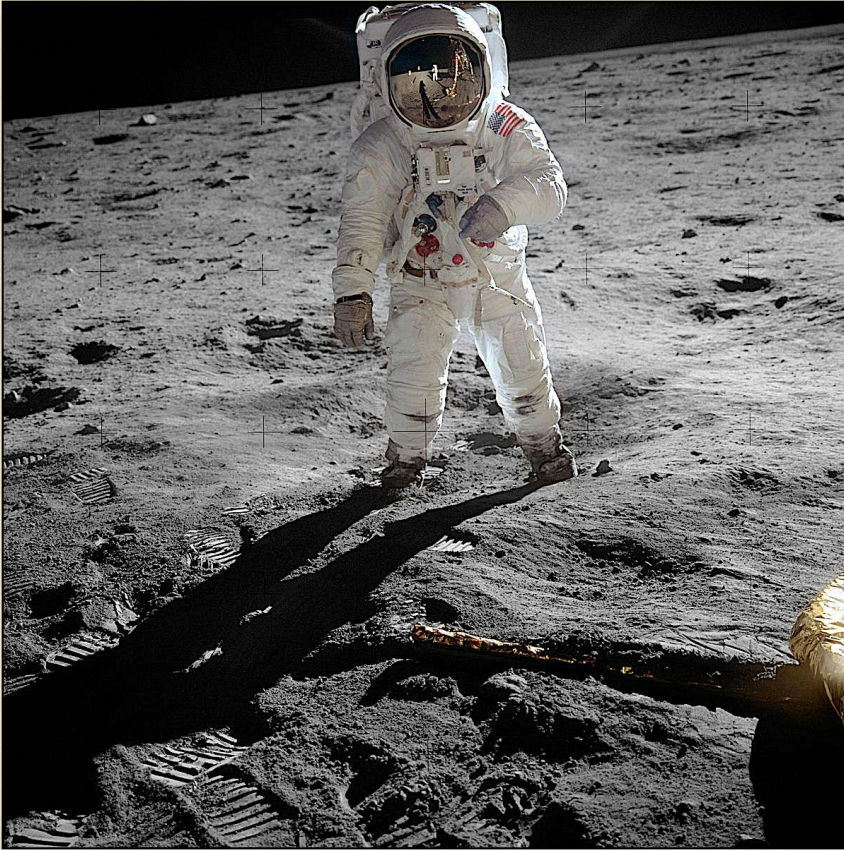
## Katherine Johnson

Childhood Teachers Moved Her Into  
Advanced Math

## Hal Laning

Algebra Equations  
Lunar Lander Computer

# Visual Thinking Mission Critical



Sewn by the  
best bra  
seamstresses  
at Playtex

Credit: NASA

# Today's Generation Mars Rover Camera



Credit: NASA.gov

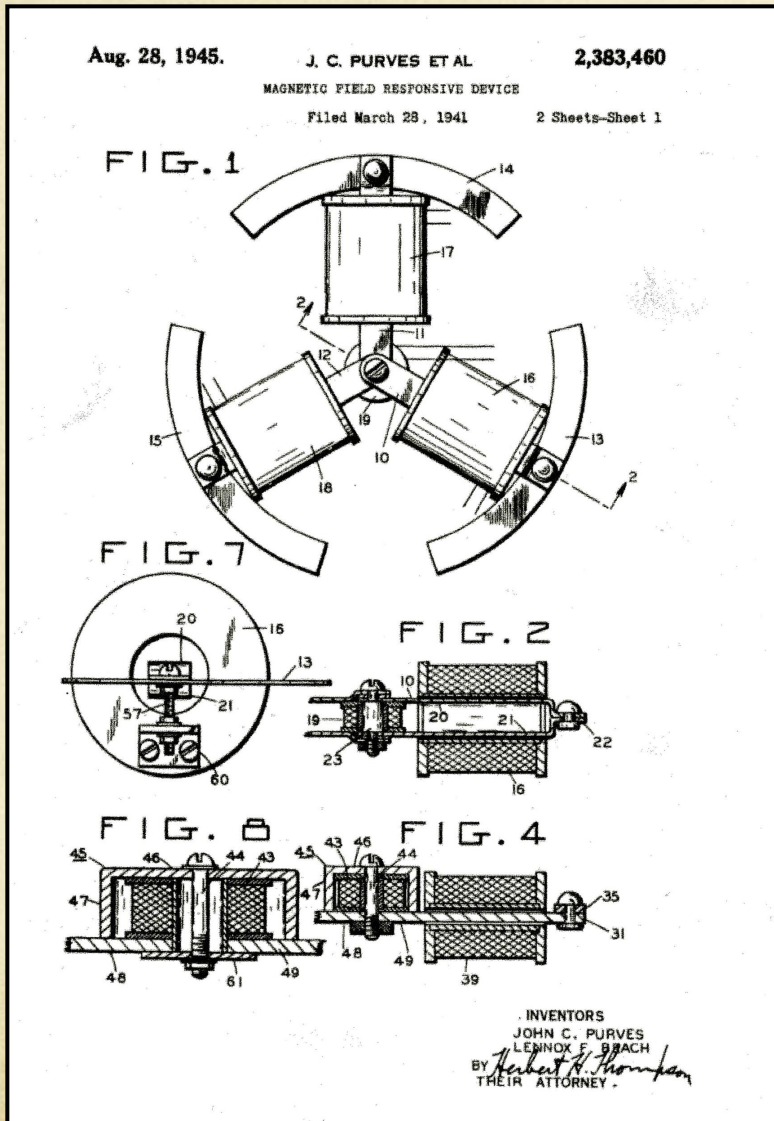
## Meticulous Hand Wiring

# Perseverance View of Mars



Credit: NASA.gov

# Grandfather Co-Invents Auto Pilot

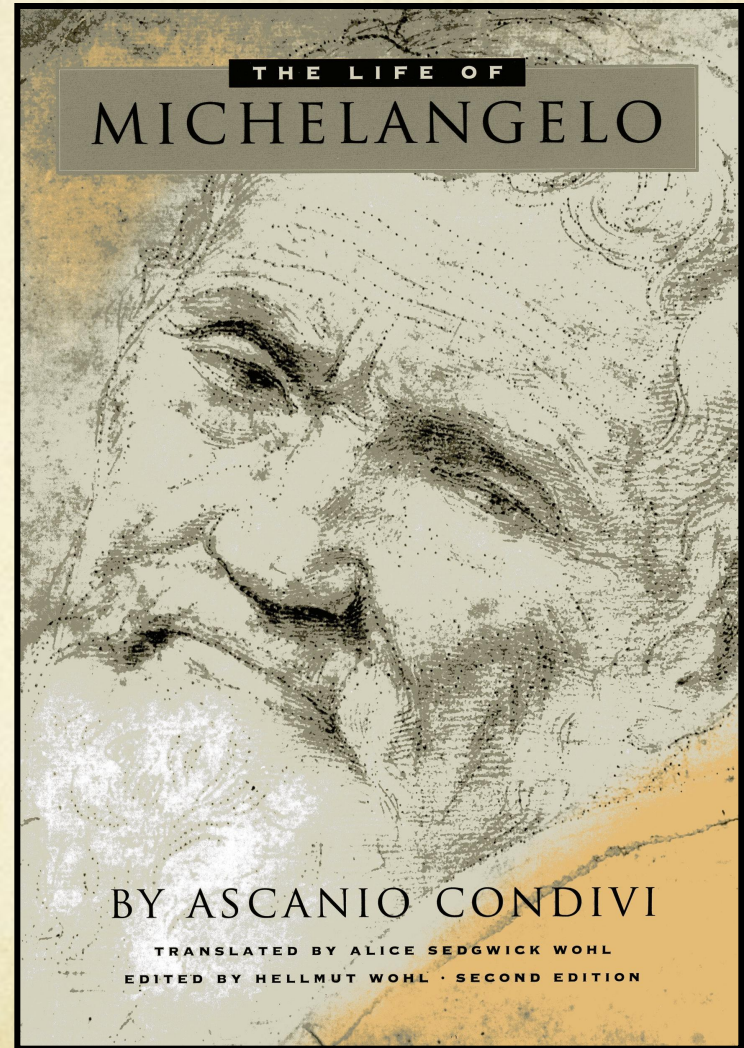


- Different Kinds of Minds Complemented Each Other
- Visual Thinker
- Mathematical Engineer



