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Get Beyond Learning Styles

ALL LEARNERS ARE DIFFERENT, and all rising to a great place, as Francis Bacon tells us, is by a winding stair.[1]

Consider the story of Bruce Hendry, born in 1942, raised on the banks of the Mississippi north of Minneapolis by a machinist and a homemaker, just another American kid with skinned knees and fire in the belly to get rich. When we talk about self-made men, the story often sounds familiar. This is not that story. Bruce Hendry is self-made, but the story is in the winding stair, how he found his way, and what it helps us understand about differences in how people learn.

The idea that individuals have distinct learning styles has been around long enough to become part of the folklore of educational practice and an integral part of how many people perceive themselves. The underlying premise says that people receive and process new information differently: for example,

some learn better from visual materials, and others learn better from written text or auditory materials. Moreover, the theory holds that people who receive instruction in a manner that is not matched to their learning style are at a disadvantage for learning.

In this chapter, we acknowledge that everyone has learning preferences, but we are not persuaded that you learn better when the manner of instruction fits those preferences. Yet there are other kinds of differences in how people learn that do matter. First, the story of Bruce, to help frame our argument.

Active Learning from the Get-Go

Part of the secret to Bruce is his sense, from the earliest age, of being the one in charge of Bruce. When he was two his mother, Doris, told him he couldn't cross the street because a car might hit him. Every day, Bruce crossed the street, and every day Doris gave him a spanking. "He was born aggressive," Doris told friends.

At eight he bought a ball of string at a garage sale for a dime, cut it up, and sold the pieces for a nickel each. At ten he got a paper route. At eleven he added caddying. At twelve he stuffed his pocket with $30 in savings, sneaked out of his bedroom window before dawn with an empty suitcase, and hitchhiked 255 miles to Aberdeen, South Dakota. He stocked up on Black Cats, cherry bombs, and roman candles, illegal in Minnesota, and hitched home before supper. Over the next week, Doris couldn't figure out why all the paperboys were dropping by the house for a few minutes and leaving. Bruce had struck gold, but the paper route supervisor found out and tipped off Bruce Senior. The father told the son if he ever did it again he'd get the licking of his life. Bruce repeated the buying trip the following summer and got the promised licking.

"It was worth it," he says.[2] He was thirteen, and he had learned a lesson about high demand and short supply.

The way Bruce figured, rich people were probably no smarter than he was, they just had knowledge he lacked. Looking at how he went after the knowledge he sought will illustrate some of the learning differences that matter. One, of course, is taking charge of your own education, a habit with Bruce from age two that he has exhibited through the years with remarkable persistence. There are other signal behaviors. As he throws himself into one scheme after another, he draws lessons that improve his focus and judgment. He knits what he learns into mental models of investing, which he then uses to size up more complex opportunities and find his way through the weeds, plucking the telling details from masses of irrelevant information to reach the payoff at the end. These behaviors are what psychologists call "rule learning" and "structure building." People who as a matter of habit extract underlying principles or rules from new experiences are more successful learners than those who take their experiences at face value, failing to infer lessons that can be applied later in similar situations. Likewise, people who single out salient concepts from the less important information they encounter in new material and who link these key ideas into a mental structure are more successful learners than those who cannot separate wheat from chaff and understand how the wheat is made into flour.

When he was barely a teenager, Bruce saw a flyer advertising wooded lots on a lake in central Minnesota. Advised that no one ever lost money on real estate, he bought one. Over four subsequent summers, with occasional help from his dad, he built a house on it, confronting each step in the process one at

a time, figuring it out for himself or finding someone to show him how. To dig the basement, he borrowed a trailer and hooked it up to his '49 Hudson. He paid 50 cents for every load his friends excavated, shovel by shovel, and then charged the owner of a nearby lot that needed fill a dollar for it. He learned how to lay block from a friend whose father was in the cement business and then laid himself a foundation. He learned how to frame the walls from the salesman at the lumber yard. He plumbed the house and wired it the same way, a wide-eyed kid asking around how you do that sort of thing. "The electrical inspector disapproved it," Bruce recalls. "At the time, I figured it was because they wanted a union guy to do it, so I popped for a union guy to come up from the Cities and redo all my wiring. Looking back, I'm sure what I had done was totally dangerous."

He was nineteen and a university student the summer he traded the house for the down payment on a fourplex in Minneapolis. It was a simple premise: four apartments would generate four checks in the mail, month in and month out. Soon, besides his studies at university, he was managing the rental property, paying on the mortgage, answering midnight calls over broken plumbing, raising rents and losing tenants, trying to fill vacant units, and pouring in more money. He had learned how to parlay a vacant lot into a house, and a house into an apartment complex, but in the end the lesson proved a sour one, yielding more headache than reward. He sold the fourplex and swore off real estate for the next two decades.

Out of college, Bruce went to work for Kodak as a microfilm salesman. In his third year, he was one of five top salesmen in the country. That was the year he found out how much his branch manager was making: less than Bruce made as a salesman, if he factored in his company car and expense account. It pays better to be a rainmaker than a manager:

another lesson learned, another step up Bruce's winding stair. He quit to join a brokerage firm and sell stocks.

