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## The Geek Syndrome

**Autism - and its milder cousin Asperger's syndrome - is surging among the children of Silicon Valley. Are math-and-tech genes to blame?**

By Steve Silberman

Nick is building a universe on his computer. He's already mapped out his first planet: an anvil-shaped world called Denthaim that is home to gnomes and gods, along with a three-gendered race known as *kiman*. As he tells me about his universe, Nick looks up at the ceiling, humming fragments of a melody over and over. "I'm thinking of making magic a form of quantum physics, but I haven't decided yet, actually," he explains. The music of his speech is pitched high, alternately poetic and pedantic - as if the soul of an Oxford don has been awkwardly reincarnated in the body of a chubby, rosy-cheeked boy from Silicon Valley. Nick is 11 years old.

Nick's father is a software engineer, and his mother is a computer programmer. They've known that Nick was an unusual child for a long time. He's infatuated with fantasy novels, but he has a hard time reading people. Clearly bright and imaginative, he has no friends his own age. His inability to pick up on hidden agendas makes him easy prey to certain cruelties, as when some kids paid him a few dollars to wear a ridiculous outfit to school.

One therapist suggested that Nick was suffering from an anxiety disorder. Another said he had a speech impediment. Then his mother read a book called *Asperger's Syndrome: A Guide for Parents and Professionals*. In it, psychologist Tony Attwood describes children who lack basic social and motor skills, seem unable to decode body language and sense the feelings of others, avoid eye contact, and frequently launch into monologues about narrowly defined - and often highly technical - interests. Even when very young, these children become obsessed with order, arranging their toys in a regimented fashion on the floor and flying into tantrums when their routines are disturbed. As teenagers, they're prone to getting into trouble with teachers and other figures of authority, partly because the subtle cues that define societal hierarchies are invisible to them.

"I thought, 'That's Nick,'" his mother recalls.

Asperger's syndrome is one of the disorders on the autistic spectrum - a milder form of the condition that afflicted Raymond Babbitt, the character played by Dustin Hoffman in *Rain Man*. In the taxonomy of autism, those with Asperger's syndrome have average - or even very high - IQs, while 70 percent of those with other autistic disorders suffer from mild to severe mental retardation. One of the estimated 450,000 people in the US living with autism, Nick is more fortunate than most. He can read, write, and speak. He'll be able to live and work on his own. Once he gets out of junior high hell, it's not hard to imagine Nick creating a niche for himself in all his exuberant strangeness. At the less fortunate end of the spectrum are what diagnosticians call "profoundly affected" children. If not forcibly engaged, these children spend their waking hours in trancelike states, staring at lights, rocking, making high-pitched squeaks, and flapping their hands, repetitively stimulating ("stimming") their miswired nervous systems.

In one of the uncanny synchronicities of science, autism was first recognized on two continents nearly simultaneously. In 1943, a child psychiatrist named Leo Kanner published a monograph outlining a curious set of behaviors he noticed in 11 children at the Johns Hopkins Hospital in Baltimore. A year later, a pediatrician in Vienna named Hans Asperger, who had never seen Kanner's work, published a paper describing four children who shared many of the same traits. Both Kanner and Asperger gave the condition the same name: autism - from the Greek word for self, *autòs* - because the children in their care seemed to withdraw into iron-walled universes of their own.

Kanner went on to launch the field of child psychiatry in the US, while Asperger's clinic was destroyed by a shower of Allied bombs. Over the next 40 years, Kanner became widely known as the author of the canonical textbook in his field, in which he classified autism as a subset of childhood schizophrenia. Asperger was virtually ignored outside of Europe and died in 1980. The term *Asperger syndrome* wasn't coined until a year later, by UK psychologist Lorna Wing, and Asperger's original paper wasn't even translated into English until 1991. Wing built upon Asperger's intuition that even certain gifted children might also be autistic. She described the disorder as a continuum that "ranges from the most profoundly physically and mentally retarded person ... to the most able, highly intelligent person with social impairment in its subtlest form as his only disability. It overlaps with learning disabilities and shades into eccentric normality."

