Playing with the Multiple Intelligences

How Play Helps Them Grow

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Howard Gardner first posited a list of "multiple intelligences" as a liberating alternative to the assumptions underlying traditional IQ testing in his widely read study *Frames of Mind* (1983). Play has appeared only in passing in Gardner's thinking about intelligence, however, even though play instructs and trains the verbal, interpersonal, intrapersonal, logical, spatial, musical, and bodily intelligences that Gardner regards as original human endowments. Playing out of doors also enhances and exercises the faculty that Gardner later marked as the naturalist intelligence. As recess dwindles in American schools, and as free play shrinks in the childhood experience, this article finds fresh cause to inspect the merits of multiple-intelligence theory through the lens of play. **Key words**: bodily-kinesthetic intelligence; Howard Gardner; interpersonal intelligence; intrapersonal intelligence; logical intelligences; multiple intelligences; musical intelligence, naturalist intelligence; spatial intelligence; verbal intelligence

Playing pays dividends by developing our mental, physical, and social skills. The insights we derive from "This Little Piggy" and $E=MC^2$ are both rooted in play. Rarely do we deliberately set out to learn by playing. Yet play educates us broadly and deeply early on and throughout our lives. At the very beginning of our lives, we learn language in game-like interchanges with fluent speakers. Later we sharpen our vocabularies with wordplay. We explore the concepts of number and sequence in games. We tune our ears with song, chant, and rhyme. We play with our sense of space and train our appreciation of color with finger paints and computer graphics. We learn to appreciate our orientation, our location and position, and our sense of the space around us by climbing a tree, catching a ball, casting a lure, or jumping a rope. We explore the natural world by scrambling through a leaf pile, snapping a fragrant sassafras stem, chasing an ant with a stick, toasting a marshmallow, or collecting rocks. At play with others, we negotiate our place in the world and sort out our sense of ourselves as we take stock of our capabilities.

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Because the kinds of play vary so widely, tallying the profit in play requires that we take a broad view of human capability and talent. And because we tend to view talent instrumentally, according to the end it serves, that broad view does not come naturally or easily. In fact, the traditional psychometric tests invented early in the twentieth century relied heavily on measuring just two aspects of human aptitude—verbal and computational skills—and left out the bulk of mental, physical, and social ability. By the 1980s, dissatisfaction with the shortcomings and inequities of traditional intelligence tests incited one cognitive psychologist, Harvard University's Howard Gardner, to posit an alternative constellation first of seven, then of eight fundamental aptitudes that define the human mental range. He initially listed linguistic intelligence, interpersonal intelligence, intrapersonal intelligence, logical-mathematical intelligence, spatial intelligence, musical intelligence, and a bodily-kinesthetic intelligence that met a series of criteria (or, as he called them, "signs."). In the mid-1990s, Gardner, persuaded by new neurological evidence, found that a naturalist intelligence passed his test, and so he included that, too, among the endowments that lay at the human core.[1] The democratic character of Gardner's list heartened critics who thought the three-quarter-century-old, statistical science behind traditional Intelligence-Quotient (I.Q.) testing narrow, biased, and even racist.[2] They found in Gardner's aptitudes a way to appraise human ability more broadly, more practically, and more fairly.

Though Gardner's view sweeps across the range of human talent, play is conspicuously missing from his demonstrations of human intelligences. Despite Gardner's fluency with the work of Jean Piaget and Erik Erikson (thinkers who were interested in both development and play), it may well be that Gardner's interest in intelligence in the adult—essentially in measuring the end state of intelligence, not its development—steered his thinking away from play, because play, of course, is primarily associated with children. So, regardless of the fact that we learn language by playing with words; that we learn to navigate social space by seeking out playmates; that we generate ideas by abandoning ourselves to private fantasy or group brainstorming; that we explore our sense of numbers by playing counting games; that we expand our appreciation of visual and aural space by painting, drawing, and singing; that we train our muscles and our sense of balance by dancing, bicycle riding, golfing, and skiing—regardless of all that—no separate discussion of play and learning appears in Gardner's influential and widely admired *Frames of Mind* (1983).

In fact Gardner's text mentions play only once in its 496 pages. Playfulness merits a narrow discussion in relation to the sensitivities of musical composers to mathematical patterns when Gardner alludes to Mozart's *Musikalisches Würfelspeil* as a mischievous and cocky experiment with randomizing minuet variations according to a dice roll.

