

IPT 564: Temple Grandin on Visual Thinking and Animal Behavior Transcript

Begin visual description. Temple is standing at the front of a large audience. She uses a slideshow presentation throughout her lecture. End visual description.

- [00:00:05] **TEMPLE GRANDIN:** Well, it's really great to be here tonight.
- [00:00:08] What I want to do is talk tonight about different kinds of minds.
- [00:00:12] Talk some about autism, talk some about animals.
- [00:00:15] I want to really get you all thinking tonight. That's what I want to do.
- [00:00:18] I want to get you to think about different ways of thinking.
- [00:00:22] Then I'm going to be talking about how I'm a total visual thinker, and it was a shocker for me to learn that there's other kinds of thinking too, that not everybody thinks the same way I think.
- [00:00:34] In order to understand animals, and autism, art, and mathematics, you got to get away from verbal language.
- [00:00:43] When I do my talks to the veterinary students and the animal science students, I say, "You got to get away from words." Dogs and cats and horses and cattle, they don't think in words.
- [00:00:52] There's a whole world of thought and experience that's not verbal.
- [00:00:58] An animal's world is sensory based—a world of sight, sound, taste, touch.
- [00:01:04] I want you to shut your eyes and think about what you see.
- [00:01:08] What could the dog be hearing? I want to get you more observant of the animal.
- [00:01:11] I want to teach you how to observe.

- [00:01:13] What are the ears doing? Then they point their eyes and ears towards stuff they're concerned about.
- [00:01:18] What's the posture? Look at visual detail.
- [00:01:22] Now, van Gogh doesn't know anything about mathematics.
- [00:01:25] *(A picture of van Gogh's Starry Night appears on the screen.)* Of course, this is one of the most famous paintings in the world.
- [00:01:28] Since this is an art museum, I think it's a really good place to be showing it.
- [00:01:32] Van Gogh was putting mathematics into the turbulence patterns he painted in the sky, because the mathematicians got a hold of this and analyzed it.
- [00:01:41] I don't think that van Gogh realized that he was putting mathematical patterns in his paintings.
- [00:01:47] What this shows is that visual thinking, mathematics—that's hidden underneath language.
- [00:01:52] Because there's a type of Alzheimer's, it's called "frontal temporal lobe dementia," and it wrecks the language parts of the brain.
- Begin visual description. A slide appears on the screen that says, "In humans, language covers up sensory based thinking." Below these words, there is an image of horses running. End visual description.*
- [00:01:58] I'm going to pick this up before I fall over. *(Temple picks something up off the floor.)*
- [00:02:00] It wrecks the language parts of the brain, and it wrecks the frontal cortex.
- [00:02:05] Then in some of these patients, visual thinking comes out.

[00:02:09] Like one patient before the brain was completely trashed, patented a new design for a sprinkler head, of all things.

[00:02:16] Now, the mind of the person with autism looks for detail.

Begin visual description. The slideshow says, "In autism, details are attended to instead of whole Gestalts." There are two boxes on the screen. The first is labeled "consistent" and has the letter S that is made of small S's, and it also has the letter H that is made of small H's. Then, there's a box that is labeled "inconsistent." There is a letter S that is made of small H's and a letter H that is made of small S's. Below these boxes, there are two bullet points that read, "Autism faster response time to small letters" and "Attend to details of faces instead of the whole". End visual description.

[00:02:21] You've got big letters here, and you've got little letters.

[00:02:25] The autistic mind will pick out the little letters faster.

[00:02:28] Now I want to emphasize autism is a very big continuum.

[00:02:32] It's a true continuous trait.

[00:02:34] The genetics is very complicated.

[00:02:37] It's little tiny code variations inside of genes—little additions of nucleotide pairs, little reversals, little deletions.

[00:02:46] At one end of the spectrum, you're going to have individuals who are going to remain nonverbal.

[00:02:50] At the other end of the spectrum, you're going to have geeks and nerds.

[00:02:54] In other words, they're not that interested in people, but interested in things.

[00:02:59] There's a point where it's just going to be a personality variant.

[00:03:03] Einstein in a lot of school systems today would be labeled autistic—no language until age 3.

[00:03:09] Tesla, who invented the electric power plant, would be labeled autistic today.

[00:03:15] Mozart did a lot of strange behaviors.

[00:03:18] See, a little bit of this trait, you get a kid that's gifted, because you take out some of the social circuits, then you get circuits to do the good fun geek stuff, stuff that I'm interested in doing.

[00:03:29] Then there's a point where it truly becomes an abnormality.

[00:03:32] But it's a true continuous trait.

[00:03:35] It's not like having tuberculosis, you've either got it or you don't.

[00:03:38] It's embedded in the genome.

[00:03:39] They are not going to find a single gene to get rid of autism.

[00:03:43] That is absolute rubbish.

[00:03:44] There's a paper that just came out in science recently about something, the shank gene.

[00:03:48] Well, it's just a little code variation thing.

[00:03:51] It's only going to account for about 16% of the cases of autism.

[00:03:55] It's complex genetics totally embedded into the genetic code that develops the brain.

[00:04:02] That's something.

[00:04:03] Now, the normal human mind ignores the details.

Begin visual description. The slide says, "A brain scan showed that normal people ignore details." There is an image of a brain scan and another quote that says, "To understand animals, you need to train yourself to attend to the details." End visual description.

[00:04:07] There's been some very interesting research done by Dr. Nancy Minshew and all her colleagues up at the University of Pittsburgh.

[00:04:14] What was done in this experiment, they used functional MRI that measures how active different parts of the brain are.

[00:04:20] They put an autistic person in the scanner, had him read out of a book, and their brain gets turned on just where the detail of the words is.

[00:04:27] Then they put the Asperger, that's the geeks and the nerds, and Asperger's just another word for geeks and nerds.

[00:04:32] I went to school with a lot of geeks and nerds.

[00:04:35] Who do you think is running Silicon Valley? Some of the people that are most important heads of large companies today, they have a lot of Asperger traits.

[00:04:46] One thing that's concerning me today is a lot of these smart, geeky little kids aren't going anywhere.

[00:04:51] Well, they aren't getting enough discipline, like mother made me do table manners.

[00:04:54] She made me do please and thank you.

[00:04:56] Another thing that I had to do as a little kid is you'd go out and play with another kid, and you had to plan out how to build a tree house.

[00:05:04] You had to learn how to negotiate with other people.

[00:05:06] Well, then the other person they put in the scanner was a normal person.

[00:05:10] Now, the thing that was really weird was the normal person lost the detail of the words.

[00:05:15] The Asperger got both the detail of the words and the overall whole.

[00:05:19] The normal person left out all the detail.

[00:05:22] Well, that can be a real problem if you're building a bridge because there's a lot of details, and if you forget those details, it might just fall down.

[00:05:31] Now, in my work with cattle, back when I started this back in the '70s, I was one of the first people to look at how vision affected cattle behavior.

Begin visual description. The slide says, "Animals may refuse to move toward a waving flag." It has a picture of a waving flag and also says, "Most people fail to see the problem caused by the flag." End visual description.

[00:05:41] They were afraid of a lot of little things like a chain hanging down, shadows, bright spots, seeing people up ahead.

[00:05:49] This particular place, the cattle were afraid to go into the veterinary building.