Asperger's notion of a continuum that embraces both smart, geeky kids like Nick and those with so-called classic or profound autism has been accepted by the medical establishment only in the last decade. Like most distinctions in the world of childhood developmental disorders, the line between classic autism and Asperger's syndrome is hazy, shifting with the state of diagnostic opinion. Autism was added to the American Psychiatric Association's *Diagnostic and Statistical Manual of Mental Disorders* in 1980, but Asperger's syndrome wasn't included as a separate disorder until the fourth edition in 1994. The taxonomy is further complicated by the fact that few if any people who have Asperger's syndrome will exhibit all of the behaviors listed in the *DSM-IV*. (The *syn* in *syndrome* derives from the same root as the *syn* in *synchronicity* - the word means that certain symptoms tend to cluster together, but all need not be present to make the diagnosis.) Though Asperger's syndrome is less disabling than "low-functioning" forms of autism, kids who have it suffer difficulties in the same areas as classically autistic children do: social interactions, motor skills, sensory processing, and a tendency toward repetitive behavior.

In the last 20 years, significant advances have been made in developing methods of behavioral training that help autistic children find ways to communicate. These techniques, however, require prodigious amounts of persistence, time, money, and love. Though more than half a century has passed since Kanner and Asperger first gave a name to autism, there is still no known cause, no miracle drug, and no cure.

And now, something dark and unsettling is happening in Silicon Valley.

In the past decade, there has been a significant surge in the number of kids diagnosed with autism throughout California. In August 1993, there were 4,911 cases of so-called level-one autism logged in the state's Department of Developmental Services client-management system. This figure doesn't include kids with Asperger's syndrome, like Nick, but only those who have received a diagnosis of classic autism. In the mid-'90s, this caseload started spiraling up. In 1999, the number of clients was more than double what it had been six years earlier. Then the curve started spiking. By July 2001, there were 15,441 clients in the DDS database. Now there are more than seven new cases of level-one autism - 85 percent of them children - entering the system every day.

**Through the '90s, cases tripled in California. "Anyone who says this is due to better diagnostics has his head in the sand."**

California is not alone. Rates of both classic autism and Asperger's syndrome are going up all over the world, which is certainly cause for alarm and for the urgent mobilization of research. Autism was once considered a very rare disorder, occurring in one out of every 10,000 births. Now it's understood to be much more common - perhaps 20 times more. But according to local authorities, the picture in California is particularly bleak in Santa Clara County. Here in Silicon Valley, family support services provided by the DDS are brokered by the San Andreas Regional Center, one of 21 such centers in the state. SARC dispenses desperately needed resources (such as in-home behavioral training, educational aides, and respite care) to families in four counties. While the autistic caseload is rising in all four, the percentage of cases of classic autism among the total client population in Santa Clara County is higher enough to be worrisome, says SARC's director, Santi Rogers.

"There's a significant difference, and no signs that it's abating," says Rogers. "We've been watching these numbers for years. We feared that something like this was coming. But this is a burst that has staggered us in our steps."

It's not easy to arrive at a clear picture of whether there actually is a startling rise in the incidence of autism in California, as opposed to just an increase in diagnoses. One problem, says Linda Lotspeich, director of the Stanford Pervasive Developmental Disorders Clinic, is that "the rules in the *DSM-IV* don't work." The diagnostic criteria are subjective, like "Marked impairment in the use of nonverbal behaviors such as eye-to-eye gaze, facial expression, body posture, and gestures to regulate social interaction."

"How much 'eye-to-eye gaze' do you have to have to be normal?" asks Lotspeich. "How do you define what 'marked' is? In shades of gray, when does black become white?"

Some children will receive a diagnosis of classic autism, and another diagnosis of Asperger's syndrome, from two different clinicians. Tony Attwood's advice to parents is strictly practical: "Use the diagnosis that provides the services."

While diagnostic fuzziness may be contributing to a pervasive sense that autism is on the rise, Ron Huff, the consulting psychologist for the DDS who uncovered the statistical trend, does not believe that all we're seeing now is an increase in children who would have previously been tagged with some other disability, such as mental retardation - or overlooked as perfectly healthy, if quirky, kids.

"While we certainly need to do more research," says Huff, "I don't think the change in diagnostic criteria will account for all of this rise by any means."