From this new vantage point, more lessons: "If I brought a dollar into the firm in trading commissions, half went to the firm and half of the remaining half went to the IRS. To make real money, I had to focus more on investing my own money and less on making sales commissions." Oops, another lesson: investing in stocks is risky. He lost as much investing his own money as he earned in commissions selling investments to his clients. "You have no control of the down side. If a stock drops 50 percent, it has to go up by 100 percent just to break even. A hundred percent is a lot harder to make than fifty is to lose!" More knowledge banked. He bided his time, casting his eyes about for the insight he was after.

Enter Sam Leppla.

As Bruce tells it, Leppla was just a guy who roamed the Minneapolis skyways in those days, from one investment firm to another, talking deals and giving advice. One day he told Bruce about some bonds in a distressed company that were selling for 22 cents on the dollar. "There were twenty-two points of unpaid back interest on these bonds," Bruce recalls, "so when the company came out of bankruptcy, you'd collect the back interest—in other words, 100 percent of your investment cost—and you'd still own a paying bond." It amounted to free money. "I didn't buy any," Bruce says. "But I watched it, and it worked out exactly like Sam predicted. So, I called him up and said, 'Can you come down and tell me what you're doing?' "

Leppla taught Bruce a more complex understanding of the relationships between price, supply, demand, and value than he'd learned from a suitcase full of fireworks. Leppla's modus operandi was drawn from the following precept. When a company runs into trouble, the first claim on its assets belongs not

to its owners, the shareholders, but to its creditors: the suppliers and bondholders. There's a pecking order to bonds. Those bonds paid first are called senior bonds. Any residual assets after the senior bonds are paid go to pay off the junior bonds. Junior bonds in a troubled company get cheap if investors fear there won't be enough assets left over to cover their value, but investors' fear, laziness, and ignorance can depress bond prices far below the worth of the underlying assets. If you can ascertain that actual worth and you know the price of the bonds, you can invest with very little risk.

Here was the kind of knowledge Bruce had been seeking.

Florida real estate investment trusts were distressed at the time, so Sam and Bruce started looking into those, buying where they could see that the fire-sale prices significantly discounted the underlying values. "We'd buy these for 5 dollars and sell them for 50. Everything we bought made money." They had a good run, but market prices caught up with values, and soon they were in need of another idea.

At the time, eastern railroads were going bankrupt, and the federal government was buying their assets to form Conrail and Amtrak. As Bruce tells it, "One day Sam said, 'Railroads go bankrupt every fifty years and no one knows anything about them. They are real complicated and they take years to work out.' So we found a guy who knew about railroads. Barney Donahue. Barney was an ex–IRS agent and a railroad buff. If you've ever met a real railroad buff, they think it, they breathe it, they can tell you the weight of the track and they can tell you the numbers on the engines. He was one of those guys."

A central tenet of their investment model was to discover more than other investors knew about residual assets and the order in which the bonds were to be honored. Armed with the right knowledge, they could cherry-pick the underpriced junior bonds most likely to be paid off. Donahue checked out

the different railroads and decided that the best one to invest in was the Erie Lackawanna, because it had the most modern equipment when it filed for bankruptcy. Hendry, Leppla, and Donahue dived in for a closer look. They traveled the entire length of the Erie's track to check its condition. They counted the equipment that remained, looked at its condition, and checked in Moody's transportation manuals to calculate values. "You just do the arithmetic: What's an engine worth? A boxcar? A mile of track?" The Erie had issued fifteen different bonds over its 150 years in operation, and the value of each bond was dependent in part on where it stood in seniority compared to the others. Bruce's research turned up a little document in which the financial institutions had agreed to the sequence in which bonds were to be paid off when the assets were liquidated. With a fix on the value of the company's assets, liabilities, and the bond structure, they knew what each class of bonds was worth. Bondholders who hadn't done this homework were in the dark. Junior bonds were selling at steeply discounted prices because they were so far down the food chain that investors doubted they would ever see their money. Bruce's calculations suggested otherwise, and he was buying.

It's a longer story than we have space to tell. A railroad bankruptcy is an astonishingly convoluted affair. Bruce committed himself to understanding the entirety of the process better than anybody else. Then he knocked on doors, challenged the good-old-boys' power structure that was managing the proceedings, and eventually succeeded in getting appointed by the courts to chair the committee that represented the bondholders' interests in the bankruptcy process. When the Erie came out of bankruptcy two years later, he was made chairman and CEO of the company. He hired Barney Donahue to run it. Hendry, Donahue, and the board guided the

surviving corporation through the remaining lawsuits, and when the dust settled, Bruce's bonds paid twice face value, twenty times what he paid for some of the junior bonds he had purchased.

The Erie Lackawanna, with all its complexity and David versus Goliath qualities, was just the kind of mess that became Bruce Hendry's bread and butter: finding a company in trouble, burrowing into its assets and liabilities, reading the fine print on credit obligations, looking at its industry and where things are headed, understanding the litigation process, and wading into it armed with a pretty good idea of how things were going to play out.