[00:05:53] The owners of this place couldn't figure out why the cattle were afraid to go in there.

[00:05:57] Come on, it's a flag.

[00:05:58] It's right there.

[00:05:59] It's waving, it's rapid motion, weird noise, and very high contrast of light and dark that's moving.

[00:06:06] Sometimes the most obvious is the least obvious.

[00:06:09] The flag is right there, right there staring at you in the face, and you don't see it.

[00:06:15] Look at how that animal's looking at that beam of sunlight.

[00:06:19] On a cloudy day, you're not going to have a beam of sunlight.

[00:06:23] I would get down in the chutes and see what cattle were seeing.

[00:06:26] When I first started doing this, people thought I was absolutely crazy.

[00:06:30] "You're looking at stuff the cattle were seeing?" They just couldn't see the point of doing it.

[00:06:34] But since I'm a visual thinker, that seemed like an obvious thing to do.

[00:06:39] If you're a verbal thinker, it wouldn't seem so obvious.

[00:06:42] I'd get down the chutes and see what they're seeing.

[00:06:45] The movie did an absolutely fantastic job of showing how my visual thinking mind worked.

[00:06:52] I really loved the fact they duplicated all my projects exactly.

[00:06:55] I've really turned me on.

[00:07:01] That DVD, by the way, has a really great commentary track on it when Nick Jackson and Christopher Monger, the writer, and I talk about that cattle handling, we also talk about autism.

Begin visual description. The next slide says, "Cattle can see people through the open sides." There is an image of a cattle chute with open slats on either side. The slats are causing shadows. Below this image, the slide says, "To find distractions: Get in the chute to see it from the animal's point of view." End visual description.

[00:07:10] But look how you got shadows there.

[00:07:12] Now, on a cloudy day, you won't have the shadows.

[00:07:15] Cattle will stop, put their head down, and look at the shadows.

[00:07:17] But most people would just get more prods and just start hitting them and trying to push them.

[00:07:22] No, you use behavior.

[00:07:24] You get those distractions out of there, they'll walk right up there.

[00:07:27] I get asked all the time, "Are cattle scared of getting slaughtered?" That's a question I had to answer very early in my career.

[00:07:34] I go over to the Swift Plant, and it was renamed "Abbott" for the movie because Swift still exists.

[00:07:40] Then I'd go out to the ranch and the feed yard, and I'd watch cattle go up the veterinary chute. They'd behave the same way in both places.

[00:07:47] If they knew they were going to get slaughtered, they should be a lot wilder at the slaughterhouse than at the feed yard, but that just wasn't the way it was.

[00:07:56] If you got rid of the things they are scared of, they'd walk right up the chute.

[00:07:59] When I did the Animal Welfare work for McDonald's, I developed a very simple scoring system.

[00:08:05] Instead of somebody just walking into a plant and saying, well, is that plant good or bad? I just developed a thing that was simple like traffic rules.

[00:08:12] The police, they measure speed and then, okay, running red lights and stop signs, not allowed to do that.

[00:08:18] They also get you for erratic driving.

- [00:08:21] But there's very specific things that they look for.
- [00:08:24] You measure. How many cattle were bellowing their heads off just as they were going up into the slaughterhouse? You're only allowed 3 out of 100.
- [00:08:33] If more than 3 cattle out of 100 moo as they walk up the chute, you fail the McDonald's audit.
- [00:08:40] You're only allowed one animal falling down and you fail the audit.
- [00:08:43] It was numerical scoring.
- [00:08:45] It worked really well.
- [00:08:46] If you want to read about it, I got lots of stuff on my website at grandin.com.
- Begin visual description. The next slide says, "Animals also 'watch' with their ears for potential danger." There is an image of a horse and a zebra with their ears perked up. Next to the image, the slide says, "The horse has an ear pointed at both the photographer and the zebra." End visual description.*
- [00:08:51] Look at how the zebra and the horse have an ear on each other and the other ears on me.
- [00:08:56] The movie does a fantastic job of showing that.
- [00:08:59] When I talked to the vet students and the animal behavior, I want to get you looking at these things.
- [00:09:04] What are some of the signs that your animal's scared? Horses and cattle, the whites of the eyes will start to show and their tail will start switching.
- [00:09:13] In dogs, they're waving their tails like that, that's happy. (*Temple swings her arm vigorously back and forth to represent a tail wagging.*)

[00:09:16] But in horses and cattle, when they're going like this (*swings arm the same way*), they're not happy.

[00:09:20] If they're switching their tails all the time, that's a horse or cow starting to get stressed.

[00:09:26] They'll tell you before they kicked your head off.

[00:09:28] You just have got to make sure that you read the body language.

[00:09:32] Now, I see movies in my head, and this is a picture that a young man sent to me to show how he has movies in his head.

Begin visual description. The slide has an image of a side profile of someone's head with gears on the back of it. End visual description.

[00:09:39] That's exactly how I think.

[00:09:41] I used to think that everybody thought in pictures.

[00:09:45] I didn't know that other people think differently until I wrote my book, "Thinking in Pictures" and I started interviewing people about how they think.

[00:09:53] It's a real revelation.

[00:09:56] One of the things that first started making me think about it is I got to review of "Thinking in Pictures" on amazon.com that basically just said, "Well, there are people on the spectrum that don't think in pictures." Now, of course, that stung.

[00:10:07] But then I thought, "Well, I'd better investigate this." I found out that there were different ways of thinking.

[00:10:14] Some people with autism think in pictures; others don't.

[00:10:17] But the thing is, the person with autism tends to have uneven skills, good at one thing, bad at something else.

[00:10:24] I was good at art, and my mother always built up my ability in art.

[00:10:29] That was always encouraged.

[00:10:30] She also encouraged me to make pictures of many different things.

[00:10:34] Otherwise, I would have just drawn horses or nothing else.

[00:10:38] Now, I realized my thinking was different when I asked other people about church steeples.

[00:10:42] Think about church steeples.

[00:10:44] I was shocked when I found out what other people saw.

[00:10:48] Most people told me they just see this generalized generic one.

[00:10:53] I'd asked people before about seeing a house or car.

[00:10:57] Most people will see their own house or car, because they're so familiar with it.

[00:11:00] But I asked something you're less familiar with, like maybe a factory.

[00:11:07] Well, if you live next door to one, then you'll see the one that you live next door to. A boat, a church steeple, something you don't own, then the image got more generalized.

[00:11:18] What neuroscience shows right now is this generalized one is coming out of the association cortex.

[00:11:24] I'm going all the way back into the visual cortex.

[00:11:27] I see only specific steeples.

[00:11:30] I see a whole bunch of specific pictures.

[00:11:33] I have to put them in a church steeple file folder in my brain.

[00:11:37] It's bottom-up thinking.

[00:11:39] It's not top-down.

[00:11:40] They flash up in my mind as a set of steel slides like Google for images.

[00:11:45] If I hold one of those slides in my mind, I can turn it into a video.

[00:11:51] They just flash up like this, just like they did in the movie.

Begin visual description. Temple flips through the slides, which show pictures of many different kinds of steeples. End visual description.

[00:11:55] Then if I hold a still angle, would you like a snowstorm there? Would you like a wedding there? Whatever I can test run it in my head.

Begin visual description. The slideshow stops at a single picture titled "Famous Steeples Westminster Abbey." It shows a large chapel with a steeple. End visual description.