The department is making its data available to the MIND Institute at the University of California at Davis, to tease out what's behind the numbers. The results of that research will be published next year. But the effects of a surging influx are already rippling through the local schools. Carol Zepecki, director of student services and special education for the Palo Alto Unified School District, is disturbed by what she's seeing. "To be honest with you, as I look back on the special-ed students I've worked with for 20 years, it's clear to me that these kids would not have been placed in another category. The numbers are definitely higher." Elizabeth Rochin, a special-ed teacher at Cupertino High, says local educators are scrambling to create new resources. "We know it's happening, because they're coming through our schools. Our director saw the iceberg approaching and said, 'We've got to build something for them.'"

The people scrambling hardest are parents. In-home therapy alone can cost \$60,000 or more a year, and requires so much dedication that parents (particularly mothers) are often forced to quit their jobs and make managing a team of specialists their new 80-hour-a-week career. Before their children become eligible for state funding, parents must obtain a diagnosis from a qualified

clinician, which requires hours of testing and observation. Local facilities, such as the Stanford Pervasive Development Disorders Clinic and its counterpart at UC San Francisco, are swamped. The Stanford clinic is able to perform only two or three diagnoses a week. It currently has a two- to six-month waiting list.

For Rick Rollens, former secretary of the California Senate and cofounder of the MIND Institute, the notion that there is a frightening increase in autism worldwide is no longer in question. "Anyone who says this epidemic is due to better diagnostics," he says, "has his head in the sand."

Autism's insidious style of onset is particularly cruel to parents, because for the first two years of life, nothing seems to be wrong. Their child is engaged with the world, progressing normally, taking first steps into language. Then, suddenly, some unknown cascade of neurological events washes it all away.

One father of an autistic child, Jonathan Shestack, describes what happened to his son, Dov, as "watching our sweet, beautiful boy disappear in front of our eyes." At two, Dov's first words - *Mom, Dad, flower, park* - abruptly retreated into silence. Over the next six months, Dov ceased to recognize his own name and the faces of his parents. It took Dov a year of intensive behavioral therapy to learn how to point. At age 9, after the most effective interventions available (such as the step-by-step behavioral training methods developed by Ivar Lovaas at UCLA), Dov can speak 20 words.

Even children who make significant progress require levels of day-to-day attention from their families that can best be described as heroic. Marnin Kligfeld is the founder of a software mergers-and-acquisitions firm. His wife, Margo Estrin, a doctor of internal medicine, is the daughter of Gerald Estrin, who was a mentor to many of the original architects of the Internet (see "[Meet the Bellbusters](#)," *Wired* 9.11, page 164). When their daughter, Leah, was 3, a pediatrician at Oakland Children's Hospital looked at her on the examining table and declared, "There is very little difference between your daughter and an animal. We have no idea what she will be able to do in the future." After eight years of interventions - behavioral training, occupational therapy, speech therapy - Leah is a happy, upbeat 11-year-old who downloads her favorite songs by the hundreds. And she is still deeply autistic.

Leah's first visit to the dentist required weeks of preparation, because autistic people are made deeply anxious by any change in routine. "We took pictures of the dentist's office and the staff, and drove Leah past the office several times," Kligfeld recalls. "Our dentist scheduled us for the end of the day, when there were no other patients, and set goals with us. The goal of the first session was to have Leah sit in the chair. The second session was so Leah could rehearse the steps involved in treatment without actually doing them. The dentist gave all of his equipment special names for her. Throughout this process, we used a large mirror so Leah could see exactly what was being done, to ensure that there were no surprises."

Daily ordeals like this, common in the autistic community, underline the folly of the hypothesis that prevailed among psychologists 20 years ago, who were convinced that autism was caused by a lack of parental affection. The influential psychiatrist Bruno Bettelheim aggressively promoted a theory that has come to be known as the "refrigerator mother" hypothesis. He declared in his best-selling book, *The Empty Fortress*, "The precipitating factor in infantile autism is the parent's wish that his child should not exist. ... To this the child responds with massive withdrawal." He prescribed "parentectomy" - removal of the child from the parents - and years of family therapy. His hypothesis added the burden of guilt to the grief of having an autistic child, and made autism a source of shame and secrecy, which hampered efforts to obtain clinical data. The hypothesis has been thoroughly discredited. Richard Pollak's *The Creation of Dr. B* exposed Bettelheim as a brilliant liar who concocted case histories and exaggerated both his experience with autistic children and the success of his treatments.