Play occurs in Gardner's reexamination of his theory only indirectly in the instance of what he calls a "cultural product," and once again, he focuses on the adult end state, discussing the implications of "creating an end to a story," say, or of "anticipating a mating move in chess," or of "repairing a quilt." Even in Gardner's study of creativity, *Creating Minds* (1994), play appears only in the context of Freud's musing about the nearness of creative writing and daydreaming to play. Play crops up only obliquely in Gardner's sequel, *Intelligence Reframed* (1999). In the retrospective *Multiple Intelligences: New Horizons in Theory and Practice* (2006), Gardner describes debate matches, jigsaw kibitzing, and role playing at school as instances of "well-designed group *work*" (my emphasis). When Gardner recently prescribed the five "minds" that we will need to "thrive in the world in the eras to come," he included the "disciplined mind," "the synthesizing mind," "the creating mind," "the respectful mind," and "the ethical mind." The *playful* mind did not make the cut.[3]

In this essay, I do not fault Gardner for failing to write the books he did not intend to; again, had he become interested in development as a process rather than in intelligence as a product, his thinking may more easily have pointed to play. Instead, I note the way play expresses the multiple intelligences and helps them grow, often in concert. And further, I observe how, by describing a wide swath of human ability, the multiple intelligences offer a convenient checklist for the instructive and enriching effects of play. Finally, I mark some urgency in the errand because, as the intelligences have come to be appreciated widely among progressive educators in Gardner's audience, reading the multiple intelligences in the light of play should instruct the way teachers teach.

At the same time, I do not join the continuing debate around the ontological status of the concept of "multiple intelligence." Scholars will surely continue to argue the propriety of making such a list of intelligences, however long and inclusive, in the first place.[4] A student of play need not regard the multiple intelligences as innate, immutable, or above criticism—nor should I need to claim that the list of them is complete—before finding the constructs themselves useful in describing the benefits of free and structured play. I do not even need to insist that the intelligences are independent or entirely distinct. Instead, my argument means to reveal how the most basic of mammalian talents, our ability to play, expresses a variety of human gifts.

Playing on Words: The Linguistic Intelligence

First and most uniquely among mammals, play trains and exercises what Gardner calls human linguistic intelligence in obvious and subtle ways. Linguist Stephen Pinker describes children as “lexical vacuum cleaners” for the way they powerfully suck up words. Toddlers add a new word to their lifelong dictionary every two hours, and they do it mostly through a process of playful experimentation and mimicry. Parents know that this continual game entails encouraging repetition, feigned surprise, interactive pantomime, and call and response: “Light, yes, *light*”; “Hot! Oooh, ouch! Yes, *hot*.” The acquisition rate is so rapid that by the time children are six, they will know about thirteen thousand words, Pinker says, and they accomplish this feat “despite those dull, dull, *Dick and Jane* reading primers which are based on ridiculously lowball estimates.”[5]

Along the way, children learn the strange and difficult tricks that language plays, too. Two-year-olds still confuse “you” and “me,” for example, because when I say “you” I mean *you*, and when you say “you” you mean *me*, and it takes some time playing around with it to get this subtlety straight. British linguist Guy Cook notes the “predominance of play in all areas of human life, language in particular.” The feeling for rhythm, rhyme, assonance, consonance, and even grammatical structure emerges from play according to Cook, as learners take pleasure in the sounds and comforting society that go into making words and building vocabulary.[6]

A noticeable feature of individual development, language also figured prominently in human social evolution. Modern humans, people like us, emerged about 150,000 years ago. Our vocal apparatus has not changed much in that time, but about 100,000 years ago or more, small technological innovations began to appear that showed progress in fine workmanship, and the cognitive and behavioral evolution that enabled fine workmanship in the Lower Paleolithic may also have favored development of language. A remarkable efflorescence of invention and exploration that began in the Upper Paleolithic some 40,000 years ago has come with justification to be called the Great Leap Forward. The colonizing groups who moved out of Africa at that time soon brought the world small, finely crafted thin stone blades, specialized tools like hooks and harpoons, transportable shelters for people on the move, miniature statuary that may have been devotional objects or playthings, cave painting, jewelry, and personal ornamentation. And these explorers solved problems as they moved north and east, too, inventing warm clothing and boats, for example, to meet the challenges of climate and transportation.[7]

Language existed before the time of the Great Leap Forward. It is likely that planning to move and adapting to new terrain required not just new technology and new materials, but migrating also required our ancestors to continually develop a more specific and discriminating terminology, the way it has of modern hunter-gatherers like the Inuit.[8] Today we can still hear the echoes of original speech in the phonemic richness of clicks, whistles, ejectives, implosives, and a great variety of other sounds distinctive to the many languages of Southern and Western Africa. But after languages moved out of Africa about 50,000 years ago, the sounds grew simplier. Hawaiian, a recent language at the end of a long migration, holds less than a tenth of the variety of sound of its African progenitors.[9]

Evolutionary biologist Richard Dawkins and others have speculated that something else peculiar and wonderful happened to language around the time of the Great Leap Forward: people discovered the conditional tense. "At a stroke," Dawkins wrote, "the new grammatical trick . . . would have enabled 'what-if' imagination to flower." Migrating humans thus discovered something else crucial to survival—how to pretend and speculate. Evidence of the process, the representational art we know from a few surviving paintings in ancient caves, encouraged people to imagine and talk about things not present.[10] Imagining, pretending, planning, projecting, and conceptualizing, in turn, enabled playful storytelling that helped people make sense of a threatening and unpredictable world.