[00:12:07] I didn't know that other people couldn't test run pictures in their head.

[00:12:12] This is one of my cattle handling facilities.

Begin visual description. The slide says, "Visual Thinking has been a huge asset in my career designing livestock facilities." It shows a picture of a curved ramp that cattle are walking on. End visual description.

[00:12:14] You might wonder, Why curved? Cattle like to go back to where they came from, so you got to lay out the full circle so they go back to where they come from.

[00:12:22] When I design things, I can test run them in my head.

[00:12:26] I didn't know that the other designers couldn't do this.

[00:12:30] I actually got into a giant fight in a job down in the '70s when I didn't know this because we were building some meat packing plants stuff and I go, "If you make that piece of equipment that way, it's going to pull a rail out of the ceiling.

[00:12:41] The whole rail's just going to come crashing down." And it did.

[00:12:44] You see because in my mind, I could test run it.

[00:12:47] Now I realize today that they're not able to see it, but they're good at doing things I'm bad at doing, like a lot of mathematical things.

[00:12:56] There's the cattle handling facility that HBO built in the movie. *(A picture appears of an aerial view of the curved facility.)*

[00:13:01] It's really turning me on to see this.

[00:13:05] There's a scene in the movie where they put a metal slide in and they drown the cattle.

[00:13:10] That actually happened.

[00:13:11] They really messed up my design.

[00:13:13] They couldn't get the idea of letting them walk in down a ramp that's non-slip.

[00:13:19] Today, well, my center track restrainer, a piece of equipment I designed for the big meat plants, people are still making the ramp slippery.

[00:13:27] They're making the same mistake.

[00:13:29] I've got lots of YouTube videos that show these things.

[00:13:32] I always like to show my drawings off.

- [00:13:34] We've just got a so-so projector tonight.
- [00:13:37] It's not showing them off too good. Besides, the monitor down here is just showing them off just great.
- Begin visual description. The slide says, "Hand drawn drawings for one of my early projects." It shows a detailed, hand-drawn image that Temple made. End visual description.*
- [00:13:44] One young geek and one young nerd, one thing I learned very early on is I had to sell my work rather than myself.
- [00:13:53] People thought I was really weird.
- [00:13:54] But when I wrote for the (inaudible) magazine, I wrote really good, accurate articles.
- [00:13:59] When I went to sell jobs, I'd show people my drawings.
- [00:14:03] Then I got respect.
- [00:14:05] I remember going to an agricultural engineering meeting in the early '70s, and they wouldn't even talk to me until a whipped out one of my drawings.
- [00:14:13] They'd go, "And you drew that?" "Yeah, I did." There's the actual drawing for the dipping vat system I designed for John Wayne's feed yard (*shows another detailed hand-drawn picture*), and it's the John Wayne.
- [00:14:28] 26 Bar Red River Cattle Company.
- [00:14:32] I have a class where I have my students actually lay out and design a cattle handling facility.
- [00:14:38] One thing I'm getting concerned today, there is a lot of courses, you got to regurgitate a lot of multiple-choice stuff.

[00:14:45] What this teaches the students is how to solve a visual problem.

[00:14:51] When I was first learning how to do drawing, I had to learn how to relate the lines of the drawing to the actual real facility.

Begin visual description. The slide says, "The curved facility consists of three half circles positioned on a layout line." There is a detailed drawing of a cattle facility that is captioned as "Basic Cattle Layout." End visual description.

[00:15:00] I have my students take this drawing and walk through the real facility.

[00:15:05] Then they switch that back and forth like that.

[00:15:09] You might wonder about the curves there.

[00:15:11] You've got to lay them out right. As they're coming on around the bend, they think they're going back to where they came from.

[00:15:16] We're going to use that behavior to help us.

[00:15:18] But I had to learn how to relate the more abstract drawing to the actual thing.

[00:15:26] What I did is I got this drawing for the whole entire Swift Plant.

[00:15:31] I spent two days in the Swift Plant with the drawing in my hand, a layout drawing of the whole plant, and walked around in the plant until I could look at every line on that drawing and relate it to something in the plan.

[00:15:41] Like the big circle was the water tower.

[00:15:44] This little square was a concrete column that held up the building.

[00:15:47] This other oval thing, that was the vat they put the hides in.

[00:15:50] This other square building, that was a cattle buying office.

[00:15:54] This little thing that goes like that, that was a door. Then the way they did some other little lines, that was a window.

[00:16:00] I was really good at designing and building things, but I would just go out in the shop and do it.

[00:16:06] I had to learn how to take the shop and put it on the paper so I could design bigger projects, and other people would build.

Begin visual description. The slide is titled, "Common Perceptual Mistakes" and has four bullet points that say, "Radius point of a circle is in the wrong place," "25 feet long gates," "Uneven alley width on a curved alley," and "Gates swing wrong." End visual description.

[00:16:15] I observed a very interesting disturbing phenomenon as the meat industry.

[00:16:22] I've designed work for all the major companies.

[00:16:24] Half the cattle in this country handle in the center track restrainer system that I designed for meat plants.

[00:16:30] I watched the designers in my industry go from paper drawings into computers.

[00:16:35] When the old folks switched over, everything was fine.

[00:16:38] But I noticed an odd, disturbing thing when some of the young guys would come in.

[00:16:43] You got a guy, maybe 22 years old.

[00:16:45] He's taken a course in CAD drafting, but he's never built anything, and he's never drawn by hand.

[00:16:51] I was getting drawings, drawings from every single major meat company, with strange mistakes on them, like not knowing where the center of the circle is.

[00:17:00] They were not seeing it because they'd never taken a compass and actually had rotated it around, or taken a gate, swung it around the crowd pen.

[00:17:09] They had never built anything.

[00:17:11] I had this happen with five or six major companies.

[00:17:14] When I tracked back the history of that drawing, it was always some young guy that had never had any hands-on experience.

[00:17:22] I think hands-on experience teaches important skills.

[00:17:25] Now, on some day in the future you'll be able to take Google SketchUp, maybe put on an electronic glove and feel the thing you drew.

[00:17:32] But until you're able to do that, I'm going to insist on hand drawing and building things, because you got to get that touch feedback.

[00:17:40] There's a very interesting chapter that Oliver Sacks wrote about a person that was blind all his life.

[00:17:47] Then as a grown-up, he had cataracts taken off, and he didn't know how to use vision.

[00:17:51] He looked at this little black-and-white thing, and he didn't know what it was until he touched it.

[00:17:57] It was his dog.

[00:17:58] He didn't know what a cup was looking at it until he actually handled it and felt it.

[00:18:03] He didn't know how to use vision until he started touching.

[00:18:07] Then they'll have gates that don't swing correctly.

[00:18:10] Now, certain autistic kids, oftentimes drawing skills will show up.

Begin visual description. The slide says, "Drawing in perspective by a 9-year-old child with autism. Most children do not have this innate ability." The image is drawn and shows a classroom with a vanishing point in the distance. In other words, the drawing shows dimension in the room. End visual description.

[00:18:14] On a lot of these are my older autistic kids, the Asperger kids, which is just my older ones around third and fourth grade, that's oftentimes where the uneven skills will show up, where they will be bad in one thing and good at something else.

[00:18:27] We need to build up the thing that they're good at.