**One thing nearly everyone in the field agrees on: genetic predisposition. Identical twins share the disorder 9 times out of 10.**

But the debates about the causes of autism are certainly not over. Controversies rage about whether environmental factors - such as mercury and other chemicals in universally administered vaccines, industrial pollutants in air and water, and even certain foods - act as catalysts that trigger the disorder. Bernard Rimland, the first psychologist to oppose Bettelheim and promote the idea that autism was organic in origin, has become a leading advocate for intensified investigation in this area. The father of an autistic son, Rimland has been instrumental in marshaling medical expertise and family data to create better assessment protocols.

The one thing that almost all researchers in the field agree on is that genetic predisposition plays a crucial role in laying the neurological foundations of autism in most cases. Studies have shown that if one identical twin is autistic, there's a 90 percent chance that the other twin will also have the disorder. If parents have had one autistic child, the risk of their second child being autistic rises from 1 in 500 to 1 in 20. After two children with the disorder, the sobering odds are 1 in 3. (So many parents refrain from having more offspring after one autistic child, geneticists even have a term for it: *stoppage*.) The chances that the siblings of an autistic child will display one or more of the other developmental disorders with a known genetic basis - such as dyslexia or Tourette's syndrome - are also significantly higher than normal.

The bad news from Santa Clara County raises an inescapable question. Unless the genetic hypothesis is proven false, which is unlikely, regions with a higher than normal distribution of people on the autistic spectrum are something no researcher could ask for: living laboratories for the study of genetic expression. When the rain that fell on the Rain Man falls harder on certain communities than others, what becomes of the children?

The answer may be raining all over Silicon Valley. And one of the best hopes of finding a cure may be locked in the DNA sequences that produced the minds that have made this area the technological powerhouse of the world.

It's a familiar joke in the industry that many of the hardcore programmers in IT strongholds like Intel, Adobe, and Silicon Graphics - coming to work early, leaving late, sucking down Big Gulps in their cubicles while they code for hours - are residing somewhere in Asperger's domain. Kathryn Stewart, director of the Orion Academy, a high school for high-functioning kids in Moraga, California, calls Asperger's syndrome "the engineers' disorder." Bill Gates is regularly diagnosed in the press: His single-minded focus on technical minutiae, rocking motions, and flat tone of voice are all suggestive of an adult with some trace of the disorder. Dov's father told me that his friends in the Valley say many of their coworkers "could be diagnosed with ODD - they're odd." In *Microserfs*, novelist Douglas Coupland observes, "I think *all* tech people are slightly autistic."

Though no one has tried to convince the Valley's best and brightest to sign up for batteries of tests, the culture of the area has subtly evolved to meet the social needs of adults in high-functioning regions of the spectrum. In the geek warrens of engineering and R&D, social graces are beside the point. You can be as off-the-wall as you want to be, but if your code is bulletproof, no one's going to point out that you've been wearing the same shirt for two weeks. Autistic people have a hard time multitasking - particularly when one of the channels is face-to-face communication. Replacing the hubbub of the traditional office with a screen and an email address inserts a controllable interface between a programmer and the chaos of everyday life. Flattened workplace hierarchies are more comfortable for those who find it hard to read social cues. A WYSIWYG world, where respect and rewards are based strictly on merit, is an Asperger's dream.

Obviously, this kind of accommodation is not unique to the Valley. The halls of academe have long been a forgiving environment for absentminded professors. Temple Grandin - the inspiring and

accomplished autistic woman profiled in Oliver Sacks' *An Anthropologist on Mars* - calls NASA the largest sheltered workshop in the world.

A recurring theme in case histories of autism, going all the way back to Kanner's and Asperger's original monographs, is an attraction to highly organized systems and complex machines. There's even a perennial cast of hackers: early adopters with a subversive streak. In 1944, Asperger wrote of a boy "chemist [who] uses all his money for experiments which often horrify his family and even steals to fund them." Another boy proved a mathematical error in Isaac Newton's calculations while he was still a freshman in college. A third escaped neighborhood bullies by taking lessons from an old watchmaker. And a fourth, wrote Asperger, "came to be preoccupied with fantastic inventions, such as spaceships and the like." Here he added, "one observes how remote from reality autistic interests really are" - a comment he qualified years later, when spaceships were no longer remote or fantastic, by joking that the inventors of spaceships might themselves be autistic.