Play also matters to the development of that most specialized skill of linguistic intelligence—writing. Writing first appeared at the end of the Great Leap Forward, seven or eight thousand years ago, wherever people began to settle from nomadic lives. Civilization came to depend on agricultural surplus, and stored grain needed keeping track of. Such an accounting demanded writing systems carved on tortoise shells, incised on soft clay tablets, or, eventually, inscribed on paper—none of it much fun. True, to become a scribe was to join a venerable, priestly class, but it also meant having to learn to write. From the start, the path most pupils followed to literacy proved a trail of toil and tears. Lucian, the second-century Roman satirist, for example, remembered the thrashings his teachers dealt out when he scraped the wax off his writing tablet to make toy animals.[11] Critics (many of them, no doubt, former victims) long urged reading and writing teachers to take the sting out by incorporating play into their students' learning. In 1693 the empiricist philosopher John Locke, for example, insisted that learning to read "must never be imposed as a task, nor made a trouble." And to remove the drudgery and punishment, he pointed out that "dice and play-things, with the letters on them to teach children the alphabet by playing" would "make this kind of learning a sport." Two and a half centuries later, Locke's American heir, John Dewey, also took pains to ponder the relationship of necessary work to play where learning is concerned, and he echoed the sentiment. "Where something approaching drudgery or the need of fulfilling externally imposed tasks exists," Dewey said, "the demand for play persists. . . . No demand of human nature is more urgent or less to be escaped."[12]

We humans may not be wired for language as specifically as Gardner and others claim, but we are surely wired for prosody, the sense for sound, rhythm, cadence, intonation, stress, and sequence containing the patterns of language and the music of speech. As the Welsh neuro-biologist Colwyn Trevarthen explained, this musicality "precedes and underlies" language both in the development of the child and in the evolution of humanity itself. A focus on adult intelligence led Gardner to separate linguistic, musical, and bodily intelligence, but when viewed developmentally, from an evolutionary perspective and in the context of play, the intelligences seem more complementary and less distinct. Trevarthen is one thinker who sees more connection than distinction.[13] One easy way to observe how the musical and linguistic intelligences are linked, for instance, is to try reciting the alphabet backwards. You will find this game difficult, but try singing the alphabet song backwards and you will likely find it impossible because a song flows forward. The last four notes of the alphabet song descend in a musical phrase that is so memorable that it is hard to reverse.

I discuss Gardner's musical intelligence more fully later, so here, I will just note that mnemonics like the alphabet song have long demonstrated the linguistic intelligence at play; the ancient history of memory games stretches back to a time long before literate people could claim ready access to notepads, PowerPoint, and Wikipedia. The startlingly accurate lore and literature of preliterate people depended on the capacious memories of the keepers of their oral cultures: troubadours and praise singers, griots and bards. The rapsodes of Greece, though literate, also depended on rhyme, rhythm, alliteration, and other wordplay to assist their prodigious recall.[14]

Games and tricks helped Greek and Roman orators deliver long speeches without notes. They imagined traveling through a "memory house," an unfolding mental image of a building that would carry some item or fact as signage on every architectural detail outside and in every room inside.[15] Simpler games like acronyms and rhymes still help us remember sets of facts: "every good boy does fine" cues beginning piano students to remember the notes of the g-clef; "Roy G. Biv" sequences the visible spectrum; "homes" tags the Great Lakes, though against the flow. We look to play for instruction: occasional screwdriver users apply the catchy verse "righty tighty, lefty loosey." But far more complicated games instruct students of anatomy and medicine, law, theology, geology, natural history, and grammar in the vocabulary and conceptual schemes that inhere in their specialized idioms. To remember their large inside lingos, professionals often depend upon a song, acronym, rhyme, or ribald joke.[16]

If specialized terminologies are impressive in their volume and variety, our large, ordinary lexicon is as well; a high school senior may have learned 45,000 words in the usual way by graduation. Here, too, play serves as a powerful vocabulary coach. The highest ranks of professional Scrabble players, for instance, store more than 120,000 "official" words in their ready memory. Random amusing linguistic events like slips of the tongue and tongue twisters make us laugh by prying apart the usual order. Storytellers, on the other hand, playfully but deliberately compose order. Jokes, the shortest of short stories, show how clearly order emerges when playing with language. Consider, for instance, this brief and uncluttered example composed of a mere thirteen words from exposition to climax: "A horse walks into a bar; the bartender says, 'Why the long face?'" But thick, erudite novels like *Gravity's Rainbow* and *The Satanic Verses* lie at the opposite end of the scale. James Joyce based his experimental work *Finnegan's Wake* on a *perpetuum mobile*, a comic children's song that begins where it ends: "There was an old man named Michael Finnegan/ he grew whiskers on his chinnegan/ he shaved them off and they grew in again/ Poor old Michael Finnegan; Begin again. . . ." The universe of wordplay lies in between the children's song and the sprawling novel. We play at acrostics, anagrams, Burma-Shave signs, codes, crossword puzzles, dingbats (ginkool = looking backwards), doubletalk in dialect, homonyms and heteronyms, jingles, knock-knock jokes, Klingon and Elvish, malapropisms, non sequiturs, palindromes, parodies, pig Latin, punny names for pleasure boats, riddles, rap, rebuses, rhymes, regionalisms, slang, Tom Swifties, and droll word-number puzzles on vanity license plates.