# Michelangelo

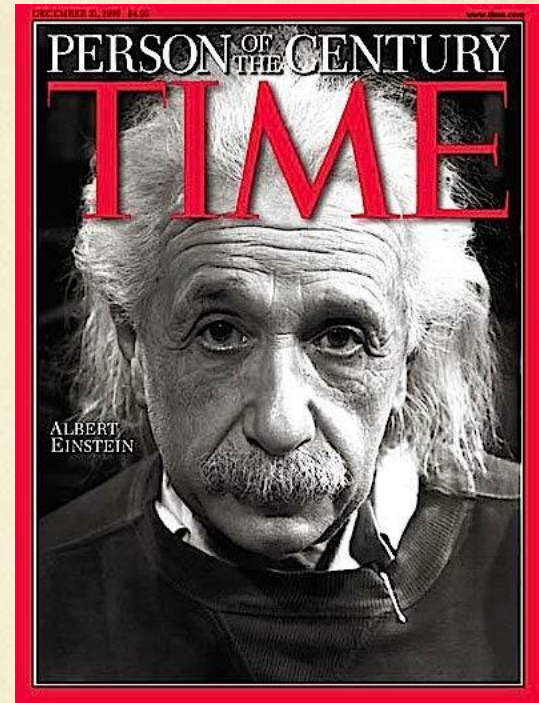
- Dropped out of school at age 12
- Exposed to both art and stone cutting tools



# These Innovators Had Creative Hobbies

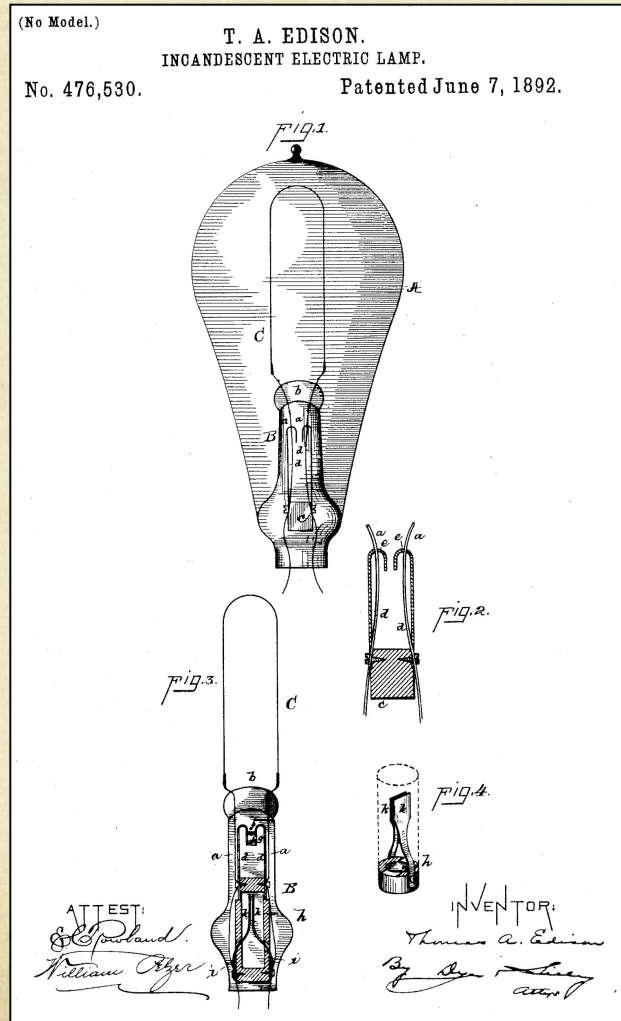


Bullied in school  
Learned calligraphy



No speech until age 3  
Played the violin

# Thomas Edison



- High School drop out
- Probably had autism
- Learned how to work
- Mentored in New Technology

# **Schools Need to Keep Classes That Foster Creativity and Expose Children to Careers Based on Their Strengths**

---

- 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

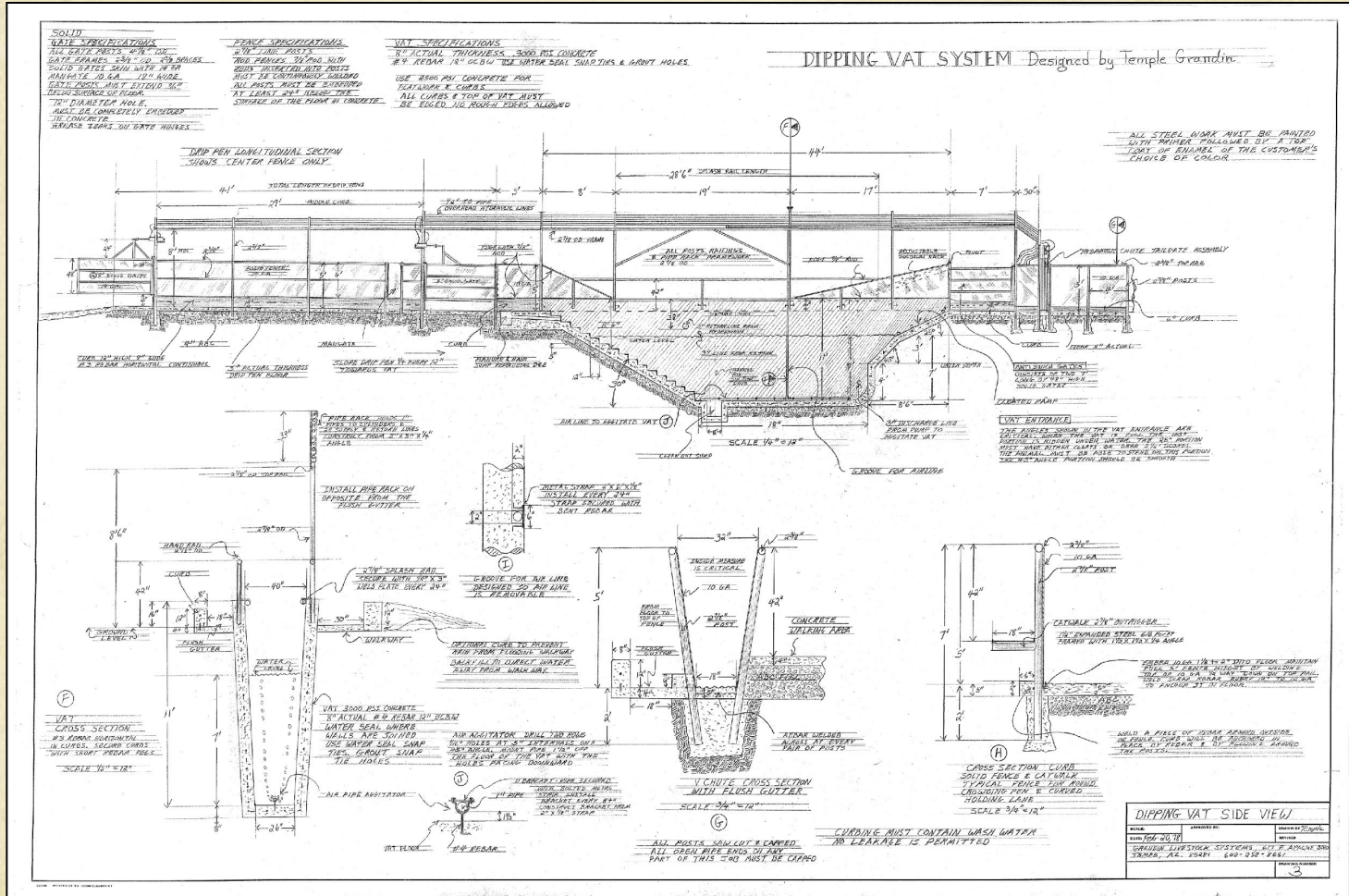
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**Since I was weird, I learned  
how to impress potential  
customers by showing a  
portfolio of my work**