[00:18:30] I used to joke around that I had a huge Internet trunk line deep into my visual cortex.

Begin visual description. The slide is titled "I have a huge 'internet' trunk line for graphics." There are two images of brain scans. The one on the right is labeled "Temple Grandin." The one on the left is labeled "Control." The Control brain scan shows two lines that start at the back of the head on either side and extend to behind each eye. Temple's brain scan shows that these lines (or "trunks") are thicker and longer than the Control brain scan. End visual description.

[00:18:37] I'm on the right-hand side.

[00:18:38] This is tensor imaging.

[00:18:40] It measures huge myelinated Internet superhighways in the brain.

[00:18:45] Mine is really big and it goes way back because the graphics files are here.

[00:18:52] This is parietal here (*motions to the back half of the brain*).

[00:18:53] That's more of the mathematics area, pattern thinking.

[00:18:57] This doesn't go back all the way.

[00:18:59] Then we take a slice up here, and it's a real big one.

Begin visual description. Another brain scan appears with Temple's scan and a Control scan. Temple's scan shows that the trunk on the right side of her brain is incredibly thick and long especially. End visual description.

[00:19:04] It goes all the way back.

[00:19:06] When I got these scans—that's on the right-hand side too—I'm like going, "Wow." I really do have a big Internet line.

[00:19:15] I mean, that just blew my mind.

[00:19:16] Then another scan that was done, they played on all these weird videos while I was in the functional MRI.

[00:19:22] I was more interested in looking at things than looking at people.

[00:19:26] Well, the thing is, you need to have some people interested in things, or we'd still be living in caves.

[00:19:31] Because who do you think made the first stone spear? It certainly wasn't the social yakety yaks.

[00:19:38] That's for sure.

[00:19:43] Now I want to show you another kind of mind.

Begin visual description. The slide is titled "Pattern Thinking Mind for Extreme Origami, Computer, Programming, and Engineering." There is a picture of a

praying mantis on a piece of paper with many fold patterns on it. End visual description.

[00:19:47] I figured out after the Amazon review got written on “Thinking in Pictures” in the mid-’90s that there were visual thinkers and there were verbal thinkers.

[00:19:57] But now I figured out that visual thinking has another sub-component called “pattern thinking.” I think in photorealistic pictures, but there’s another kind of mind that thinks in patterns.

[00:20:10] These are your computer programmers, your engineers.

[00:20:14] They are into chess, they’re into mathematics and organic chemistry.

[00:20:18] Now, up there is a praying mantis made out of a single sheet of folded paper—no scotch tape, no cutting.

[00:20:27] What you see there in the background is the folding pattern.

[00:20:30] Now, this is not my mind, this is the mind of the pattern thinker.

[00:20:36] I think in photo-realistic pictures.

[00:20:39] There’s actual brain scan resource.

[00:20:42] When I can’t sleep, I go surfing on the Internet.

[00:20:44] I went surfing on the Internet, and I got into Google Scholar, and I was looking at citations on some rather boring paper.

[00:20:54] But I looked at the citations, and I found this really cool paper on PET scanning that showed that the photo-realistic visual thinker and the pattern thinker use different parts of the brain.

[00:21:05] This is an important slide.

Begin visual description. The slide is titled "Types of Thinking" and lists four: "Photo Realistic Visual Thinkers—poor at Algebra," "Pattern Thinkers—music and math," "Verbal Mind—poor at drawing," and "Auditory Thinkers—poor at drawing." End visual description.

- [00:21:07] I am a photo-realistic visual thinker, and I absolutely can't do algebra.
- [00:21:13] I had another brain scan that was done at the University of Utah, and I've got a defect in the parietal cortex, and I have a very bad working memory.
- [00:21:23] I have tons and tons and tons of hard drive space, and my mind is just like Google for images.
- [00:21:30] But in order for me to really think, I had to get out and see a whole lot of different things.
- [00:21:34] I had to read a whole lot of different things.
- [00:21:36] You got to get these kids out doing stuff because you've got to fill up the Internet that's in their head with a lot of experiences. Because to understand something in the future, I got to compare it back to something in the past.
- [00:21:47] When I was 15 and I had a chance to go to my aunt's ranch, I was scared to go.
- [00:21:53] Not going was not going to be an option.
- [00:21:55] The choice was one week or all summer.
- [00:21:57] But you got to push them to do things.
- [00:22:00] I absolutely couldn't do algebra.
- [00:22:02] One of the mistakes made in my education was the pound away on algebra instead of going to geometry and trig.

[00:22:08] I'm finding a lot of students that can do geometry and trig but can't do algebra.

[00:22:15] The verbal thinkers say algebra is a prerequisite for geometry.

[00:22:19] I go, that's really interesting; geometry was invented before algebra.

[00:22:22] That shuts them up.

[00:22:27] But how did I get through college? I got to thank educational fads because in this early '60s when I went to college, we had to do finite math.

[00:22:39] Algebra, it was probability matrices and statistics.

[00:22:43] Had to be tutored, but more visual.

[00:22:45] Then you got the pattern thinking mind, the music and math mind.

[00:22:49] These kids often have trouble with reading.

[00:22:51] This is the little kid that when he's in fourth grade, you better move them three grades ahead in math because if you don't he's going to become oppositional defiant.

[00:22:58] I think that's a ridiculous label.

[00:23:01] The thing you got to realize about these diagnostic things, they are not precise.

[00:23:06] Right now all the committees arguing over the revisions in the diagnostic manual, they're going to take Asperger's out, merge it all into autism.

[00:23:15] Scientifically, it is truly continuous, but I'm worried about what that's going to do to service providers.

[00:23:22] Then you've got the verbal mind.

[00:23:25] These are the kids that love history.

- [00:23:27] These are the kids that know all kinds of facts.
- [00:23:30] Their math skills are average, and they are not a visual thinker.
- [00:23:35] You see, they're good at writing.
- [00:23:38] Then I had a dyslexic student that was an auditory thinker; not really a word thinker, but auditory.
- [00:23:44] She was very much tuned in to what things sounded like.
- [00:23:49] I got this book, "Perfect Rigor," and this really turns me on because you can look at this formula $a^2+b^2 = c^2$, or you can do it with the pattern thinking method and you've got this pattern, a right triangle with squares. (*The slide that shows these is titled "Two Categories of Mathematicians."*)
- [00:24:03] The reason why for someone like me it'd be easier to understand a pattern is it puts no load on working memory.
- [00:24:10] I had a horrible time in physics with those physics problems.
- [00:24:14] They'll say something like, "One plane takes off from LaGuardia and is going this many miles per hour, and another plane takes off from Chicago and it's doing this, and it's got a headwind of this, what point will they meet?" There's too much load on working memory.
- [00:24:29] Now, the only way I could learn how to solve those problems would be to take the formulas for different things and figure out how the problems fit different patterns of the formula.
- [00:24:41] I'd go out and buy 10 physics books, sit down with a tutor and say, "For these speed problems, I can make the formula go three different ways, catalog these problems on a spreadsheet, and just get to where I could pick out a certain pattern." Because I got no working memory at all.

[00:24:57] I can't hold one piece of information in my mind while I manipulate something else.

[00:25:02] But boy, I got tons and tons and tons of hard drive space, more hard drive space than most people have.