Clumsy and easily overwhelmed in the physical world, autistic minds soar in the virtual realms of mathematics, symbols, and code. Asperger compared the children in his clinic to calculating machines: "intelligent automata" - a metaphor employed by many autistic people themselves to describe their own rule-based, image-driven thought processes. In her autobiography, *Thinking in Pictures*, Grandin compares her mind to a VCR. When she hears the word *dog*, she mentally replays what she calls "videotapes" of various dogs that she's seen, to arrive at something close to the average person's abstract notion of the category that includes all dogs. This visual concreteness has been a boon to her work as a designer of more humane machinery for handling livestock. Grandin sees the machines in her head and sets them running, debugging as she goes. When the design in her mind does everything it's supposed to, she draws a blueprint of what she sees.

**"In another age, these men would have been monks, developing new ink for printing presses. Suddenly, they're reproducing at a much higher rate."**

These days, the autistic fascinations with technology, ordered systems, visual modes of thinking, and subversive creativity have plenty of outlets. There's even a cheeky Asperger's term for the rest of us - NTs, "neurotypicals." Many children on the spectrum become obsessed with VCRs, *Pokémon*, and computer games, working the joysticks until blisters appear on their fingers. (In the diagnostic lexicon, this kind of relentless behavior is called "perseveration.") Even when playing alongside someone their own age, however, autistic kids tend to play separately. Echoing Asperger, the director of the clinic in San Jose where I met Nick, Michelle Garcia Winner, suggests that "*Pokémon* must have been invented by a team of Japanese engineers with Asperger." Attwood writes that computers "are an ideal interest for a person with Asperger's syndrome ... they are logical, consistent, and not prone to moods."

This affinity for computers gives teachers and parents leverage they can use to build on the natural strengths of autistic children. Many teenagers who lack the motor skills to write by hand find it easier to use a keyboard. At Orion Academy, every student is required to buy an iBook fitted with an AirPort card. Class notes are written on electronic whiteboards that port the instructional materials to the school server for retrieval. (At lunch, the iBooks are shut off, and if the kids want to play a two-person game, they're directed to a chess board.) The next generation of assistive technology is being designed by Neil Scott's Archimedes Project at Stanford. Scott's team is currently developing the equivalent of a PDA for autistic kids, able to parse subtle movements of an eyebrow or fingertip into streams of text, voice, or images. The devices will incorporate video cameras, head and eye tracking, intelligent agents, and speech recognition to suit the needs of the individual child.

The Valley is a self-selecting community where passionately bright people migrate from all over the world to make smart machines work smarter. The nuts-and-bolts practicality of hard labor among the bits appeals to the predilections of the high-functioning autistic mind. The hidden cost of

building enclaves like this, however, may be lurking in the findings of nearly every major genetic study of autism in the last 10 years. Over and over again, researchers have concluded that the DNA scripts for autism are probably passed down not only by relatives who are classically autistic, but by those who display only a few typically autistic behaviors. (Geneticists call those who don't fit into the diagnostic pigeonholes "broad autistic phenotypes.")

The chilling possibility is that what's happening now is the first proof that the genes responsible for bestowing certain special gifts on slightly autistic adults - the very abilities that have made them dreamers and architects of our technological future - are capable of bringing a plague down on the best minds of the next generation. For parents employed in prominent IT firms here, the news of increased diagnoses of autism in their ranks is a confirmation of rumors that have quietly circulated for months. Every day, more and more of their coworkers are running into one another in the waiting rooms of local clinics, taking the first uncertain steps on a journey with their children that lasts for the rest of their lives.

In previous eras, even those who recognized early that autism might have a genetic underpinning considered it a disorder that only moved diagonally down branches of a family tree. Direct inheritance was almost out of the question, because autistic people rarely had children. The profoundly affected spent their lives in institutions, and those with Asperger's syndrome tended to be loners. They were the strange uncle who droned on in a tuneless voice, tending his private logs of baseball statistics or military arcana; the cousin who never married, celibate by choice, fussy about the arrangement of her things, who spoke in a lexicon mined reading dictionaries cover to cover.