Those who have listened closely to the language of playing children and recorded their conversations have found that pretense, plot, and character tumble through the storylines that they generate on impulse, but continually. Pioneering folklorist Brian Sutton-Smith, who mined a rich lode of storytelling at a grade school in New York City in the early 1970s, noted that children's fast-paced, evolving, nonsensical, frequently hilarious, and episodic stories—"childish phantasmagoria" he memorably called them—swell with playful rhyme, alliteration, "crazy titles," disastrous twists, dark thoughts, and obscenity on the one side, and with extracted morals on the other. Set in a "world of great flux and anarchy," their stories contained an "infinity of nuances."[17]

Others found children's cooperative improvised stories more ordered and integrating for the storytellers, with the oral culture developing in range and sophistication alongside the developing language capabilities of the peer group. Sociodramatic play is "improvisational rehearsal" to sociologist of education R. Keith Sawyer. And so the evolving story a child generates is part of an "emergent" system that brings order and complexity out of disparate, chaotic elements. [18]

Understanding the Interpersonal Intelligence

Kids' understanding that emerges spontaneously from literary play rehearses their greater social understanding—Gardner's interpersonal intelligence. In fact, the path toward literacy is itself an emerging understanding rooted in playful social give-and-take. Kids will follow the wacky plots wherever they lead, create meaning while they pretend, and—this is crucial—they explore the relationships that their narratives create. Fun keeps them at it and keeps them together. The rolling improvisational theater that children create enriches the growing appreciation of cause and effect, motivation and consequence, and the boundaries that created characters themselves create out of their own character. But most important, pretending—sociodramatic play—stirs a moral narrative that orders the world, and so players as young as five years old impose on it the moral order that stems from rule making inherent in play.[19] This builds the foundation of interpersonal intelligence.

Play instructs us about both cooperation and competition—playing along and playing against—and in this way helps exercise and train our interpersonal intelligence. Playing together would not be possible were it not for the interpersonal intelligence that lets us "notice and make distinctions among other individuals and, in particular, among their moods, temperaments, motivations, and intentions," as Gardner put it.[20] Nor would prolonged competitive play be possible without the leeway and forgiveness that grants players a measure of trust. Thus play sharpens both the talent for empathy and the cooperation and appetite for competition.

Gender is as important as time and place in shaping play, of course. When Vivian Paley observed another kindergarten class with an eye toward the differences between girls and boys at play, she found the gender differences striking, a reasonable and significant finding when policy makers were urging blindness toward differences. At play, players divided along lines of girls seeking to find how they fit in and boys struggling to stand out. In her kind and observant book *Boys and Girls: Superheroes in the Doll Corner* (1984), Paley noted that though girls and boys played very differently and with different aims, they both ended with play as an exercise in interpersonal intelligence.

The funniest gender-revealing incident happened in Paley's classroom at the Chinese New Year celebration when, fatefully, the teachers decided that a single, elongated, student-decorated parade dragon would be harder to manage in the school's hallway than would a dragon divided in two and walking side-by-side. One side, the orderly side controlled by girls, would be decked with flowers. The other, which featured a Star Wars motif, would run on boy power. Colored red and yellow with rocket flashes, the boys' dragon "seemed to breathe fire from every jagged point," Paley wrote. Meanwhile, the girls' dragon—having sprouted fragile doilies and valentines—seemed vulnerable to damage by the boys' rambunctious beast.

Within a few steps of the start of the parade, the boy's jostling dragon began to tear and fray; the girls' dragon "barely fluttered" as the girls within stayed in line. Paley warned the boys to "stop growling" and hoped against hope that they would declare a truce. But their dragon tore further as "heads, arms, and legs thrust in all directions, jerking and ducking into the dragon." After singing the Chinese song that capped the presentation, the boys raced through the hallway carrying dragon fragments, merrily unaware that they had "mutilated their dragon and disrupted the parade." "What did you think of the parade?" Paley asked the boys after they had settled down. "Great! We had a great dragon!" For the boys, a great dragon was one that could be tricked and slain from inside. Theirs was an expendable dragon. The girls, for their part, were well pleased with the compliments they received for the pretty, undamaged dragon that they admired as it hung on the classroom wall.[21]