There are stories of other remarkable conquests. He took control of Kaiser Steel, staved off its liquidation, guided it out of bankruptcy as CEO, and was awarded 2 percent ownership of the new corporation. He interceded in the failure of First RepublicBank of Texas and came out the other side with a 600 percent return on some of his first investments in the company. When manufacturers stopped making railroad boxcars because they were in oversupply, Bruce bought a thousand of the last ones built, collected 20 percent on his investment from lease contracts that the railroads were bound to honor, and then sold the cars a year later when they were in short supply and fetching a handsome price. The story of Hendry's rise is both familiar and particular; familiar in the nature of the quest and particular in the ways Bruce has "gone to school" on his ventures, building his own set of rules for what makes an investment opportunity attractive, stitching the rules into a template, and then finding new and different ways to apply it.

When he is asked how he accounts for his success, the lessons he cites are deceptively simple: go where the competition isn't, dig deep, ask the right questions, see the big picture, take

risks, be honest. But these explanations aren't very satisfying. Behind them is a more interesting story, the one we infer from reading between the lines: how he figured out what knowledge he needed and how he then went after it; how early setbacks helped seed the skills of shrewder judgment; and how he developed a nose for value where others can only smell trouble. His gift for detecting value seems uncanny. His stories bring to mind the kid who, waking up on his fourth birthday to find a big pile of manure in the yard, dances around it crying, "I'm pretty sure there's a pony in there somewhere!"

All people are different, a truism we quickly discern as children, comparing ourselves to siblings. It's evident in grade school, on the sports field, in the boardroom. Even if we shared Bruce Hendry's desire and determination, even if we took his pointers to heart, how many of us would learn the art of knowing which pile had a pony in it? As the story of Bruce makes clear, some learning differences matter more than others. But which differences? That's what we'll explore in the rest of this chapter.

One difference that appears to matter a lot is how you see yourself and your abilities.

As the maxim goes, "Whether you think you can or you think you can't, you're right." The work of Carol Dweck, described in Chapter 7, goes a long way toward validating this sentiment. So does a *Fortune* article of a few years ago that tells of a seeming contradiction, the stories of people with dyslexia who have become high achievers in business and other fields despite their learning disabilities. Richard Branson, of Virgin Records and Virgin Atlantic Airways, quit school at sixteen to start and run businesses now worth billions; Diane Swonk is one of the top economic forecasters in the United States; Craig

McCaw is a pioneer of the cellular phone industry; Paul Orfalea founded Kinko's. These achievers and others, when asked, told their stories of overcoming adversity. All had trouble in school and with the accepted methods of learning, most were mislabeled low IQ, some were held back or shunted into classes for the mentally retarded, and nearly all were supported by parents, tutors, and mentors who believed in them. Branson recalled, "At some point, I think I decided that being dyslexic was better than being stupid." There, in a phrase, Branson's personal narrative of exceptionalism.[3]

The stories we create to understand ourselves become the narratives of our lives, explaining the accidents and choices that have brought us where we are: what I'm good at, what I care about most, and where I'm headed. If you're among the last kids standing on the sidelines as the softball teams are chosen up, the way you understand your place in the world likely changes a little, shaping your sense of ability and the subsequent paths you take.

What you tell yourself about your ability plays a part in shaping the ways you learn and perform–how hard you apply yourself, for example, or your tolerance for risk-taking and your willingness to persevere in the face of difficulty. But differences in skills, and your ability to convert new knowledge into building blocks for further learning, also shape your routes to success. Your finesse at softball, for example, depends on a constellation of different skills, like your ability to hit the ball, run the bases, and field and throw the ball. Moreover, skill on the playing field is not a prerequisite for becoming a star in the sport in a different capacity. Many of the best managers and coaches in pro sports were mediocre or poor players but happen to be exceptional students of their games. Although Tony LaRussa's career as a baseball player was short and undistinguished, he went on to manage ball teams with remark-

able success. When he retired, having chalked up six American and National League championships and three World Series titles, he was hailed as one of the greatest managers of all time.

Each of us has a large basket of resources in the form of aptitudes, prior knowledge, intelligence, interests, and sense of personal empowerment that shape how we learn and how we overcome our shortcomings. Some of these differences matter a lot—for example, our ability to abstract underlying principles from new experiences and to convert new knowledge into mental structures. Other differences we may think count for a lot, for example having a verbal or visual learning style, actually don't.

On any list of differences that matter most for learning, the level of *language fluency and reading ability* will be at or near the top. While some kinds of difficulties that require increased cognitive effort can strengthen learning, not all difficulties we face have that effect. If the additional effort required to overcome the deficit does not contribute to more robust learning, it's not desirable. An example is the poor reader who cannot hold onto the thread of a text while deciphering individual words in a sentence. This is the case with dyslexia, and while dyslexia is not the only cause of reading difficulties, it is one of the most common, estimated to affect some 15 percent of the population. It results from anomalous neural development during pregnancy that interferes with the ability to read by disrupting the brain's capacity to link letters to the sounds they make, which is essential for word recognition. People don't get over dyslexia, but with help they can learn to work with and around the problems it poses. The most successful programs emphasize practice at manipulating phonemes,

building vocabulary, increasing comprehension, and improving fluency of reading. Neurologists and psychologists emphasize the importance of diagnosing dyslexia early and working with children before the third grade while the brain is still quite plastic and potentially more malleable, enabling the rerouting of neural circuits.