[00:25:09] That's how it works.

[00:25:11] Now, how do I form a concept when I got all these individual discrete pictures? Well, this little boy sent me this (*picture appears on the screen*), showing how he has boxes in his brain and he's sorting cats and dogs into different categories.

[00:25:24] Well, I take all the church steeples, and I put them in one box.

[00:25:28] How about cell phone towers? They go in another box.

[00:25:32] That includes the Hilton Hotel in Fort Collins because it has cell phone towers on top.

[00:25:36] Even some churches are going to go in that category because they're renting out their steeple.

[00:25:41] There's a situation where it could go into either one of those categories if the church steeples got cell phone transmitters inside.

[00:25:52] Now when I'm thinking about these things, the pictures flash up, I saw the Hilton Hotel.

[00:25:56] I'm seeing these disgustingly ugly fake tree cell phone towers—dumbest thing. It looks like some prehistoric tree out of a science fiction movie.

[00:26:05] But I see the individual different things.

[00:26:11] A dog will form categories, like when I'm on the leash, I protect my owner.

[00:26:16] When I'm off the leash, I can go play.

[00:26:19] You see, for me, making categories, that's the beginning of concept formation.

[00:26:24] How are you going to teach an autistic kid a concept like not being rude? You're going to have to go out in the community and when he does something that's rude, you're going to have to say, "Put that in the rude file folder." Sticking your tongue out in church is rude.

[00:26:36] Spitting in public is rude.

[00:26:39] Pushing in line at the movie theater is rude.

[00:26:41] You just do it by specific example out in the real world.

[00:26:45] We got to get these kids out and doing things.

[00:26:48] If I took my fork and I twirled it around, mother would say, "Put your fork back down on a table." If I picked up the meat in my hands, my mother would say, "Use the utensils." She would just give me the instruction.

[00:27:00] I think sometimes too many of these kids are coddled.

[00:27:02] I'm seeing smart 12-year-olds where nobody ever taught them how to order food at a restaurant.

[00:27:07] Well, that's just ridiculous.

[00:27:09] By the time I was seven years old, I could go in the news stand, buy a kite.

[00:27:13] I knew I wasn't supposed to stand there and read all the magazines without buying them, because you only touch the things you're going to buy.

[00:27:21] I don't sit in the airport and read all the magazines.

[00:27:24] I buy plenty of magazines at the airport, but I have stood in the bookstore, and I'm a speed reader, and I have read books in Barnes and Noble.

[00:27:34] At least Barnes and Noble always provides chairs. Airport bookstore—I have read books in the airport bookstore.

[00:27:39] Just talking about reading, when I first started out learning reading with the Dick and Jane books, I was terrible.

[00:27:48] Then Mother taught me with phonics, and then I caught on really quickly.

[00:27:52] Some kids are going to learn with phonics, but other autistic kids it's going to be sight words, so use the method that works.

[00:27:58] Now, here's another example of categories in the brain of an animal.

Begin visual description. The slide says, "Cattle perceive a man on a horse and a man on foot as two different things. They need to be habituated to both." The slide shows an image of a man riding a horse among cattle. End visual description.

[00:28:02] In the mind of this horse, a man on a horse and a man on the ground are two totally different things.

[00:28:09] See, it's a different picture.

[00:28:11] And you could have a horse that's been abused by the horseshoer, and he's going to get scared for anything with people on the ground.

[00:28:18] But when you go to ride him, he's fine.

[00:28:20] See, that's a different picture.

[00:28:21] The cattle are the same way.

[00:28:23] If those cattle have been trained and they get used to a person on a horse, they might be very tame, and you can get really close to them when you're riding a horse.

[00:28:32] But if they've never seen you on the ground, then they panic.

[00:28:35] You see, you need to train them to tolerate both the person on the horse and the person on the ground.

[00:28:41] You can get similar situations with a kid with autism.

[00:28:44] Things don't generalize.

[00:28:46] If you want to teach a concept like not running across the street, you better teach it in 10 different places.

[00:28:51] Because if you just teach it at home, he might think it doesn't apply at school. Well, it applies at school; it applies at Joneses'; it applies at the library—a whole lot of different places.

[00:29:00] I'm finding that professionally, and working on equipment, I'm finding that normal people are having a hard time differentiating something wrong with equipment from something the people are doing wrong.

Begin visual description. The slide is titled "How to Categorize Problems When Troubleshooting" and gives two bullet points: "People training vs. equipment design problem" and "A major design fault vs. an easy-to-fix glitch". End visual description.

[00:29:13] To me, this is very easy to differentiate, but I find a lot of my clients have difficulty doing this.

- [00:29:19] When we're doing a startup on a piece of equipment, they don't seem to be able to tell a major design fault—in other words, true project failure mode—from glitches.
- [00:29:29] I've had probably five or six different plants where I've told them that when we start up this equipment, do not put old, worn-out trolleys on brand new cooler rail, because they jam. You need to buy new trolleys. Well, they want to be cheap and they don't buy new trolleys, and then they jam.
- [00:29:45] Then that causes a ton of downtime, and the plant manager is out there throwing a fit.
- [00:29:49] Then they're up there grinding the rail to make it fit the crummy old trolleys.
- [00:29:54] Well, that's a glitch. That's not a major design fault.
- [00:29:59] To me, being a visual thinker, it's very, very easy for me to categorize these problems out.
- [00:30:05] If it's a glitch, I just let him throw a fit.
- [00:30:07] If it's something that can be a major design fault, then I'm panicking.
- [00:30:11] When I was developing my center track restrainer system, the plant manager comes running out, and he said, "It's wrecking the hides." I go, "That's real serious." Well, I run down to the hide room in a panic, and there was a tiny cut this big on a hide, and all it was was a rough edge, and we grounded off the grinder in five seconds.
- [00:30:31] Wasn't a major design thing.
- [00:30:33] But for a minute there, I was really, really scared.
- [00:30:39] Here's where you got a problem out here with BP with categorization.

[00:30:44] They were very proud of the fact that they had drastically reduced slips and falls on oil rigs.

[00:30:49] You could get written up for safety violation if you walked around an oil rig without a lid on your coffee cup, because you might spill the coffee and slip and fall on your little tuchus while walking down the stairs or going around on these catwalks.

[00:31:04] But they hadn't thought about the big important thing: process safety.

[00:31:09] Things like you got the big pipe, and then you got to keep a little pipe in the middle of the big pipe, and you got to put these things in there called centralizers.

[00:31:17] They didn't use enough of those things, and they didn't do the cementing right.

[00:31:22] They had thought about one category of safety, but process safety, let me tell you, they had totally forgotten about that.

[00:31:31] Then I've been following the whole nuclear reactor mess over in Japan.

[00:31:37] I've been reading all the articles on it very, very carefully.

[00:31:41] They made a design mistake I would not make.

[00:31:45] You see, the mathematics thinker, he designs the reactor.

[00:31:49] But I'm the one that can in my mind play out the scenarios of something that could destroy the reactor.

[00:31:55] I went on the Internet three o'clock in the morning when I couldn't sleep.

[00:31:59] I looked up all the rules for nuclear power plants.

[00:32:01] I found manuals for operating nuclear power plants.

[00:32:03] I read a chapter in a book about all the different designs of them.

[00:32:07] They talked about redundancy of backups.