The old line "insanity is hereditary, you get it from your kids" has a twist in the autistic world. It has become commonplace for parents to diagnose themselves as having Asperger's syndrome, or to pinpoint other relatives living on the spectrum, only after their own children have been diagnosed.

High tech hot spots like the Valley, and Route 128 outside of Boston, are a curious oxymoron: They're fraternal associations of loners. In these places, if you're a geek living in the high-functioning regions of the spectrum, your chances of meeting someone who shares your perseverating obsession (think Linux or *Star Trek*) are greatly expanded. As more women enter the IT workplace, guys who might never have had a prayer of finding a kindred spirit suddenly discover that she's hacking Perl scripts in the next cubicle.

One provocative hypothesis that might account for the rise of spectrum disorders in technically adept communities like Silicon Valley, some geneticists speculate, is an increase in *assortative mating*. Superficially, assortative mating is the blond gentleman who prefers blondes; the hyperverbal intellectual who meets her soul mate in the therapist's waiting room. There are additional pressures and incentives for autistic people to find companionship - if they wish to do so - with someone who is also on the spectrum. Grandin writes, "Marriages work out best when two people with autism marry or when a person marries a handicapped or eccentric spouse.... They are attracted because their intellects work on a similar wavelength."

That's not to say that geeks, even autistic ones, are attracted only to other geeks. Compensatory unions of opposites also thrive along the continuum, and in the last 10 years, geekitude has become sexy and associated with financial success. The lone-wolf programmer may be the research director of a major company, managing the back end of an IT empire at a comfortable remove from the actual clients. Says Bryna Siegel, author of *The World of the Autistic Child* and director of the PDD clinic at UCSF, "In another historical time, these men would have become monks, developing new ink for early printing presses. Suddenly they're making \$150,000 a year with stock options. They're reproducing at a much higher rate."

Genetic hypotheses like these don't rule out environmental factors playing a role in the rising

numbers. Autism is almost certainly not caused by the action of a single gene, but by some orchestration of multiple genes that may make the developing child more susceptible to a trigger in the environment. One consequence of increased reproduction among people carrying some of these genes might be to boost "genetic loading" in successive generations - leaving them more vulnerable to threats posed by toxins in vaccines, candida, or any number of agents lurking in the industrialized world.

At clinics and schools in the Valley, the observation that most parents of autistic kids are engineers and programmers who themselves display autistic behavior is not news. And it may not be news to other communities either. Last January, Microsoft became the first major US corporation to offer its employees insurance benefits to cover the cost of behavioral training for their autistic children. One Bay Area mother told me that when she was planning a move to Minnesota with her son, who has Asperger's syndrome, she asked the school district there if they could meet her son's needs. "They told me that the northwest quadrant of Rochester, where the IBMers congregate, has a large number of Asperger kids," she recalls. "It was recommended I move to that part of town."

For Dov's parents, Jonathan Shestack and Portia Iversen, Silicon Valley is the only place on Earth with enough critical mass of supercomputing resources, bio-informatics expertise, genomics savvy, pharmaceutical muscle, and VC dollars to boost autism research to the next phase. For six years, the organization they founded, Cure Autism Now, has led a focused assault on the iron-walled fortress of the medical establishment, including the creation of its own bank of DNA samples, available to any scientist in the field on a Web site called the Autism Genetic Resources Exchange (see "[The Citizen Scientists](#)," *Wired* 9.09, page 144).

At least a third of CAN's funding comes from donors in the Valley. Now Shestack and Iversen want to deliver the ultimate return on that investment: better treatments, smarter assistive technology - and, eventually, a cure.

"We have the human data," says Shestack. "Now we need the brute-force processing power. We need high-density SNP mapping and microarray analysis so we can design pharmaceutical interventions. We need Big Pharma to wake up to the fact that while 450,000 people in America may not be as large a market as for cholesterol drugs, we're talking about a demand for new products that will be needed from age 2 to age 70. We need new technology that measures modes of perception, and tools for neural retraining. And we need a Web site where families with a newly diagnosed kid can plug into a network of therapists in their town who have been rated by buyers - just like eBay."