Like Paley's side-by-side dragons, any other game organized by teams draws on and deepens the interpersonal intelligence. It is the context that determines the content of play. Perhaps the most planned of all games, American football, depends on controlled corporate coordination and maximum specialization in a tightly time-managed contest. (Positions are not just specialized by function, but increasingly among varsity and professional football players, the very bodies and minds of the players reflect the part they play—none will mistake a deep safety for an offensive tackle.) With only a few exceptions, football coaches—the field generals who devise strategy and train their players in tactics—dislike surprises that signal deviation from the game plan.[22]

But one relationship that lies at the heart of the game draws deeply and more spontaneously from the interpersonal intelligence, and that is the understanding that passes between quarterback and receiver. This relationship resists the premeditation and managerial control of other plays. The downfield pass speaks to our point about developing bodily-kinesthetic and interpersonal intelligence. A good quarterback will not throw a long pass to his capable receiver; he will throw to that point where he has good reason to expect his receiver will soon be. Further, a successfully completed pass depends not just on calculating speed and distance, the way a duck hunter or bicyclist will anticipate and measure. Completing a long pass depends more on shared insight: the receiver understands the quarterback's habits, and the quarterback understands the receiver's downfield tricks and feints.

Imagine team sports as a sliding scale with closely managed and coached from above American football at one end and freer games such as soccer, ice hockey, lacrosse, and basketball at the other. These latter games, when played at a high level, develop in a fluid, inspired way that depends on the skill, insight, and mutual understanding that lets teammates adjust on the fly to changing patterns of play and yet still remain a team. Mihaly Csikszentmihalyi called this fluid mutual understanding "flow."[23] Conversely, when young and inexperienced teams play in zones, a formal version of the professionals' inspiration, they have only the rules and the coaches' strategies to guide them, and so they are vulnerable to tactics that change the conditions of play. In time and with practice, young teams and their rookie coaches learn to respond to surprises and so become seasoned, responsive, more understanding, and poised players.

If play does not always grant players poise, it nevertheless gives players the excuse to gather and mingle, and it imposes the necessity to organize (however loosely), the requirement to agree (however freely), and a common purpose in creating fun (however briefly). The Sunday picnic and the Saturday barbecue, the bowling league and the pickup game of Frisbee in the park, the weekly poker night and the impromptu game of cards among strangers on the commuter train, the formal debate and the idle conversation on the ski lift, the elaborate role playing of the massively multiplayer online game and the joke exchanged on e-mail all engage the interpersonal intelligence and enrich it. Games often require players to take stock of the other person's point of view or call on some understanding of the opponent's thought processes. Think here of guessing games like charades or the board game Battleship in this category, or games of strategy such as Chinese checkers, chess, the Japanese game of Go, and many of the new multiplayer online games. Champion tennis players win by anticipating their opponent's serves. We should lament where the forces for isolation have caused these playful forms of cooperation and competition to decline, and we should remember that play is the antidote to social isolation and alienation.[24]

Understanding from Within: The Intrapersonal Intelligence

Gardner points out that the second of the personal intelligences, the intrapersonal intelligence, the self-regarding intelligence within, emerges early as the infant first differentiates pleasure from pain. Slightly older infants will begin to tell themselves apart from others; they will recognize their faces in a mirror with a talent for self-awareness that only a few animals besides humans—apes, dolphins, and elephants—can master.[25] A daub of lipstick on the nose of a one-year-old will delight her and provoke her curiosity when she sees it in the mirror. Infants will recognize their own names, too. This is the self-recognition of the "incipient person" according to Gardner. Knowing oneself is inherently to explore and to stretch the limit of what one knows, especially what one knows and understands about others. Between two and five years of age, as Gardner points out, the child begins to master the linguistic and cultural symbols that order the world: "Through talk, pretend play, gestures, drawing and the like, the young child tries out facets of the roles of mother and child, doctor and patient, policeman and robber, teacher and pupil, astronaut and Martian. In experimenting with these role fragments the child comes to know not only which behavior is associated with these individuals but also something about how it feels to occupy their characteristic niches."[26] Over the next years, the child's sensitivity and sense of reciprocity develops with the growing sense of self. For some, this becomes a lifelong project.

Not all introspection involves isolation, and not all personal searches become socially alienating. Introspective revolutionaries such as Mohandas Gandhi and Martin Luther, by looking inside themselves, fundamentally changed the world. We would do well to think less of the loneliness of collectors, photographers, Internet users, and long-distance runners than we think of the fulfilling play that their temperaments urge them toward. It is only the extrovert who accuses the introvert of always having "your nose stuck in a book," because for many, the life of the mind is enough. When someone couples looking inward with play, though, they often reach out to entertain, enlighten, or enlist an audience. Many inventive novelists, poets, philosophers, playwrights, performance artists, songwriters, and visual artists begin by looking inward. Indeed, we often grant to artists license to play with their inward being so they can frankly explore for us topics that mainstream culture cannot confront more directly.