[00:32:11] You've got to have a backup for your emergency generator so when the power lines break, you got an emergency generator that runs your emergency cooling pumps so the plant doesn't melt down.

[00:32:22] Then they got this big seawall here.

[00:32:24] They didn't have a backup for the seawall.

[00:32:27] They had two generators, but they were inside a non-waterproof building.

[00:32:32] What happened, when the earthquake hit, it didn't break anything, all the emergency systems came on, emergency pumps are running, the generators are running, everything was cool, everything was nice.

[00:32:43] Thirty minutes, an hour later, tsunami breaches the seawall and drowns the generators that are not in a waterproof building.

[00:32:51] Now, if I had walked around in that plant, I would have looked at that seawall and gone, "Hmm. Water coming over the top of this, seawall breaking, generator building over here doesn't have submarine doors.

[00:33:03] What's going to happen?" Now, the nuclear reactor, that's for the pattern thinkers.

[00:33:08] But I understand the pumps, and I understand the generators, and I just know that they got to keep running.

[00:33:13] And generators don't work when they get wet.

[00:33:15] The electric panels, the supplies generators are going to fry when they get wet.

[00:33:19] It's that simple.

[00:33:20] I'd see that.

[00:33:23] Another design mistake a visual thinker doesn't make is the airbags that were killing babies.

[00:33:29] The engineers just blindly followed the spec.

[00:33:32] It's got to hold in a full-grown man with no seat belt.

[00:33:36] Well, I would have watched those crash dummy videos, and I would have put a baby in there.

[00:33:40] In my mind, I would go, "Wait a minute.

[00:33:41] This is not going to work." The thing is, you need to have the different kinds of minds work together.

[00:33:47] Let's take something like the iPhone 4.

[00:33:50] The different minds there failed to work together, where on the iPod, they worked together beautifully.

[00:33:57] The iPod, the little music player, was designed by a fine arts major, and the engineers had to make it work.

[00:34:04] The two worked together, and it was just wonderful.

[00:34:06] iPhone 4, pretty, beat out the laws of antenna design.

[00:34:11] Your hand went against the antenna and messed up the reception until you put duct tape on it.

[00:34:17] Now you get these really disgusting cases to put on it, keep your hand off the antenna.

[00:34:23] But when the two kinds of minds really work together, it's great.

[00:34:26] Because I find that my students, they're really good at the statistics.

[00:34:29] That's the stuff I can't do. But where I'm really good is figuring out the methods of the experiment.

[00:34:34] Because I can visualize how that experiment is done, and making sure it's not confounded.

[00:34:39] Both animals and people with autism are bottom-up thinkers, not top-down.

[00:34:45] I'm a bottom-up thinker.

[00:34:46] I take all the details, put them together like a puzzle to form the whole.

[00:34:52] I make my concepts by categorizing specific examples.

Begin visual description. The slide says, "Bottom Up Thinkers form concepts by categorizing specific examples. Top Down Thinkers form the concept first." End visual description.

[00:34:58] Top-down gets a concept first, and I'm getting very concerned.

[00:35:02] We've got a lot of problems in today's society.

[00:35:05] What's happening to the top-down thinkers is they're getting too far away from practical things.

[00:35:10] Things are getting more and more ideological because they're not doing practical stuff.

[00:35:14] People don't come off the farm anymore.

[00:35:16] I call it "abstractification." We've got to get back to doing stuff.

[00:35:22] Bottom-up thinking makes it easier to put information in different categories because everything is specific examples.

[00:35:28] The thing I want to emphasize is there's a place for the different kinds of minds.

[00:35:32] We need all the different kinds of minds.

[00:35:34] Where are all the old aspects? One of the questions that's supposed to be answered at the end, but I'm going to answer it right now, was, Why is there is so much autism and stuff in Indiana? I think some severe autism has increased.

[00:35:49] There's definitely been some increases there.

[00:35:51] But you take your geeks and your nerds, they're living in a looser society day where social rules aren't pounded in. Because where all the old geeks and nerds my age? They're all employed.

[00:36:01] Go on United Airlines.

[00:36:04] I was just talking to some of the gate agents of United Airlines. I said, "You've got some mechanics out there that I know are Aspergers." Now, this airline wouldn't run without those mechanics, and they've managed to keep these jobs.

[00:36:14] I go out to a meat packing plant, and this guy was his big ponytail, he's my age, comes up. And he started out gutting hogs, but then he went to boiler school and now he fixes all the boilers.

[00:36:24] You have to be licensed to fix boilers.

[00:36:25] They don't let just any nincompoop fix boilers.

[00:36:28] There is definitely a place for these people.

[00:36:30] We need to get the different kinds of minds to work together because they can compliment each other, especially when you realize the differences.

[00:36:38] Let's look at the visual thinker and the word thinker working together.

[00:36:42] Nick Jackson, the director in the movie, was a total visual thinker.

[00:36:46] But one of the problems of the visual thinker is a ramble, and they don't have a linear structure.

[00:36:52] Mick and Christopher, the writer, worked together.

[00:36:54] Mick was constantly changing the script.

[00:36:56] But he didn't change it until Christopher worked on it, because Christopher gave it the linear structure.

[00:37:01] Otherwise, all the flashbacks wouldn't have worked.

[00:37:04] Because if you look at one of Mick's earlier movies, "LA Stories," very cute, but it doesn't have much structure.

[00:37:10] Christopher gave it the structure.

[00:37:13] Mick would change one little thing and he'd call Christopher, and that's what made it work.

[00:37:18] That's a perfect example of the two kinds of minds working together.

[00:37:21] They complement each other.

[00:37:23] You can have real successes when the different minds work together.

[00:37:28] We need to be doing more of that.

[00:37:31] One of the things that really helped me when I was in high school was my science teacher.

[00:37:36] He got an honorary doctorate for the movie, and he got me motivated to study.

[00:37:42] When I was in high school and boarding school, I wasn't doing any studying.

[00:37:46] But I was learning lots of work skills.

[00:37:47] When I was 13, I did a seamstress job.

[00:37:50] When I was 15, I took care of nine horses every day, cleaning their stalls.

[00:37:54] I shingled the barn. I built things.

[00:37:56] When I was in college, I interned in a research lab.

[00:37:59] I'm seeing too many smart and quirky nerdy kids graduating from college and then they can't get employment.

[00:38:04] There needs to be a lot more work on learning work skills.

[00:38:09] But I wasn't studying.

[00:38:11] And then I got shown the movie about the optical illusion room.

[00:38:15] I got fixated on that.

[00:38:17] My science teacher got me motivated to study because if I wanted to become a scientist, then I had to study stuff I wasn't interested in like English and History.

[00:38:26] I can't emphasize enough mentor teachers like this.

[00:38:30] I think it's a shame that so many schools have taken out the hands-on classes.

[00:38:35] What's happening is the community colleges are getting the classes, and I think that's just great.

[00:38:40] But the thing is we need to be getting these kids turned on to this stuff in middle school.

[00:38:44] Because what I'm saying now, I'm seeing a lot of smart, quirky kids getting so addicted to video games, they don't do anything else.

[00:38:51] I am concerned that our educational system is failing to stimulate, educate the visual and the pattern thinker.

[00:39:00] Too many of them, I think, are getting labeled "handicapped." The problem is you've got a lot of educators that have totally gotten away from the world of practical things.