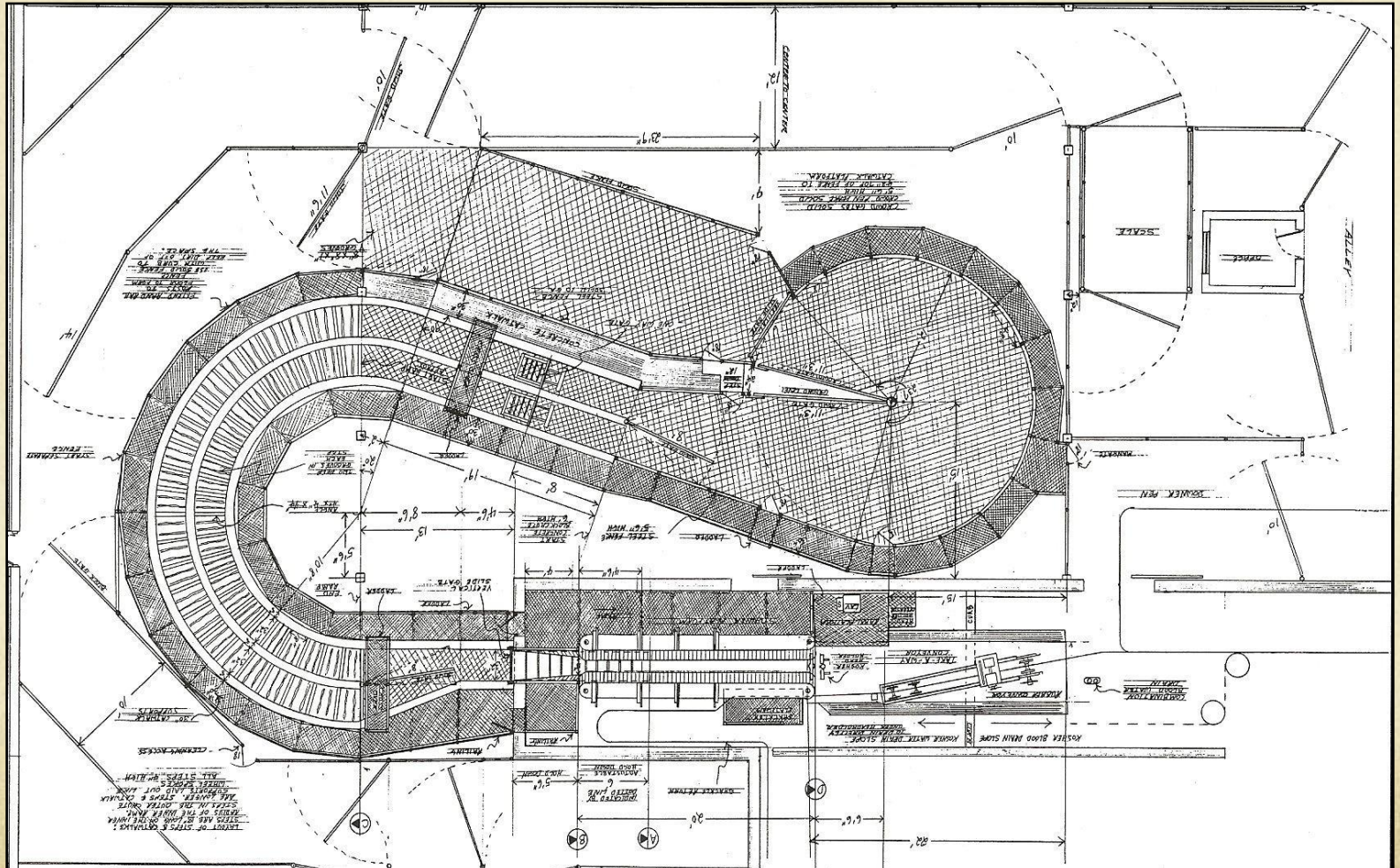
---



# 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.

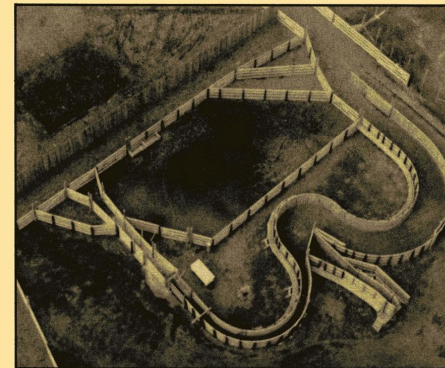


### CUSTOM DESIGNED To Fit Your Operation:

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 invent highly specialized mechanical equipment
- ❑ **Math Thinkers** – Engineers, boilers, refrigeration, calculate roof trusses