Any number of such licensed players spring to mind—Lenny Bruce, Robert Pirsig, William Blake, Eugene O'Neil, Bob Dylan, Francis Bacon, and Albert Camus. Perhaps comedy affords an especially clear example of this crossroads of play and intrapersonal intelligence. Often described as groundbreaking, the popular 1970s television series *All in the Family* featured Carroll O'Connor's lovable mossback Archie Bunker, who by way of skewed perceptions and comically incomplete thoughts brought contentious issues of war and peace, tolerance and racism, sexuality, women's liberation, illness and death, and religion and nonbelief to millions of viewers.[27] More specifically, the late Richard Pryor's funny and raw routines of the 1970s drew from the experience of his troubled childhood in pre-Civil-Rights-era Peoria, Illinois. Teachers of this lonely black kid in a predominantly white school were frustrated with his tardiness and exhausted by his mouth, and they traded a promise of prompt arrival and silence for the opportunity to perform once a week. This indifferent student excelled in comedy, and he honed his skills while deflecting bullies by making them laugh. As a professional comedian, the stage gave Pryor the chance to explore the deep, personally vexing, and otherwise untouchable subjects of race and class in America with both black and white audiences.[28]

Playing the Numbers: The Logical-Mathematical Intelligence

Educators and theorists inspired by the Swiss philosopher Jean Piaget (Gardner among them) have long believed that children build up a sense of numbers gradually and out of their "socio-motor" experience with things. Tests that researchers administered to younger children proved to Piaget's satisfaction that young children failed to "conserve number," and so they failed to realize that numbers of things do not change when their appearance changes. But when investigators asked children similar but more child-friendly questions that avoided the deliberate confusions and distractions of the test, and when the questioners made the test a game with built-in rewards, young children found correct answers, thus demonstrating a working knowledge of arithmetic. In fact, recent discoveries point to a remarkable inborn mathematical sense, observable even in babies. Experiments at the University of Pennsylvania in the 1980s established that infants as young as sixteen weeks notice changes in the numbers of objects, i.e. they can "discriminate numerosities." They perceive a sense of numbers long before they can count. Studies of four- and five-month-olds at Yale showed their ability to add and subtract. Nine-month-old infants have a feel for manipulating even large numbers.[29] This fundamental mathematical intelligence is comparable to the aptitude for prosody that lies at the root of language.

It makes good sense to pair logical and mathematical intelligence the way Gardner has. Each depends on the accurate observation and assessment of—and on the understanding of and ability to predict—natural chains of events. Further, though each of these abilities seems inborn, the logical and mathematical intelligence can be trained and then practiced as play. In protomath activities, parents play several games with infants that enhance their sense of sequencing and augment their feeling for cause and effect. Bouncing a baby may be the simplest of these games. For one-year-old children going on two, games such as peek-a-boo and "This Little Piggy"—and later, pat-a-cake and "This is the Way the Lady Rides"—build a sequence of anticipation and surprise into learning the logic of cause and effect.

Remarkable though our inborn mathematical talents are, here, again, play exercises and expresses intelligence. Adults who give no thought to how they perform mathematical operations need to remember that the most elementary math skill—counting, representing things as numbers—is not easy to acquire. One must first learn to name numbers, then remember not to leave any out of the counting, and then finally recognize the last number as the special one. Incidentally, none—zero—is one of the most difficult concepts that children master because it literally represents nothing at all.[30] When parents combine reading with counting, they nourish a budding numeracy as the intelligences conspire. Publishing houses accommodate the growing math and logical skills by offering up a tall stack of funny and instructive books with titles such as *Big is Big and Little is Little*, *Counting Crocodiles*, *Double the Ducks*, *Henry the Fourth*, and *How to Weigh an Elephant*.

But oral tradition and folklore, rhymes and songs out of antiquity, also support math learning. Even though shoes no longer have buckles, younger children today still begin manipulating numbers with counting rhymes like "One, Two, Buckle My Shoe." Children who have never seen a farm animal sing "Baa, Baa, Black Sheep." Soon children are ready for more complex games that count players "out," such as "Eeny Meeny" and "One Potato, Two Potato." The Count, the popular *Sesame Street* Muppet, brings numbers to children in a stagy Transylvanian accent, "I vant to count your neck—*vun neck*." Colorful refrigerator magnets encourage children to recognize numbers and arrange them in sequence. Many card games oblige players to compare numbers; the higher number usually wins, and sometimes a special number grants special powers as in Crazy Eights, or a special power can be conferred on a "wild" card, as in poker. Card games such as sevens or chemin de fer or blackjack depend on addition. The four suits add an additional task of counting and classifying. Probably the most elementary social aspect of card games is that they require players to take turns, an elementary but essential sequencing skill for play and for life. These games can be as simple as Go Fish or as complex as chess. Tic-tac-toe demands logical thinking of young players. Once they discover the advantage of the center box and strategies for playing games to a tie, they are ready for more complex games.