Dyslexia is far more common among prison inmates than the general population, as a result of a series of bad turns that often begin when children who can't read fall into a pattern of failure in school and develop low self-esteem. Some of them turn to bullying or other forms of antisocial behavior to compensate, and this strategy, if left unaddressed, can escalate into criminality.

While it is difficult for learners with dyslexia to gain essential reading skills and this disadvantage can create a constellation of other learning difficulties, the high achievers interviewed for the *Fortune* article argue that some people with dyslexia seem to possess, or to develop, a greater capacity for creativity and problem solving, whether as a result of their neural wiring or the necessity they face to find ways to compensate for their disability. To succeed, many of those interviewed reported that they had to learn at an early age how to grasp the big picture rather than struggling to decipher the component parts, how to think outside the box, how to act strategically, and how to manage risk taking—skills of necessity that, once learned, gave them a decided leg up later in their careers. Some of these skills may indeed have a neurological basis. Experiments by Gadi Geiger and Jerome Lettvin at Massachusetts Institute of Technology have found that individuals with dyslexia do poorly at interpreting information in their visual field of focus when compared to those without dyslexia. However, they significantly outperform others in their ability to interpret information from their peripheral vision,

suggesting that a superior ability to grasp the big picture might have its origins in the brain's synaptic wiring.[4]

There's an enormous body of literature on dyslexia, which we won't delve into here beyond acknowledging that some neurological differences can count for a lot in how we learn, and for some subset of these individuals, a combination of high motivation, focused and sustained personal support, and compensating skills or "intelligences" have enabled them to thrive.

Belief in the *learning styles* credo is pervasive. Assessing students' learning styles has been recommended at all levels of education, and teachers are urged to offer classroom material in many different ways so that each student can take it in the way he or she is best equipped to learn it. Learning styles theory has taken root in management development, as well as in vocational and professional settings, including the training of military pilots, health care workers, municipal police, and beyond. A report on a 2004 survey conducted for Britain's Learning and Skills Research Centre compares more than seventy distinct learning styles theories currently being offered in the marketplace, each with its companion assessment instruments to diagnose a person's particular style. The report's authors characterize the purveyors of these instruments as an industry bedeviled by vested interests that tout "a bedlam of contradictory claims" and express concerns about the temptation to classify, label, and stereotype individuals. The authors relate an incident at a conference where a student who had completed an assessment instrument reported back: "I learned that I was a low auditory, kinesthetic learner. So there's no point in me reading a book or listening to anyone for more than a few minutes."[5] The wrongheadedness of this

conclusion is manifold. It's not supported by science, and it instills a corrosive, misguided sense of diminished potential.

Notwithstanding the sheer number and variety of learning styles models, if you narrow the field to those that are most widely accepted you still fail to find a consistent theoretical pattern. An approach called VARK, advocated by Neil Fleming, differentiates people according to whether they prefer to learn through experiences that are primarily visual, auditory, reading, or kinesthetic (i.e., moving, touching, and active exploration). According to Fleming, VARK describes only one aspect of a person's learning style, which in its entirety consists of eighteen different dimensions, including preferences in temperature, light, food intake, biorhythms, and working with others versus working alone.

Other learning styles theories and materials are based on rather different dimensions. One commonly used inventory, based on the work of Kenneth Dunn and Rita Dunn, assesses six different aspects of an individual's learning style: environmental, emotional, sociological, perceptual, physiological, and psychological. Still other models assess styles along such dimensions as these:

- Concrete versus abstract styles of perceiving
- Active experimentation versus reflective observation modes of processing
- Random versus sequential styles of organizing

The Honey and Mumford Learning Styles Questionnaire, which is popular in managerial settings, helps employees determine whether their styles are predominantly "activist," "reflector," "theorist," or "pragmatist" and to improve in the areas where they score low so as to become more versatile learners.

The simple fact that different theories embrace such wildly discrepant dimensions gives cause for concern about their

scientific underpinnings. While it's true that most all of us have a decided preference for how we like to learn new material, the premise behind learning styles is that we *learn better* when the mode of presentation matches the particular style in which an individual is best *able* to learn. That is the critical claim.

In 2008 the cognitive psychologists Harold Pashler, Mark McDaniel, Doug Rohrer, and Bob Bjork were commissioned to conduct a review to determine whether this critical claim is supported by scientific evidence. The team set out to answer two questions. First, what forms of evidence are needed for institutions to justify basing their instructional styles on assessments of students' or employees' learning styles? For the results to be credible, the team determined that a study would need to have several attributes. Initially, students must be divided into groups according to their learning styles. Then they must be randomly assigned to different classrooms teaching the same material but offering it through different instructional methods. Afterward, all the students must take the same test. The test must show that students with a particular learning style (e.g., visual learners) did the best when they received instruction in their own learning style (visual) relative to instruction in a different style (auditory); in addition, the other types of learners must be shown to profit more from their style of instruction than another style (auditory learners learning better from auditory than from visual presentation).

The second question the team asked was whether this kind of evidence existed. The answer was no. They found very few studies designed to be capable of testing the validity of learning styles theory in education, and of those, they found that virtually none validate it and several flatly contradict it. Moreover, their review showed that it is more important that the mode of instruction match the nature of the *subject* being

taught: visual instruction for geometry and geography, verbal instruction for poetry, and so on. When instructional style matches the nature of the content, all learners learn better, regardless of their differing preferences for how the material is taught.