**Huge shortage of electricians, mechanics, and welders who can read drawings.**



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

---

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

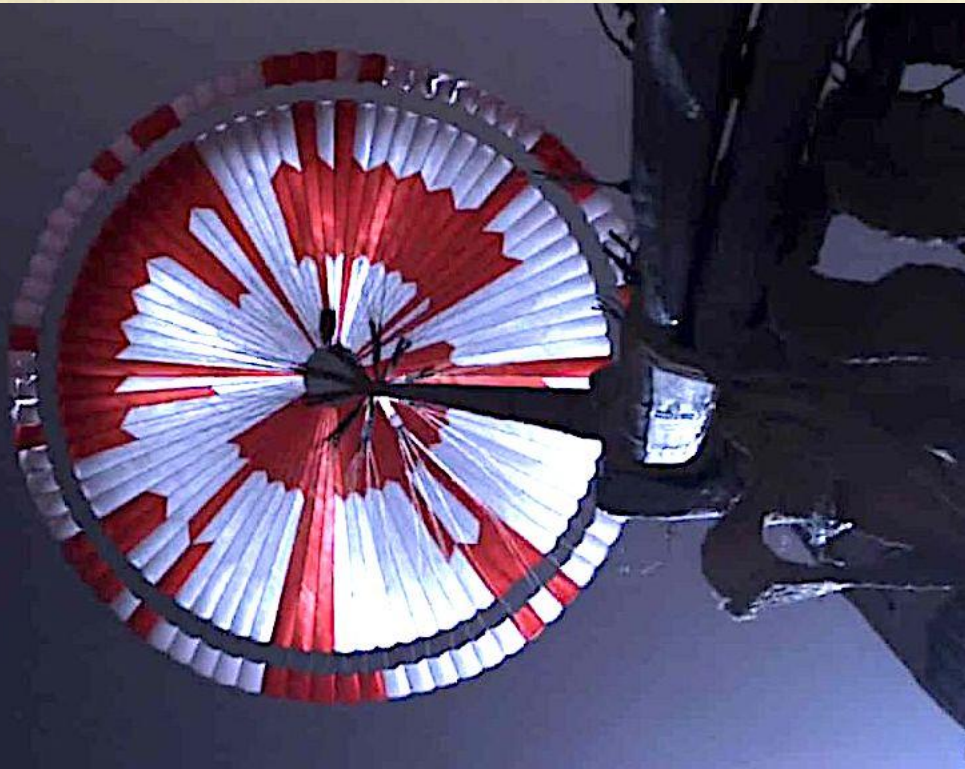
# We Have Lost the Skills to Build This



# 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**

# Tips for Working with Minds That are Different

---

- ✓ Never overload working memory with multi-tasking
  - ✓ Provide a written Pilot's Checklist for tasks with multiple steps
  - ✓ Stretch them slightly out of their comfort zones
  - ✓ Limit video games
  - ✓ Provide choices of hands-on activities
  - ✓ Do not use vague instructions
-

# 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

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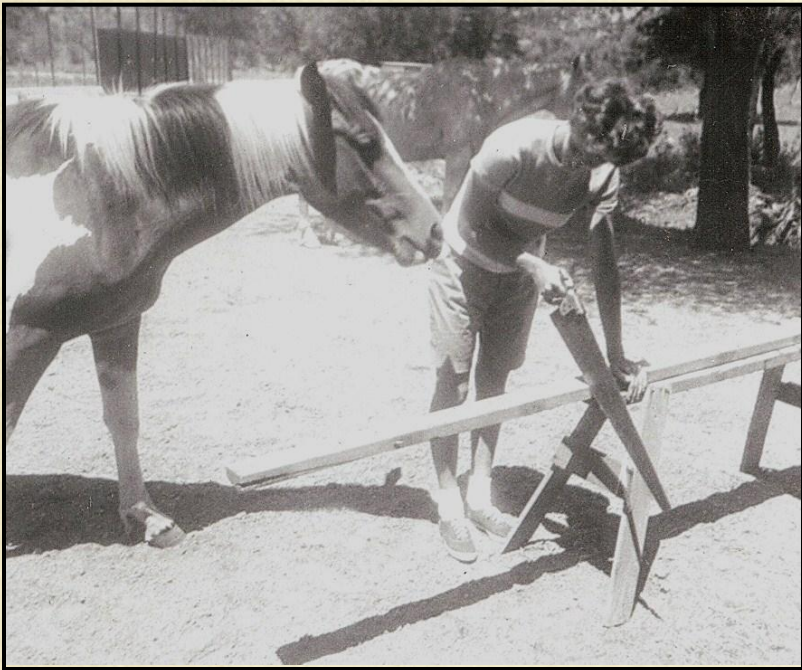
- ✓ Friend's Business
  - ✓ Contacts in Your Industry
  - ✓ Half of All Good Jobs Back Door
-

# My Elementary School Life Skills Training

---

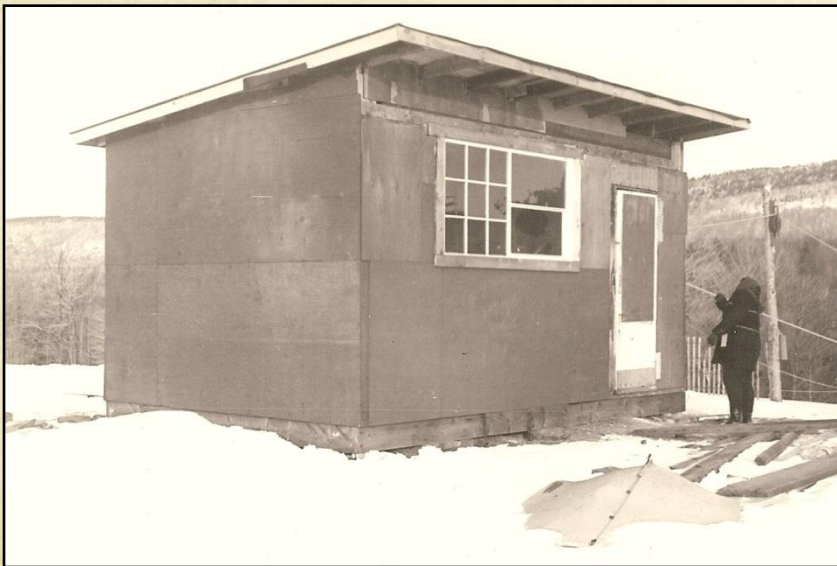
- Party hostess at family parties and shake hands with guests
- Sold candy to neighbors for charity
- Shopped by myself for small toys and snacks
- Learned saving money