Number play is not limited to children's games; in fact, all along the lifespan, play exercises the logical and mathematical intelligence that Gardner delineates. Math games can be as inadvertent as watching a digital clock turn to 12:34 p.m. or the odometer tick up to 77,777. Older children and adults who are devoted to games that come under the heading of "recreational mathematics," however, deliberately explore the curiosities and pleasures that numbers and mathematical operations offer. The puzzle named magic squares, for example, divides into a grid filled with integers that add up to a single sum whether one follows the numbers across a row, down a column, or diagonally. The gifted and patient can follow the game into three dimensions in a complex variation called magic tesseracts.

Recently, millions have begun to follow the devilish puzzle called Sudoku, another numbers game that expresses and educates the mathematical intelligence. Invented by an American mathematician in the late 1970s, the game took root in Japan and then reemigrated with explosive, worldwide effect around 2005. This game structures play by dividing larger squares into smaller squares, and smaller squares into three-by-three boxes. In each one of these smaller boxes, the rules require players to place all nine digits; and these must appear so that no number repeats in any row or diagonal. The appeal of these puzzles may boil down to the sudden insight that the game favors. Will Shortz, who has written more than a hundred Sudoku puzzle books, noted that the psychological hook of playing at Sudoku has everything to do with the rhythm as it progresses toward a sudden burst of pleasurable comprehension. Halfway through the game slows, but after a breakthrough and a rush of solution, the game rapidly picks up speed toward completion. "It gives you a satisfying feeling to be rushing at those squares. And immediately you want to do another one," Shortz says of the understanding that gathers steam. "That's the key to why they are so addictive."[31] Crossword-puzzle players will testify to a similar effect as their game accelerates toward its conclusion.

Older children enjoy playing with math games, mind benders, numbers, and logic puzzles that emerge from an unusual or surprising angle; so do adults. Maltese psychologist Edward de Bono writes about the playful out-of-the-box creativity he calls "lateral thinking" and poses brainteasers like this: Two identical trains leave the East and West coasts at the same time and steam toward each other on the same three-thousand-mile-long track; The eastbound train is traveling at eighty miles an hour, the westbound train is doing ninety. Which train is closer to the West Coast when they collide? Reaching a solution requires understanding that wherever the trains have met they will have met at the point where *neither train* is any closer to the West Coast than is the other. The doomed trains present a problem not so much to calculate (as that would yield interesting but immaterial information that locates the crash someplace in Missouri), but to play around with. "With lateral thinking," de Bono observes "one does not move to follow a direction but to generate one."[32] Play, which is voluntary and often said to be "purposeless," favors this kind of exploration that yields discovery.

The Eyes Have It: The Visual and Spatial Intelligence

The mental image of racing trains calls to mind the most famous thought experiment of all time, conducted by the most celebrated mathematician of all time, generating the most penetrating mathematical theory of all time, that yielded the most renowned equation: a description of the relationship between energy, mass, and motion. Gardner may come closest to seeing the influence of play when he wrote about Albert Einstein in a chapter of *Creating Minds* he subtitled

"The Perennial Child." The kind of questions that Einstein posed—"gritty," "profound," and "unsettling" —were for Gardner at least "reminiscent" of childhood musing, at least those children lucky enough not to be "habitually shut up." "In the first five to ten years of life, children have ample opportunity," Gardner pointed out somewhat wistfully, "to let their imaginations roam, to raise questions about phenomena that inspire doubt or awe, and then at least sometimes, to pursue these questions for a while as they walk in the fields or fall asleep at night."[33]

As tempting as it is to equate profundity with gravity while excluding levity as a source of inspiration, we need to acknowledge that if Albert Einstein was not playful in a conventional way, it was yet his playful thinking that led to his Special Theory of Relativity and to a revolution in our view of space and time. Einstein's discovery demanded thoughts of a particular kind that drew on his habit of playing with vision and space. He turned viewpoints this way and that in his mind to conjure impossible circumstances and fantastic coincidences. Sometimes he imagined riding on a beam of light, at other times he simplified the idea of traveling in a straight line at uniform speed by thinking about how things looked to travelers on careening dream trains. Einstein himself, as Gardner notes, described these thought experiments—*Gedankenexperiment* in German—as wordless, visual, "combinatory play."[34]

If common sense and conventional arithmetic applied, we would calculate that when two trains approach each other, the first traveling at three-quarters the speed of light and the second at half, they ought to close the distance between them at a speed one-and-a-quarter times light speed. But reading Einstein's *Gedankenexperiment* as a playful interlude, we see how the mathematician showed that simple arithmetic does not apply in this case because time and space are not absolute. The only absolute is the speed of light, with the recent exception of the strange neutrino; the speed of light decrees a universal speed limit. Therefore, in special circumstances, it was time and space that had to give. Experiments had proven that time moves more slowly when the frame one observes is moving; and for a moving object, space contracts in the direction of motion. Therefore, time and space are "relative" to motion, Einstein reasoned. To arrive at this complex insight and to explain the theory simply, Einstein visualized a cinematic, science-fiction scene. Two lightning bolts strike an extraordinary train cruising comfortably near the speed of light; one reaches the engine, and at the same time the other smacks the caboose. Someone standing on the platform sees the lightning strikes as simultaneous, just as we would expect. But "an observer" riding inside, in the middle of the train, would in fact see the lightning strike at the front first because he is "hastening toward" the light coming from the front, and "riding on ahead" of the beam coming from the back.[35]