The fact that the evidence is not there to validate learning styles theory doesn't mean that all theories are wrong. Learning styles theories take many forms. Some may be valid. But if so, we can't know which: because the number of rigorous studies is extremely small, the research base does not exist to answer the question. On the basis of their findings, Pashler and his colleagues argued that the evidence currently available does not justify the huge investment of time and money that would be needed to assess students and restructure instruction around learning styles. Until such evidence is produced, it makes more sense to emphasize the instructional techniques, like those outlined in this book, that have been validated by research as benefiting learners regardless of their style preferences.[6]

Successful Intelligence

Intelligence is a learning difference that we do know matters, but what exactly is it? Every human society has a concept that corresponds to the idea of intelligence in our culture. The problem of how to define and measure intelligence in a way that accounts for people's intellectual horsepower and provides a fair indicator of their potential has been with us for over a hundred years, with psychologists trying to measure this construct since early in the twentieth century. Psychologists today generally accept that individuals possess at least two kinds of intelligence. *Fluid* intelligence is the ability to reason, see relationships, think abstractly, and hold informa-

tion in mind while working on a problem; *crystallized* intelligence is one's accumulated knowledge of the world and the procedures or mental models one has developed from past learning and experience. Together, these two kinds of intelligence enable us to learn, reason, and solve problems.[7]

Traditionally, IQ tests have been used to measure individuals' logical and verbal potential. These tests assign an Intelligence Quotient, which denotes the ratio of mental age to physical age, times 100. That is, an eight-year-old who can solve problems on a test that most ten-year-olds can solve has an IQ of 125 (10 divided by 8, times 100). It used to be thought that IQ was fixed from birth, but traditional notions of intellectual capacity are being challenged.

One countervailing idea, put forward by the psychologist Howard Gardner to account for the broad variety in people's abilities, is the hypothesis that humans have as many as eight different kinds of intelligence:

Logical-mathematical intelligence: ability to think critically, work with numbers and abstractions, and the like;

Spatial intelligence: three-dimensional judgment and the ability to visualize with the mind's eye;

Linguistic intelligence: ability to work with words and languages;

Kinesthetic intelligence: physical dexterity and control of one's body;

Musical intelligence: sensitivity to sounds, rhythms, tones, and music;

Interpersonal intelligence: ability to "read" other people and work with them effectively;

Intrapersonal intelligence: ability to understand one's self and make accurate judgments of one's knowledge, abilities, and effectiveness;

Naturalistic intelligence: the ability to discriminate and relate to one's natural surroundings (for example, the kinds of intelligence invoked by a gardener, hunter, or chef).

Gardner's ideas are attractive for many reasons, not the least because they attempt to explain human differences that we can observe but cannot account for with modern, Western definitions of intelligence with their focus on language and logic abilities. As with learning styles theory, the multiple intelligences model has helped educators to diversify the kinds of learning experiences they offer. Unlike learning styles, which can have the perverse effect of causing individuals to perceive their learning abilities as limited, multiple intelligences theory elevates the sheer variety of tools in our native toolkit. What both theories lack is an underpinning of empirical validation, a problem Gardner himself recognizes, acknowledging that determining one's particular mix of intelligences is more an art than a science.[8]

While Gardner helpfully expands our notion of intelligence, the psychologist Robert J. Sternberg helpfully distills it again. Rather than eight intelligences, Sternberg's model proposes three: analytical, creative, and practical. Further, unlike Gardner's theory, Sternberg's is supported by empirical research.[9]

One of Sternberg's studies of particular interest to the question of how we measure intelligence was carried out in rural Kenya, where he and his associates looked at children's informal knowledge of herbal medicines. Regular use of these medicines is an important part of Kenyans' daily lives. This knowledge is not taught in schools or assessed by tests, but children who can identify the herbs and who know their appropriate uses and dosages are better adapted to succeed in their environment than children without that knowledge. The children who performed *best* on tests of this indigenous informal knowledge did *worst* relative to their peers on tests of the

formal academic subjects taught in school and, in Sternberg's words, appeared to be "stupid" by the metric of the formal tests. How to reconcile the discrepancy? Sternberg suggests that the children who excelled at indigenous knowledge came from families who valued such practical knowledge more highly than the families of the children who excelled at the academics taught in school. Children whose environments prized one kind of learning over another (practical over academic, in the case of the families who taught their children about herbs) were at a lower level of knowledge in the academic areas not emphasized by their environment. Other families placed more value on the analytic (school-based) information and less on the practical herbal knowledge.

There are two important ideas here. First, traditional measures of intelligence failed to account for environmental differences; there is no reason to suspect that kids who excelled at informal, indigenous knowledge can't catch up to or even surpass their peers in academic learning when given the appropriate opportunities. Second, for the kids whose environments emphasized indigenous knowledge, the mastery of academics is still developing. In Sternberg's view, we're all in a state of developing expertise, and any test that measures only what we know at any given moment is a static measure that tells us nothing about our *potential* in the realm the test measures.