Begin visual description. The slide is titled "Visual Spatial Thinking: An Aspect of Science Overlooked by Educators" and lists the author of this article and his information: "James Matthewson, Department of Chemistry, San Diego State University, Science Education, 1999, 83:33-54". End visual description.

[00:39:10] This paper came out 10 years ago, and this educator here is very concerned about visual thinking being overlooked by educators.

[00:39:20] People think, "Well, we can't do art anymore in the schools because we've got to pass the tests." Well, I just gave a talk two days ago to Colorado business leaders, and they were telling me about a school in Loveland, Colorado, where the students build a house, and they have to do geometry and math when they are building the house.

[00:39:36] They're getting great scores on international tests.

[00:39:39] No, I think it's a mistake they're taking these things out.

[00:39:42] It's a shame so many of these things are gone because oftentimes the shop teacher, or the auto mechanics, or the art teacher, the music teacher, they'd get some of these kids turned around.

Begin visual description. The slide says, "It is a shame that many schools have taken out hands-on classes where the students with a different kind of mind can excel and learn practical problem solving skills." End visual description.

[00:39:53] Well, here's the stuff I did in high school.

[00:39:56] Here's the things that saved me.

[00:39:58] I was teased and teased in high school.

[00:40:02] It was horrible.

[00:40:03] They called me "workhorse." they called me "tape recorder." I couldn't figure out why they called me "tape recorder." Well, it's because I always repeated the same words.

[00:40:11] The only refuges I had away from teasing were horseback riding, science lab, and these kind of specialized activities.

[00:40:19] They just saved me.

[00:40:21] I'm seeing too many of these quirky kids just going nowhere because we don't have mentors to mentor them.

[00:40:27] Now, there's a lot of people going into retirement.

[00:40:29] There's a lot of retired engineers, artists, musicians, chemists, biologists, that would love to go in a high school and just teach a science class, but they don't want to get ed degree.

[00:40:39] We need to somehow get rid of that.

[00:40:40] That's just stupid.

[00:40:41] I think the qualification for high school biology teacher is he needs to have a degree in biology and he needs to have worked for at least half his professional life in something to do with biology.

[00:40:55] I'm not suggesting just dump him into the class.

[00:40:57] No, he needs to have somebody with him, ease him into the class.

[00:41:00] But he shouldn't have to be taking all these courses.

[00:41:04] Big corporations need to invest in the future.

[00:41:07] I'm very concerned that our country is eating the seed corn by not investing in universities, one of the greatest university systems.

[00:41:18] And we're getting cut back on funding and cut back on funding.

[00:41:26] These are the places where you educate the minds of tomorrow.

[00:41:30] I'm very concerned as faculty members that are my age retire.

[00:41:34] Are we going to have the funding to replace them? I want to talk about a few sensory things that can really mess you up in school, and just some very simple things that you can do to fix them.

Begin visual description. The slide says, "Sensory processing disorder occurs with many other disorders (co-morbid)." It then lists the following: autism spectrum, dyslexia, learning problems, ADHD, Aspergers, head injury, oppositional defiant, and states that there are many others. End visual description.

[00:41:44] In a lot of different labels, dyslexia, head injury, oppositional defiant—I don't understand that as a medical diagnosis. I think that's BS.

[00:41:52] I'm too much of a hardcore neuroscience background.

[00:41:57] You can get sensory problems like sound sensitivity, visual sensitivity problems.

[00:42:03] When I was a little kid and when the school bell went off, hurt my ears like a dentist's drill going into a nerve. It was terrible.

[00:42:11] High-pitched sounds were the worst.

Begin visual description. The slide says, "Students may block their ears because certain sounds hurt" and shows a picture of a student covering their ears. End visual description.

[00:42:13] Sometimes you can get the kid desensitized to this if he initiates the sound.

[00:42:19] You know, the sound that the kid initiates is better tolerated.

[00:42:23] One of the reasons why I don't want photography during my talk is because if someone's out here walking around, it attracts my attention, and then I have real slow attention shifting.

[00:42:34] Processing speed of my brain is slow.

[00:42:37] It takes me much longer to shift back and forth.

[00:42:39] I'm not good at jobs that require a lot of multitasking.

Begin visual description. The slide says, "Attention shifting slowness occurs with many disorders" and "Takes longer to shift back and forth between two different things". End visual description.

[00:42:42] Like a receptionist in a busy office, and type at the same time? That's not going to work with me.

[00:42:48] Now, another problem that a lot of kids have and a lot of grownups have too, about 5% of the population, is when they go to read the print jiggles on the page.

- [00:42:57] Because there's something wrong with these circuits back here in the visual cortex that assembled a visual image.
- [00:43:03] You see, back in here you have shape, color, motion, and texture circuits.
- [00:43:08] Scientists know where they're located because when people have strokes, weird things happen.
- [00:43:13] When the motion circuits don't work, when you pour coffee, it's a series of still images, makes it really hard to pour coffee.
- [00:43:20] One simple thing that you can do for this is try on pale-colored glasses.
- [00:43:26] If you're one of these people that hates fluorescent lights because you see them flicker, can't stand driving at night, you don't like escalators, go down to Walmart or something and try on all the pale pinks, the pale blue, just a lot of the real pale glasses.
- [00:43:41] You find the right color and the print no longer jiggles.
- [00:43:43] Try putting the homework on different pastel papers.
- [00:43:47] I have a lot more information on all of these things in my "Way I See It" book.
- Begin visual description. The slide says, "Books by Temple Grandin. It lists the following books: Thinking in Pictures, Developing Talents, Animals in Translation, Animals Make Us Human, and The Way I See It. End visual description.*
- [00:43:51] There are just some of my books, and I guess the next thing that we're going to do, I'll put my grandin.com up there.
- [00:43:59] If you want to look at my livestock stuff, I got lots of livestock stuff on grandin.com.

[00:44:04] But I guess the next step they're going to do is they are going to put some slides up here of questions.

[00:44:09] Then I'll answer the questions, and then I'm probably going to disobey the rules and do a few questions off the audience.

[00:44:15] I'm not supposed to, but I'm going to do it anyway.

[00:44:24] Okay.

[00:44:25] "What do you think are the biggest misconceptions that farmers or the general public have about animal behavior?" One of the things that bothers me today is there's a tendency when you have a problem, well, we just throw drug at it.

[00:44:38] We have the same problem in autism.

[00:44:41] Do you have a behavior problem, or do you have a biological problem? A nonverbal autistic kid, the first thing you've got to look for is a hidden painful medical issue.

[00:44:51] Maybe they've got acid reflux, heartburn, something like that.

[00:44:56] It's getting people to recognize the importance of behavior, to use behavior to control an animal rather than force.

[00:45:03] I had a lovely lunch yesterday with my graduate student, Ruth.

[00:45:06] We talked about her mare.

[00:45:08] Usually when a mare has a baby, it goes and hides, doesn't want any people around.

[00:45:13] Well, this mare waited until Ruth got back home.

[00:45:16] She trusted Ruth so much.

[00:45:18] When she got back home, she run over to Ruth and had to cult right there in front of Ruth, kind-of saying, "Now you're here, be with me. It's my first baby, and I'm really scared." That's an example of using behavior.