# 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



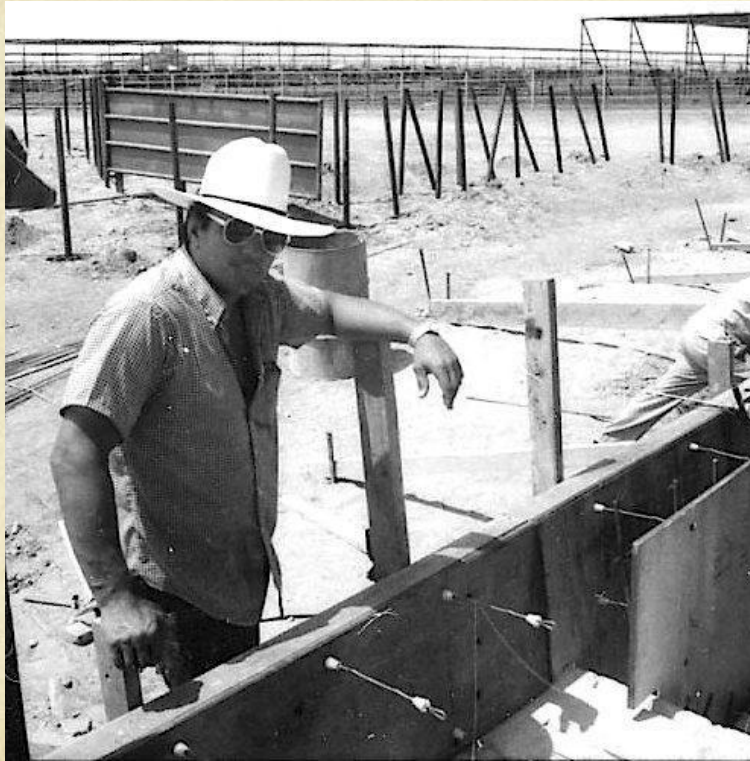
Kristina et al., 2018

# Slow Transition to the World of Work

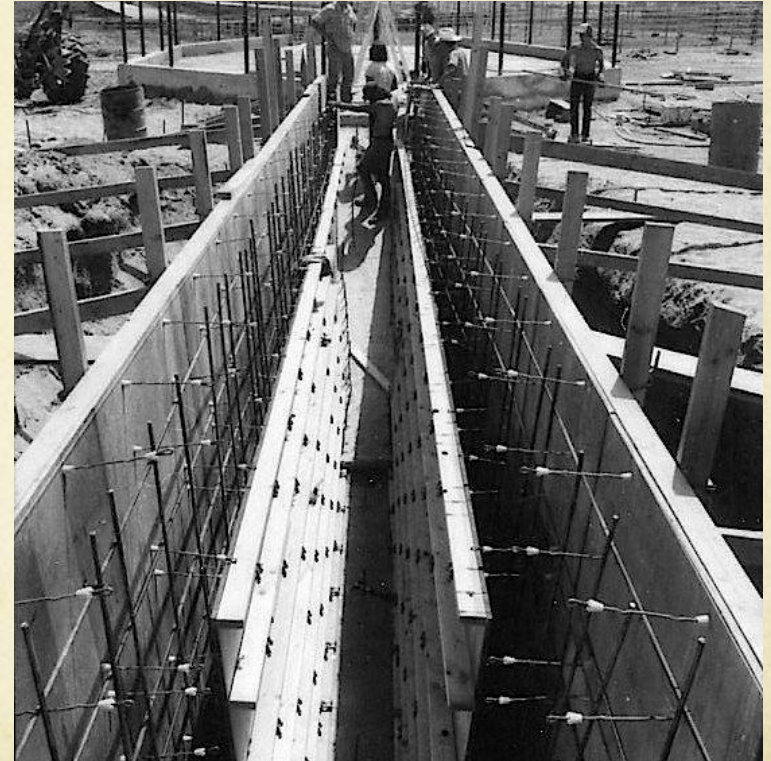
---

- 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
-

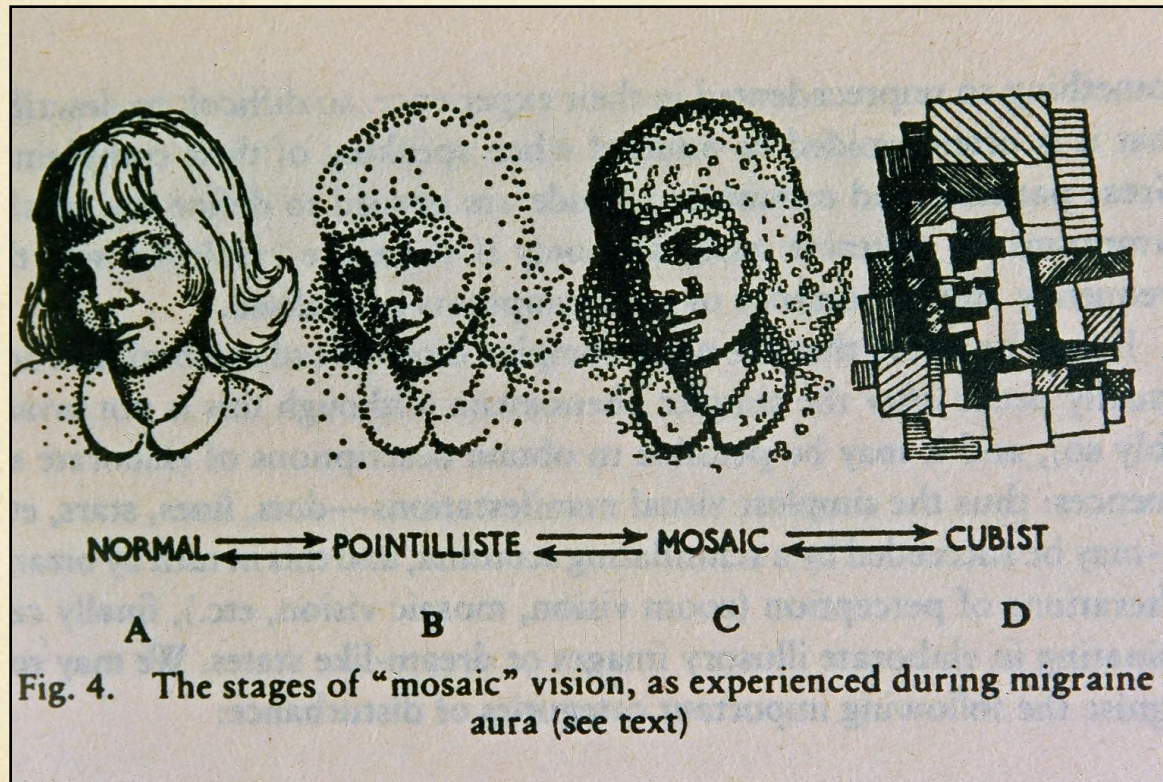
# Signs of Visual Processing Problems in Autism, Dyslexia, and Sensory Processing Disorder

---

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



# Visual images break up and fragment similar to migraine headaches



Oliver Sacks

# Examples of Video Interference



Source: [www.snug.com](http://www.snug.com)