Two other quick stories Sternberg cites are useful here. One is a series of studies of orphaned children in Brazil who must learn to start and run street businesses if they are to survive. Motivation is high; if they turn to theft as a means to sustain themselves, they risk running afoul of the death squads. These children, who are doing the math required in order to run successful businesses, cannot do the same math when the problems are presented in an abstract, paper-and-pencil

format. Sternberg argues that this result makes sense when viewed from the standpoint of developing expertise: the children live in an environment that emphasizes practical skills, not academic, and it's the practical exigencies that determine the substance and form of the learning.[10]

The other story is about seasoned, expert handicappers at horse tracks who devise highly complex mental models for betting on horses but who measure only average on standard IQ tests. Their handicapping models were tested against those devised by less expert handicappers with equivalent IQs. Handicapping requires comparing horses against a long list of variables for each horse, such as its lifetime earnings, its lifetime speed, the races where it came in the money, the ability of its jockey in the current race, and a dozen characteristics of each of its prior races. Just to predict the speed with which a horse would run the final quarter mile, the experts relied on a complex mental model involving as many as seven variables. The study found that IQ is unrelated to handicapping ability, and "whatever it is that an IQ test measures, it is not the ability to engage in cognitively complex forms of multivariate reasoning."[11]

Into this void Robert Sternberg has introduced his three-part theory of successful intelligence. *Analytical* intelligence is our ability to complete problem-solving tasks such as those typically contained in tests; *creative* intelligence is our ability to synthesize and apply existing knowledge and skills to deal with new and unusual situations; *practical* intelligence is our ability to adapt to everyday life—to understand what needs to be done in a specific setting and then do it; what we call street smarts. Different cultures and learning situations draw on these intelligences differently, and much of what's required to succeed in a particular situation is not measured by standard IQ or aptitude tests, which can miss critical competencies.

Dynamic Testing

Robert Sternberg and Elena Grigorenko have proposed the idea of using testing to assess ability in a dynamic manner. Sternberg's concept of developing expertise holds that with continued experience in a field we are always moving from a lower state of competence to a higher one. His concept also holds that standardized tests can't accurately rate our potential because what they reveal is limited to a static report of where we are on the learning continuum at the time the test is given. In tandem with Sternberg's three-part model of intelligence, he and Grigorenko have proposed a shift away from static tests and replacing them with what they call dynamic testing: determining the state of one's expertise; refocusing learning on areas of low performance; follow-up testing to measure the improvement and to refocus learning so as to keep raising expertise. Thus, a test may assess a weakness, but rather than assuming that the weakness indicates a fixed inability, you interpret it as a lack of skill or knowledge that can be remedied. Dynamic testing has two advantages over standard testing. It focuses the learner and teacher on areas that need to be brought up rather than on areas of accomplishment, and the ability to measure a learner's progress from one test to the next provides a truer gauge of his or her learning potential.

Dynamic testing does not assume one must adapt to some kind of fixed learning limitation but offers an assessment of where one's knowledge or performance stands on some dimension and how one needs to move forward to succeed: what do I need to learn in order to improve? That is, where aptitude tests and much of learning styles theory tend to emphasize our strengths and encourage us to focus on them, dynamic testing helps us to discover our weaknesses and correct them.

In the school of life experience, setbacks show us where we need to do better. We can steer clear of similar challenges in the future, or we can redouble our efforts to master them, broadening our capacities and expertise. Bruce Hendry's experiences investing in rental property and in the stock market dealt him setbacks, and the lessons he took away were essential elements of his education: to be skeptical when somebody's trying to sell him something, to figure out the right questions, and to learn how to go dig out the answers. That's developing expertise.

Dynamic testing has three steps.

Step 1: a test of some kind—perhaps an experience or a paper exam—shows me where I come up short in knowledge or a skill.

Step 2: I dedicate myself to becoming more competent, using reflection, practice, spacing, and the other techniques of effective learning.

Step 3: I test myself again, paying attention to what works better now but also, and especially, to where I still need more work.

When we take our first steps as toddlers, we are engaging in dynamic testing. When you write your first short story, put it in front of your writers' group for feedback, and then revise and bring it back, you're engaging in dynamic testing, learning the writer's craft and getting a sense of your potential. The upper limits of your performance in any cognitive or manual skill may be set by factors beyond your control, such as your intelligence and the natural limits of your ability, but most of us can learn to perform nearer to our full potential in most areas by discovering our weaknesses and working to bring them up.[12]

Structure Building

There do appear to be cognitive differences in how we learn, though not the ones recommended by advocates of learning styles. One of these differences is the idea mentioned earlier that psychologists call structure building: the act, as we encounter new material, of extracting the salient ideas and constructing a coherent mental framework out of them. These frameworks are sometimes called mental models or mental maps. High structure-builders learn new material better than low structure-builders. The latter have difficulty setting aside irrelevant or competing information, and as a result they tend to hang on to too many concepts to be condensed into a workable model (or overall structure) that can serve as a foundation for further learning.

The theory of structure building bears some resemblance to a village built of Lego blocks. Suppose you're taking a survey course in a new subject. You start with a textbook full of ideas, and you set out to build a coherent mental model of the knowledge they contain. In our Lego analogy, you start with a box full of Lego pieces, and you set out to build the town that's pictured on the box cover. You dump out the pieces and sort them into a handful of piles. First you lay out the streets and sidewalks that define the perimeter of the city and the distinct places within it. Then you sort the remaining pieces according to the elements they compose: apartment complex, school, hospital, stadium, mall, fire station. Each of these elements is like a central idea in the textbook, and each takes more shape and nuance as added pieces snap into place. Together, these central ideas form the larger structure of the village.