[00:45:31] When I first started my work on showing how shadows and reflections and things like this scared animals, I found that some people got it and other people didn't.

[00:45:42] It's like the thing in the movie where they put that metal plate in it, that was shown absolutely accurately.

[00:45:47] Behavior is important.

[00:45:49] I find the veterinary students, the scagma clubs, invite me to give talks.

[00:45:54] Our veterinary school happens to have a really good animal behavior program.

[00:45:58] But unfortunately, there's about 25% of veterinary schools that don't even have a dog and cat behavior program.

[00:46:03] Well, when you think about it, half of all pets are put down because of behavior problems.

[00:46:09] Behavior is really important.

[00:46:12] But there are certain people, again, go throw a drug at it.

[00:46:18] I had one girl in the class that the only note she took in the class was when I mentioned using a drug, and she didn't write down anything when I just talked about the behavior stuff.

[00:46:27] Sometimes you need medication, but it shouldn't be the first thing that you do.

[00:46:32] We can put the next one up there.

[00:46:33] "I've heard you say that art was one of your best subjects in school.

[00:46:36] Can you say something about the value of visual thinking?" I think I've already talked a whole lot about this.

[00:46:43] There's a huge value to visual thinking.

[00:46:46] This is where the visual thinking and the engineer need to work together.

[00:46:50] Let me tell you another little secret about design and meatpacking plants.

[00:46:53] They hire a guy with a title of "draftsman." That's the guy that's the visual thinker.

[00:46:58] Guess what? He actually designs the plant, lays out the whole entire plant, these big complicated meat plants. And the engineers have to calculate the steel and do the engineering stuff, but the engineers don't lay out the plant.

[00:47:12] The visual thinker does.

[00:47:14] You need to have the two work on it together.

[00:47:17] Then you get really great projects.

[00:47:20] Can we go on to the next one? "We are such fans of your books and your work, and my daughter is personally inspired by your story.

[00:47:27] Have you ever considered writing a book for children on the spectrum?" Yes.

[00:47:29] Right now, I'm working with Sy Montgomery, and we're going to be coming out with a children's version book about my life.

[00:47:39] I'm going to be talking about all the kites.

[00:47:41] We actually found pictures of some of my kites.

[00:47:44] I was really into kites as a child, constantly experimenting with different kinds of kites.

- [00:47:50] I made this bird kite that I flew behind my trike that had little winglets that bent up, and the ratio of the wing area to the wing tip bent up is the same as what's on an airliner today. And when I saw those little wing tips on the airliners I went, "Oh, wow. I was just six when I made those." "Indiana is ranked seventh in autism." Some of this is increased detection.
- [00:48:19] I think that truly there has been an increase in some of the severe autism, especially the regressive autism, where the kids get some language and then they lose it.
- [00:48:28] But then on the other end of the spectrum, over the last five or six years, I'm seeing milder and milder kids coming up to me at the book table.
- [00:48:36] When I was in school they would have just been the geeky, nerdy kids.
- [00:48:41] If they're out in Silicon Valley, those kids get apprenticed into the computer industry.
- [00:48:47] One of the things that's a problem is I think lot of special educators do a great job with the more severe kids.
- [00:48:53] But since they're not from a technical background, they don't know what to do with a math wiz or somebody that's interested in engineering.
- [00:49:00] They just don't understand that stuff.
- [00:49:03] I think it's important to learn how to be social.
- [00:49:06] But you can't de-geek the geek.
- [00:49:08] You can't make the geek into something that they're not.

[00:49:11] To me, really cool stuff—one of the things I had to learn is I had to learn to control the emotion of aggression because I was thrown out of ninth grade for throwing a book at a girl who teased me.

[00:49:25] After I had horseback riding taken away for two weeks, I switched to crying.

[00:49:29] Because, you see, I'm missing a few circuits here.

[00:49:32] So you lose top-down control over the emotion centers.

[00:49:36] I switched to crying, and it's fine for geeks to cry because cry babies can keep jobs.

[00:49:41] I used to go hide in the electrical rooms and places like that because I didn't want people see that I was doing this.

[00:49:47] I went to the saddest meeting.

[00:49:49] I went to this big high school convocation where I gave a talk about animal behavior, and a NASA scientist who was an engineering professor at the university gave a talk.

[00:49:58] The Shuttle program is shutting down, and he had these beautiful slides just flashing up behind him of the Shuttle assembly building, and he started crying because the Shuttle has been canceled.

[00:50:08] I was crying too.

[00:50:09] That's the stuff where if you're geeky, you get really choked up over that.

[00:50:15] I think that's something that's hard for some of the more social people to understand that, that you get that emotional about your project dying.

[00:50:23] Let's go to the next.

[00:50:24] “What two things would you say to encourage parents who have a child with autism?” First of all, early intervention.

[00:50:29] In “USA Today,” there’s an article in there about a checklist for detecting possible autism in year-old babies, babies that don’t respond to people looking at them.

[00:50:40] They don’t smile.

[00:50:41] They don’t play peekaboo.

[00:50:43] They don’t do the interactive games.

[00:50:45] That’s the first early warning sign that the kid might have autism.

[00:50:50] What do you do with that kid? You want to engage him.

[00:50:52] I can’t emphasize enough the importance of working with very young children, engaging them.

[00:50:57] When I was two-and-a-half, I went into very good early intervention.

[00:51:01] I had a nanny who played constant turn-taking games with me and my sister.

[00:51:04] We’ve got to teach these kids to take turns.

[00:51:07] And in the ‘50s, things that were fun to do were things that involved taking turns.

[00:51:12] If you had another kid over to play table hockey, you got to do it with somebody else.

[00:51:16] You have two kids over, and we go make a play together.

[00:51:20] When we put on some theater together, you’ve got to cooperate with the other person.

[00:51:24] We’ve got to teach the kids how to do these things.

[00:51:26] Early intervention.

[00:51:27] The other thing is develop the child's strengths.

[00:51:30] That one again, in middle school, we're going to have to start thinking a lot more about careers.

[00:51:34] Because what I'm seeing, and this really bothers me, being a visual thinker, I don't see the label.

[00:51:40] But the verbal people are getting too hung up on the label.

[00:51:43] I'm going to say one geek goes to Hollywood and he makes great movies.

[00:51:46] I saw a lot of them at the Golden Globes.

[00:51:48] Another geek gets to go to Silicon Valley.

[00:51:50] I've been at a lot of conferences out there.

[00:51:52] I've seen him.

[00:51:53] Another geek is getting a label, and he's going to end up in the basement playing video games.

[00:51:58] That's not good.

[00:52:00] I would have been a video game addict.

[00:52:02] Why are these things so addicting? There's something about watching how the images move.

[00:52:08] If they were learning how to program the games, fine.

[00:52:10] I'd say, okay, we're going to limit the video game playing to an hour a day.

[00:52:14] You want to spend eight hours a day making a game, that's fine.

[00:52:17] Because that's something that can become your career, and we need to be thinking a lot more about, What is this kid going to do? Mother was always pushing me.

[00:52:25] When I was in high school, I went to my aunt's ranch.

[00:52:27] Then when I was in college, she said, "Well,

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[00:52:29] you can no longer just go to the aunt's ranch all summer." She arranged other internships for me to do, like research lab.

[00:52:35] I was getting job skills.

[00:52:37] Well, thank you all for coming.