# Words vibrate and jiggle on page

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

PERSPECTIVES J. Stein and V. Walsh – Temporal processing and dyslexia

---

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 Naoki Higashida

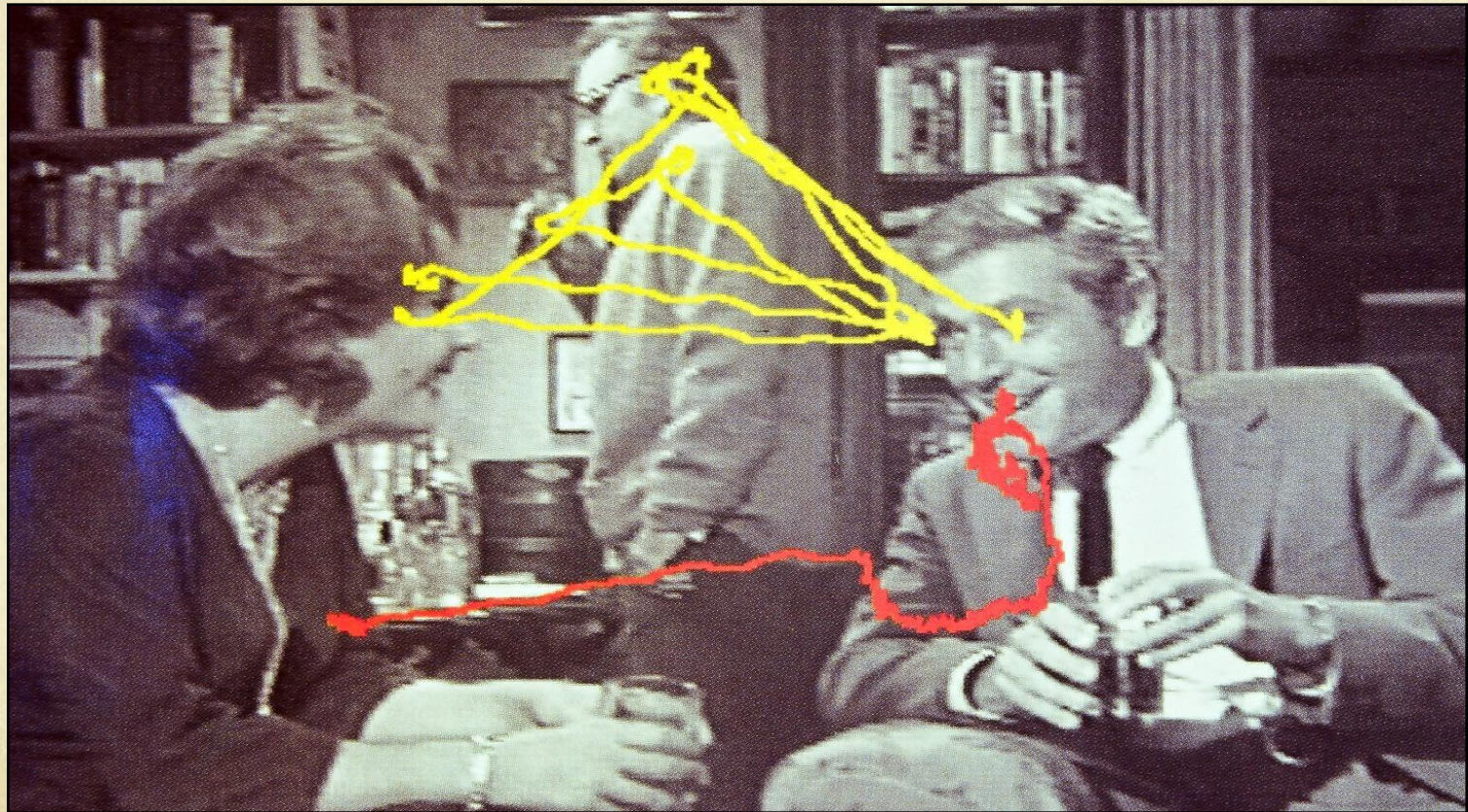
Attention shifting slowness  
occurs with many disorders