Now suppose that your brother has used this Lego set before and dumped some pieces into the box from another set.

As you find pieces, some might not fit with your building blocks, and you can put them aside as extraneous. Or you may discover that some of the new pieces can be used to form a substructure of an existing building block, giving it more depth and definition (porches, patios, and back decks as substructures of apartments; streetlights, hydrants, and boulevard trees as substructures of streets). You happily add these pieces to your village, even though the original designers of the set had not planned on this sort of thing. High structure-builders develop the skill to identify foundational concepts and their key building blocks and to sort new information based on whether it adds to the larger structure and one's knowledge or is extraneous and can be put aside. By contrast, low structure-builders struggle in figuring out and sticking with an overarching structure and knowing what information needs to fit into it and what ought to be discarded. Structure building is a form of conscious and subconscious discipline: stuff fits or it doesn't; it adds nuance, capacity and meaning, or it obscures and overfreights.

A simpler analogy might be a friend who wants to tell you a rare story about this four-year-old boy she knows: she mentions who the mother is, how they became friends in their book club, finally mentioning that the mother, by coincidence, had a large load of manure delivered for her garden on the morning of the boy's birthday—the mother's an incredible gardener, her eggplants took a ribbon at the county fair and got her an interview on morning radio, and she gets her manure from that widowed guy in your church who raises the Clydesdale horses and whose son is married to—and so on and so on. Your friend cannot winnow the main ideas from the blizzard of irrelevant associations, and the story is lost on the listener. Story, too, is structure.

Our understanding of structure building as a cognitive difference in learning is still in the early stages: is low structure-building the result of a faulty cognitive mechanism, or is structure-building a skill that some pick up naturally and others must be taught? We know that when questions are embedded in texts to help focus readers on the main ideas, the learning performance of low structure-builders improves to a level commensurate with high structure-builders. The embedded questions promote a more coherent representation of the text than low-structure readers can build on their own, thus bringing them up toward the level achieved by the high structure-builders.

What's happening in this situation remains an open question for now, but the implication for learners seems to reinforce a notion offered earlier by the neurosurgeon Mike Ebersold and the pediatric neurologist Doug Larsen: that cultivating the habit of reflecting on one's experiences, of making them into a story, strengthens learning. The theory of structure building may provide a clue as to why: that reflecting on what went right, what went wrong, and how might I do it differently next time helps me isolate key ideas, organize them into mental models, and apply them again in the future with an eye to improving and building on what I've learned.[13]

Rule versus Example Learning

Another cognitive difference that appears to matter is whether you are a "rule learner" or "example learner," and the distinction is somewhat akin to the one we just discussed. When studying different kinds of problems in a chemistry class, or specimens in a course on birds and how to identify them, rule learners tend to abstract the underlying principles or "rules"

that differentiate the examples being studied. Later, when they encounter a new chemistry problem or bird specimen, they apply the rules as a means to classify it and select the appropriate solution or specimen box. Example learners tend to memorize the examples rather than the underlying principles. When they encounter an unfamiliar case, they lack a grasp of the rules needed to classify or solve it, so they generalize from the nearest example they can remember, even if it is not particularly relevant to the new case. However, example learners may improve at extracting underlying rules when they are asked to compare two different examples rather than focus on studying one example at a time. Likewise, they are more likely to discover the common solution to disparate problems if they first have to compare the problems and try to figure out the underlying similarities.

By way of an illustration, consider two different hypothetical problems faced by a learner. These are taken from research into rule learning. In one problem, a general's forces are set to attack a castle that is protected by a moat. Spies have learned that the bridges over the moat have been mined by the castle's commander. The mines are set to allow small groups to cross the bridges, so that the occupants of the castle can retrieve food and fuel. How can the general get a large force over the bridges to attack the castle without tripping the mines?

The other problem involves an inoperable tumor, which can be destroyed by focused radiation. However, the radiation must also pass through healthy tissue. A beam of sufficient intensity to destroy the tumor will damage the healthy tissue through which it passes. How can the tumor be destroyed without damaging healthy tissue?

In the studies, students have difficulty finding the solution to either of these problems unless they are instructed to look

for similarities between them. When seeking similarities, many students notice that (1) both problems require a large force to be directed at a target, (2) the full force cannot be massed and delivered through a single route without an adverse outcome, and (3) smaller forces can be delivered to the target, but a small force is insufficient to solve the problem. By identifying these similarities, students often arrive at a strategy of dividing the larger force into smaller forces and sending these in through different routes to converge on the target and destroy it without setting off mines or damaging healthy tissue. Here's the payoff: after figuring out this common, underlying solution, students are then able to go on to solve a variety of different convergence problems.[14]

As with high and low structure-builders, our understanding of rule versus example learners is very preliminary. However, we know that high structure-builders and rule learners are more successful in transferring their learning to unfamiliar situations than are low structure-builders and example learners. You might wonder if the tendency to be a high structure-builder is correlated with the tendency to be a rule learner. Unfortunately, research is not yet available to answer this question.