The ultimate hack for a team of Valley programmers may turn out to be cracking the genetic code that makes them so good at what they do. Taking on that challenge will require extensive use of technology invented by two people who think in pictures: Bill Dreyer, who invented the first protein sequencer, and Carver Mead, the father of very large scale integrated circuits. As Dreyer explains, "I think in three-dimensional Technicolor." Neither Mead nor Dreyer is autistic, but there is a word for the way they think - *dyslexic*. Like autism, dyslexia seems to move down genetic pathways. Dreyer has three daughters who think in Technicolor.

One of the things that Dan Geschwind, director of the neurogenetics lab at UCLA, finds fascinating about dyslexia and autism is what they suggest about human intelligence: that certain kinds of excellence might require not just various modes of thinking, but different kinds of brains.

"Autism gets to fundamental issues of how we view talents and disabilities," he says. "The flip side of dyslexia is enhanced abilities in math and architecture. There may be an aspect of this going on with autism and assortative mating in places like Silicon Valley. In the parents, who carry a few of the genes, they're a good thing. In the kids, who carry too many, it's very bad."

Issues like this were at the crux of arguments that Bryna Siegel had with Bruno Bettelheim in a Stanford graduate seminar in the early '80s, published in Bettelheim's *The Art of the Obvious*. (Siegel's name was changed to Dan Berenson.) The text makes poignant reading, as two paradigms of scientific humanism clash in the night. Siegel told "Dr. B" that she wanted to do a large study of children with various developmental disorders to search for a shared biochemical defect. Bettelheim shot back that if such a marker were to be uncovered it would dehumanize autistic children, by making them essentially different from ourselves.

Still an iconoclast, Siegel questions whether a "cure" for autism could ever be found. "The genetics of autism may turn out to be no simpler to unravel than the genetics of personality. I think what we'll end up with is something more like, 'Mrs. Smith, here are the results of your amnio. There's a 1 in 10 chance that you'll have an autistic child, or the next Bill Gates. Would you like to have an abortion?'"

For UCSF neurologist Kirk Wilhelmsen - who describes himself and his son as being "somewhere on that grand spectrum" - such statements cut to the heart of the most difficult issue that autism raises for society. It may be that autistic people *are* essentially different from "normal" people, he says, and that it is precisely those differences that make them invaluable to the ongoing evolution of the human race.

"If we could eliminate the genes for things like autism, I think it would be disastrous," says Wilhelmsen. "The healthiest state for a gene pool is maximum diversity of things that might be good."

One of the first people to intuit the significance of this was Asperger himself - weaving his continuum like a protective blanket over the young patients in his clinic as the Nazis shipped so-called mental defectives to the camps. "It seems that for success in science and art," he wrote, "a dash of autism is essential."

For all we know, the first tools on earth might have been developed by a loner sitting at the back of the cave, chipping at thousands of rocks to find the one that made the sharpest spear, while the neurotypicals chattered away in the firelight. Perhaps certain arcane systems of logic, mathematics, music, and stories - particularly remote and fantastic ones - have been passed down from phenotype to phenotype, in parallel with the DNA that helped shape minds which would know exactly what to do with these strange and elegant creations.

Hanging on the wall of Bryna Siegel's clinic in San Francisco is a painting of a Victorian house at night, by Jessy Park, an autistic woman whose mother, Clara Claiborne Park, wrote one of the first accounts of raising a child with autism, *The Siege*. Now 40, Jessy still lives at home. In her recent book, *Exiting Nirvana*, Clara writes of having come to a profound sense of peace with all the ways that Jessy is.

Jessy sent Siegel a letter with her painting, in flowing handwriting and words that are - there is no other way to say it - marvelously autistic. "The lunar eclipse with 92% cover is below Cassiopeia. In the upper right-hand corner is Aurora Borealis. There are three sets of six-color pastel rainbow on the shingles, seven-color bright rainbow on the clapboards next to the drain pipe, six-color paler pastel rainbow around the circular window, six-color darker pastel rainbow on the rosette ..."

But the words aren't the thing. Jessy's painting is the thing. Our world, but not our world. A house under the night sky shining in all the colors of the spectrum.

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