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

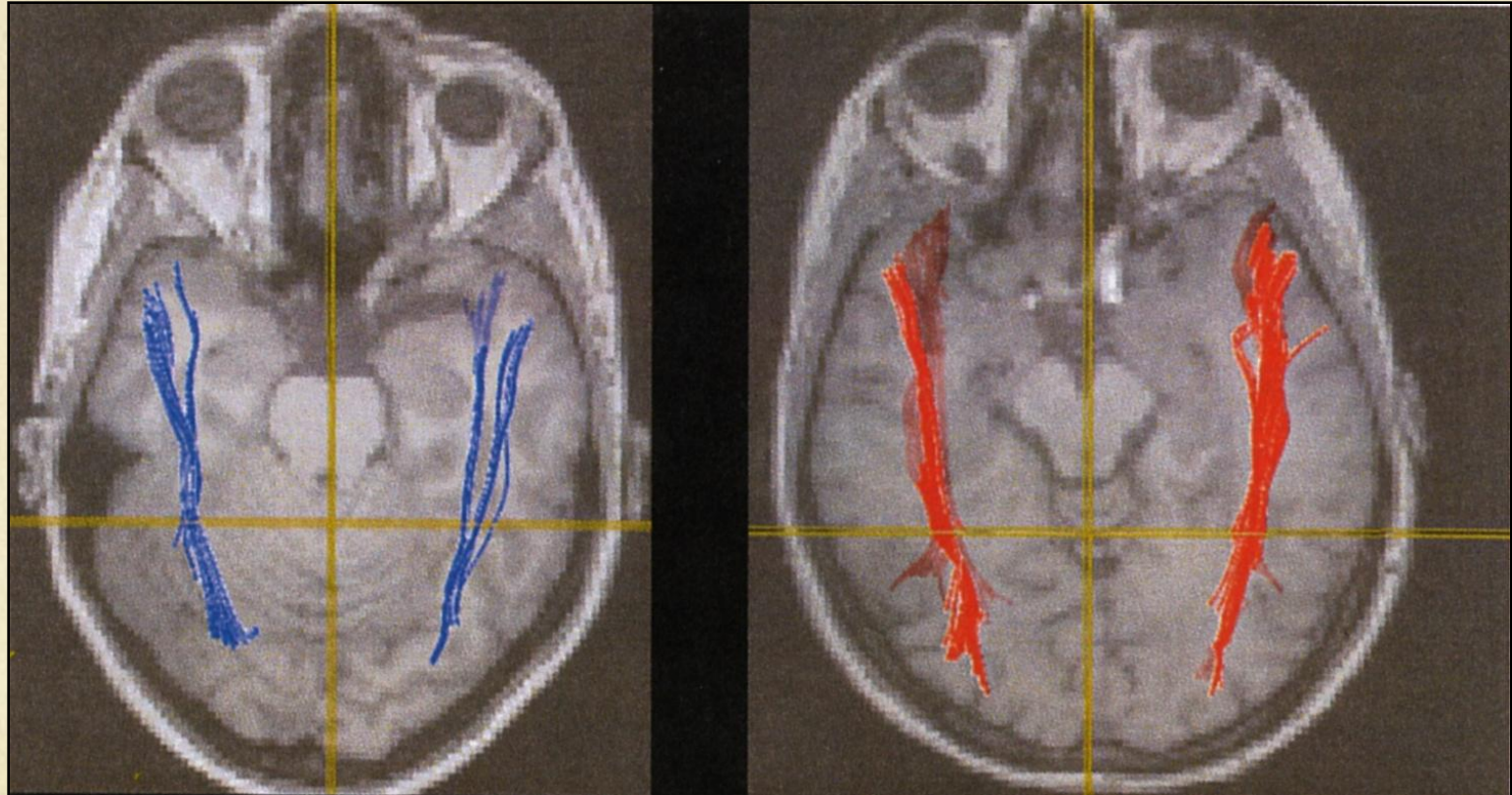
---

- 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

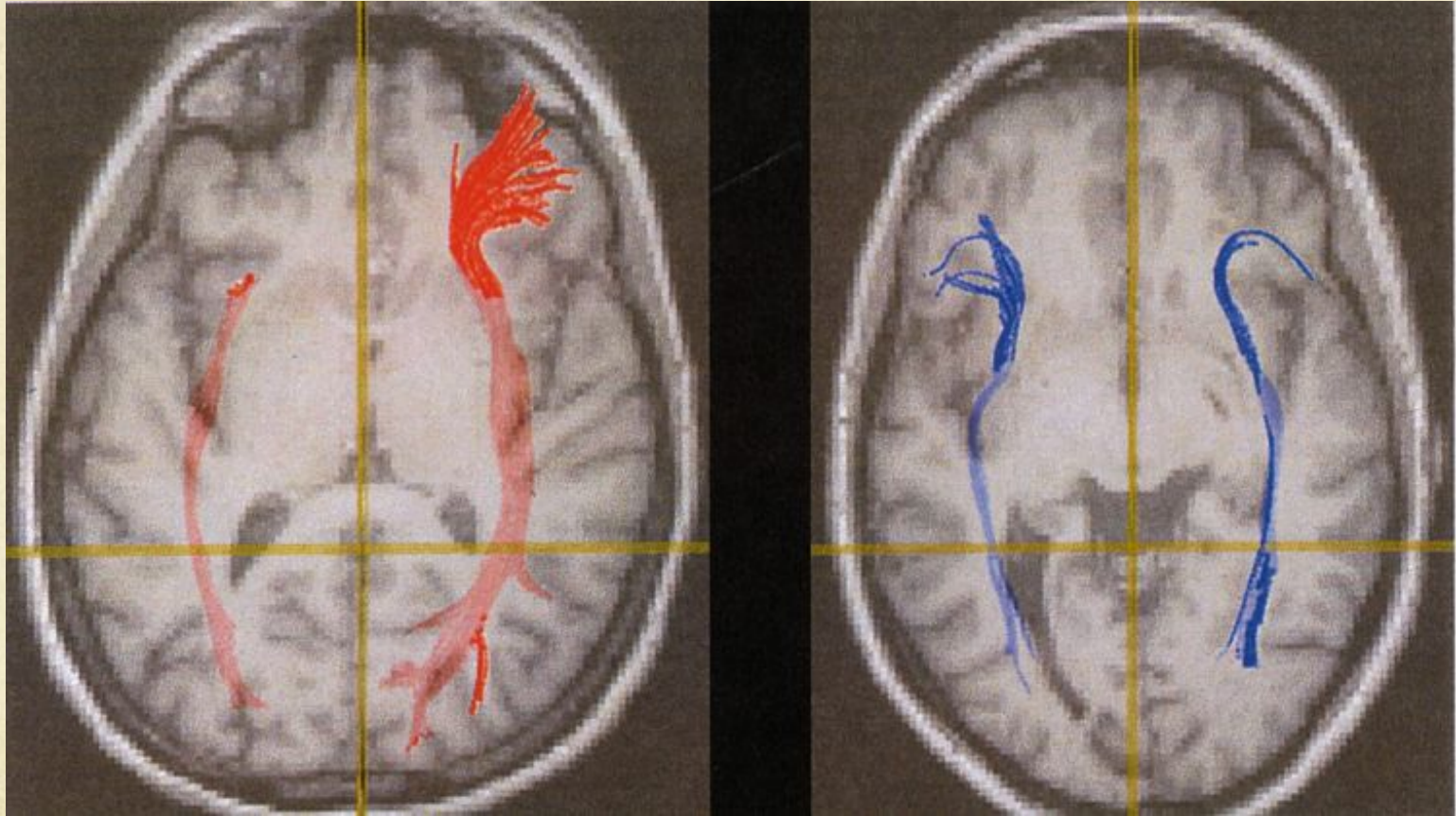


Humphreys, Minshew, Behrmann, and Cibu, 2006

# Brain Scans

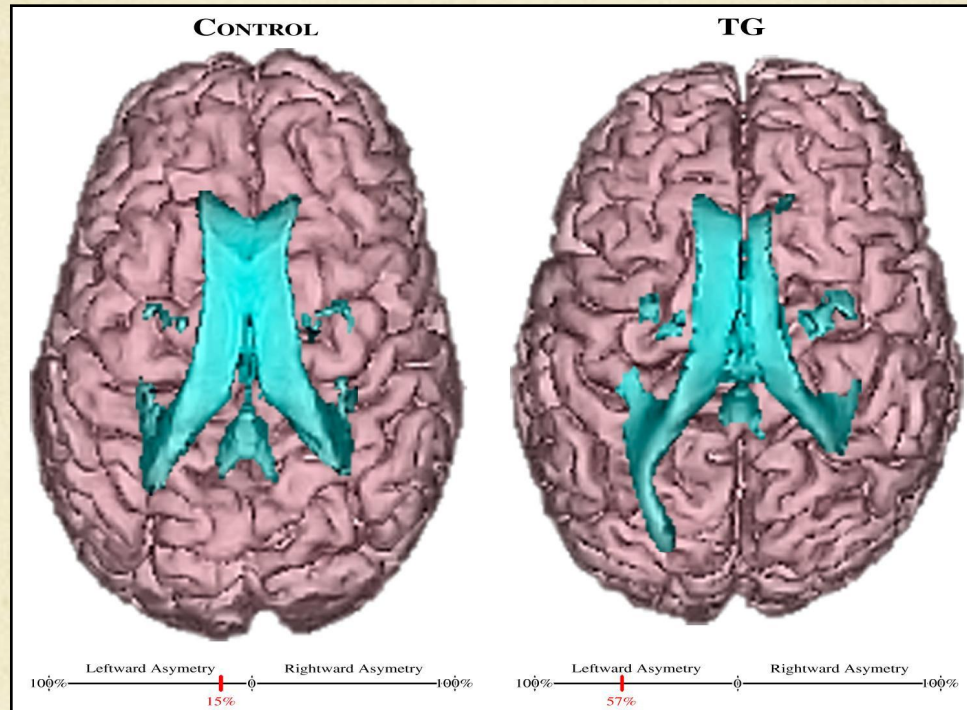
T. Grandin

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

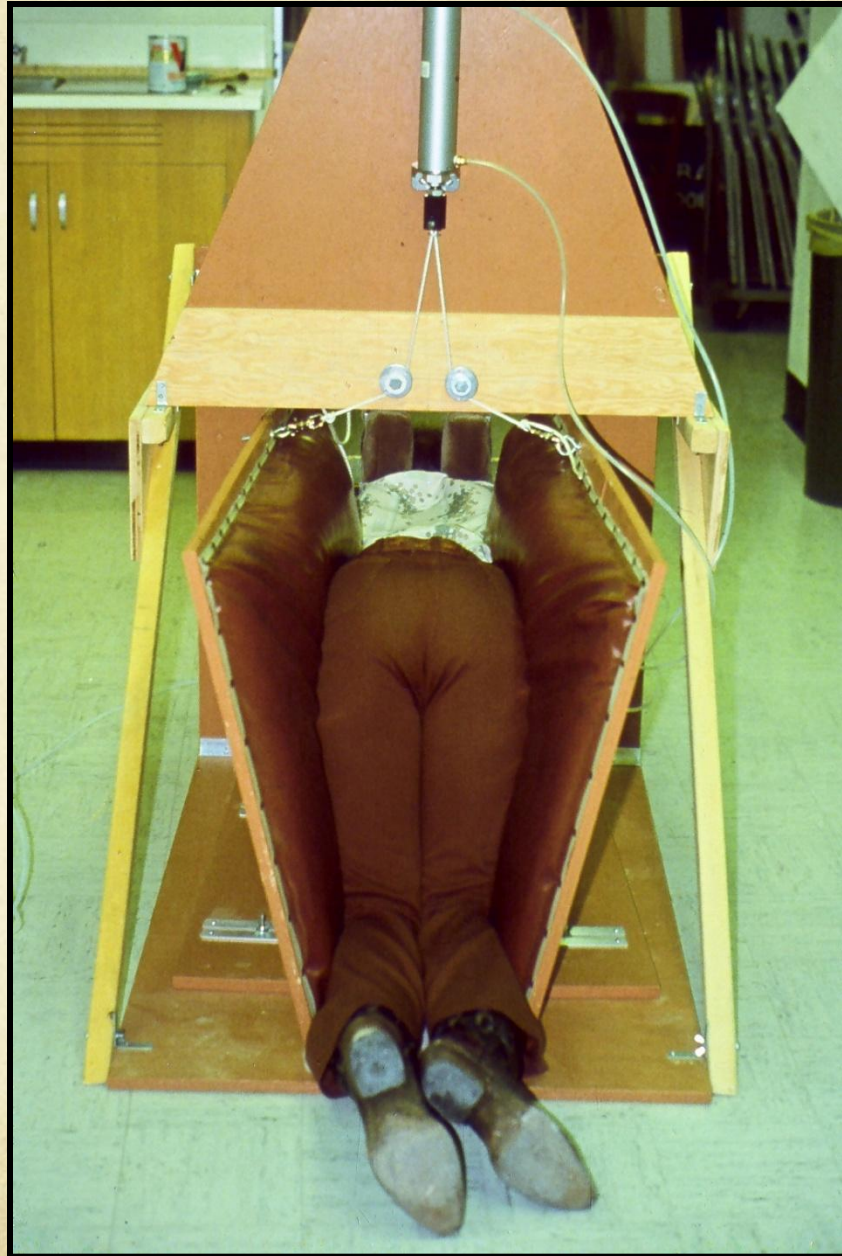
- ✓ Airplanes
- ✓ Public speaking – walked out during my first talk