You can see the development of structure-building and rule-learning skills in a child's ability to tell a joke. A three-year-old probably cannot deliver a knock-knock joke, because he lacks an understanding of structure. You reply "Who's there?" and he jumps to the punch line: "Door is locked, I can't get in!" He doesn't understand the importance, after "Who's there?", of replying "Doris" to set up the joke. But by the time he's five, he has become a knock-knock virtuoso: he has memorized the structure. Nonetheless, at five he's not yet adept at other kinds of jokes because he hasn't yet learned the essential element that makes jokes work, which, of course,

is the "rule" that a punch line of any kind needs a setup, explicit or implied.[15]

If you consider Bruce Hendry's early lesson in the high value of a suitcase full of scarce fireworks, you can see how, when he looks at boxcars many years later, he's working with the same supply-and-demand building block, but within a much more complex model that employs other blocks of knowledge that he has constructed over the years to address concepts of credit risk, business cycles, and the processes of bankruptcy. Why are boxcars in surplus? Because tax incentives to investors had encouraged too much money to flow into their production. What's a boxcar worth? They cost $42,000 each to build and were in like-new condition, as they had been some of the last ones built. He researched the lifespan of a boxcar and its scrap value and looked at the lease contracts. Even if all his cars stood idle, the lease payments would pay a pretty yield on his investment while the glut worked through the system and the market turned around.

Had we been there, we would have bought boxcars, too. Or so we'd like to think. But it's not like filling a satchel with fireworks, even if the underlying principle of supply and demand is the same. You had to buy the boxcars right, and understand the way to go about it. What in lay terms we call *knowhow.* Knowledge is not knowhow until you understand the underlying principles at work and can fit them together into a structure larger than the sum of its parts. Knowhow is learning that enables you to *go do.*

The Takeaway

Given what we know about learning differences, what's the takeaway?

Be the one in charge. There's an old truism from sales school that says you can't shoot a deer from the lodge. The same goes for learning: you have to suit up, get out the door, and find what you're after. Mastery, especially of complex ideas, skills, and processes, is a quest. It is not a grade on a test, something bestowed by a coach, or a quality that simply seeps into your being with old age and gray hair.

Embrace the notion of successful intelligence. Go wide: don't roost in a pigeonhole of your preferred learning style but take command of your resources and tap all of your "intelligences" to master the knowledge or skill you want to possess. Describe what you want to know, do, or accomplish. Then list the competencies required, what you need to learn, and where you can find the knowledge or skill. Then go get it.

Consider your expertise to be in a state of continuing development, practice dynamic testing as a learning strategy to discover your weaknesses, and focus on improving yourself in those areas. It's smart to build on your strengths, but you will become ever more competent and versatile if you also use testing and trial and error to continue to improve in the areas where your knowledge or performance are not pulling their weight.

Adopt active learning strategies like retrieval practice, spacing, and interleaving. Be aggressive. Like those with dyslexia who have become high achievers, develop workarounds or compensating skills for impediments or holes in your aptitudes.

Don't rely on what feels best: like a good pilot checking his instruments, use quizzing, peer review, and the other tools described in Chapter 5 to make sure your judgment of what you know and can do is accurate, and that your strategies are moving you toward your goals.

Don't assume that you're doing something wrong if the learning feels hard. Remember that difficulties you can overcome with greater cognitive effort will more than repay you in the depth and durability of your learning.

Distill the underlying principles; build the structure. If you're an example learner, study examples two at a time or more, rather than one by one, asking yourself in what ways they are alike and different. Are the differences such that they require different solutions, or are the similarities such that they respond to a common solution?

Break your idea or desired competency down into its component parts. If you think you are a low structure-builder or an example learner trying to learn new material, pause periodically and ask what the central ideas are, what the rules are. Describe each idea and recall the related points. Which are the big ideas, and which are supporting concepts or nuances? If you were to test yourself on the main ideas, how would you describe them?

What kind of scaffold or framework can you imagine that holds these central ideas together? If we borrowed the winding stair metaphor as a structure for Bruce Hendry's investment model, it might work something like this. Spiral stairs have three parts: a center post, treads, and risers. Let's say the center post is the thing that connects us from where we are (down here) to where we want to be (up there): it's the investment opportunity. Each tread is an element of the deal that protects us from losing money and dropping back, and each riser is an element that lifts us up a notch. Treads and risers must both be present for the stairs to function and for a deal to be attractive. Knowing the scrap value of boxcars is a tread—Bruce knows he won't get less than that for his investment. Another tread is the guaranteed lease income while his

capital is tied up. What are some risers? Impending scarcity, which will raise values. The like-new condition of the cars, which is latent value. A deal that doesn't have treads and risers will not protect the downside or reliably deliver the upside.

Structure is all around us and available to us through the poet's medium of metaphor. A tree, with its roots, trunk, and branches. A river. A village, encompassing streets and blocks, houses and stores and offices. The structure of the village explains how these elements are interconnected so that the village has a life and a significance that would not exist if these elements were scattered randomly across an empty landscape.

By abstracting the underlying rules and piecing them into a structure, you go for more than knowledge. You go for know-how. And that kind of mastery will put you ahead.