# 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

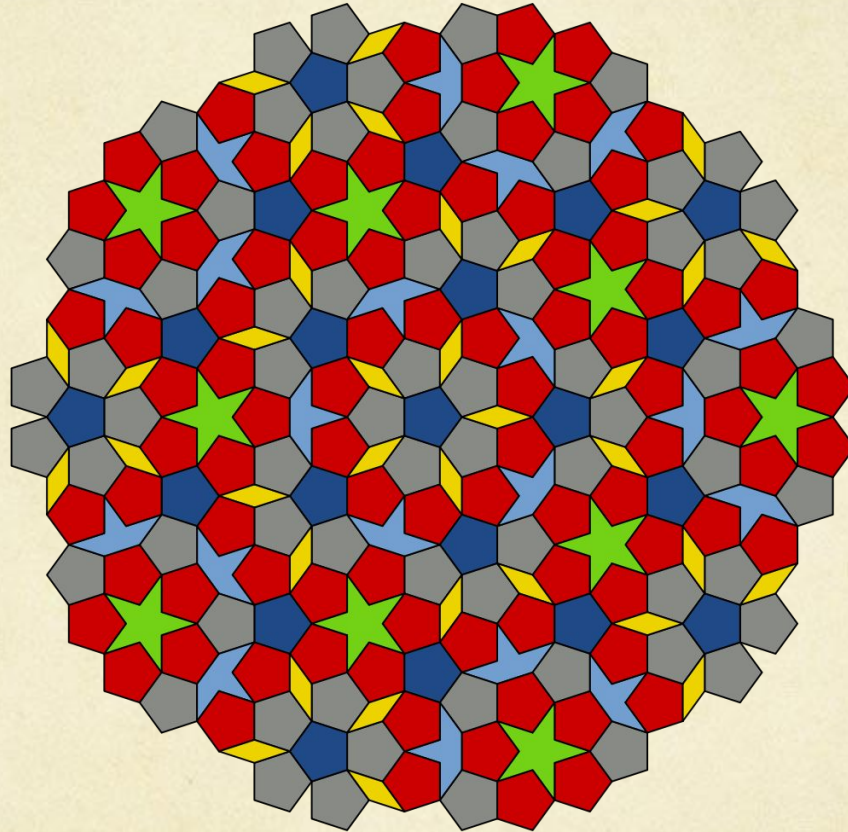


# Show Kids Interesting Things



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

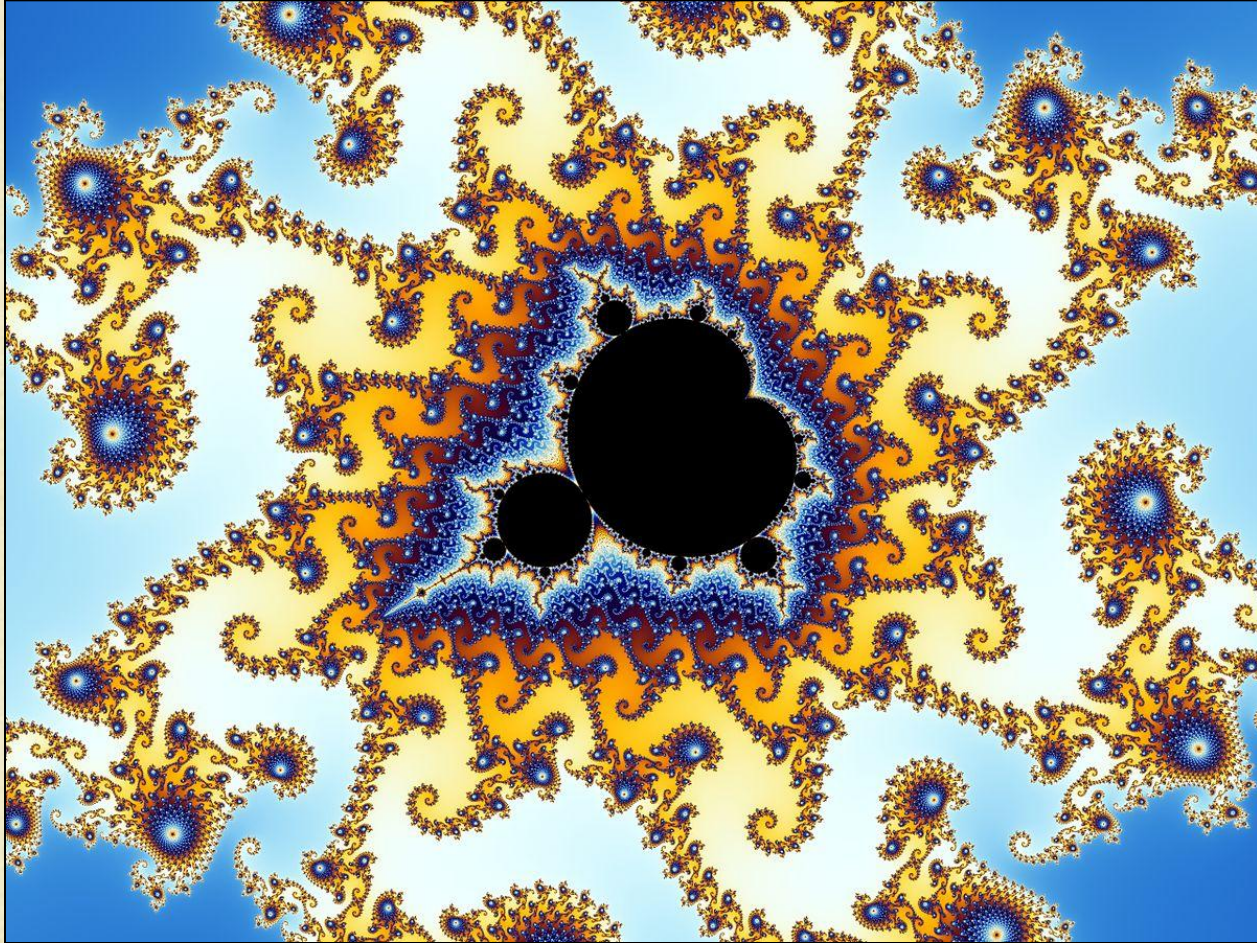
\$15  
24 AUGUST 2018  
sciencemag.org

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

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