American physicist and prankster Richard Feynman, who was even more remarkably adept at visualizing problems in physics than Einstein, made the relationship between levity and profundity easier to see. Feynman achieved the breakthrough that netted him a Nobel Prize by picturing the behavior of subatomic particles, representations in particle physics that came to be known as "Feynman diagrams." But he dedicated much of his private time to reinforcing his reputation for mischief. "The spirits of play and intellectual inquiry ran together" for Feynman, his biographer concluded.[36] Feynman drew his inspiration from where he could find it. The way a barmaid handled a tray of drinks inspired his description of subatomic spin; he flopped on the floor and wriggled to imagine an electron's wobbly path forward and *backward* through time—an embodied thought that the flow of time was only apparently irreversible. He showed this remarkable facility for understanding spatial relationships even in high school when he skipped the approved Euclidian step-by-step and Q.E.D. proceeding instead directly to mental animation to solve geometry problems. Feynman "manipulated diagrams in his mind," his biographer wrote, he "anchored some points and let others float, imagined some lines as stiff rods and others as stretchable bands, and let the shapes slide until he could see what the results must be. These mental constructs flowed more freely than any apparatus could."[37] Handy and arty people can visualize without verbalizing. They build that backyard deck without a plan or they share a wicked caricature of a teacher when forbidden to talk. Like Einstein and Feynman, they make a routine practice of freely exercising their visual imaginations.

Where Intelligences Meet: Is Beauty in the *phi* of the Beholder?

A forerunner of Einstein, the physicist Henri Poincaré insisted that "all mathematicians experience a genuine sense of aesthetics." In the Western tradition, such has been the case from the earliest Egyptian and Greek ventures into geometry. Gardner granted that aesthetic aspects of our spatial understanding are "elusive"—especially with respect to our sense of "tension," "balance," and "composition" that "occupy the attention of artists or viewers of the arts."[38] Examining the ancient equivalence of mathematics and beauty more closely, however, may well let us glimpse the intersection where the spatial and mathematical intelligences intersect.

We begin where the ancients did, with a stunning discovery: by playing with a geometry problem, isolating a square from within a rectangle, and then repeating the trick, Greek architects discovered that the ratio of the length of the sides on the square to the sides of the remaining rectangle—1.618 to 1—replicated the "Golden," later known as "Divine Proportion." The Greeks, of course, endowed this ratio with mystical significance of strength and balance; secular modern mathematicians honored their forbears by denoting the relationship with the Greek letter ϕ—"phi," named after the careful fifth-century B.C.E. Greek sculptor Phidias.[39] If you add one to two and get three, and then three to two and get five, and then five to three and get eight, and eight to five and get thirteen, and so on, you arrive at a sequence in which the numbers reflect this golden proportion. A twelfth-century mathematician from Pisa who came to be known as Fibonacci noticed that this ratio also described the "equiangular" (we would say "logarithmic") spirals that appeared on pine cones, the yellow florets of sunflowers, the rinds of pineapples, and cross sections of nautilus shells.[40] To the medieval mind, this beautiful coincidence also seemed to carry mystical import as nature itself replicated a divine proportion.

Architects, whether ancient or modern, have always been obliged to play with space, but they have not played randomly. In Western culture, buildings often follow a formula: their proportions obey rules that the rest of us have internalized even if we cannot specify them. We quickly note an ungainly painting or a poorly composed photograph or when an accretion makes a building look unbalanced. We owe this sense of proportion to Greek architects who—when they played with space—extended their understanding of the Golden Proportion to their structures. They built their most famous building, the Parthenon—along with many others— according to Golden Proportions (more or less). Two and a half millennia later, we still share their sensibilities whether we build humble garages or grand edifices.[41]

We are accustomed to giving culture its due in determining our aesthetic opinions. Some, however, contend that our aesthetic sense, our understanding of beauty that includes the Golden Proportion, is part of an older endowment that influences us independently of cultural conditioning. As far back as 1876, a German experimental psychologist named Gustav Fechner quantified how his subjects reacted to rectangles that stacked as Golden Proportions. If asked to choose between these and random rectangles, three-quarters of the respondents preferred the Golden Proportion or ratios close to it. Fechner's culturally blinkered findings may merely prove that Greek ideas of beauty were strong and persistent because they were refreshed by education and canonical art.[42] But Fechner's findings may also strongly suggest our mathematical intelligence in play.

We can see this as the story takes a modern, more substantial turn toward significance in the viewpoint of evolutionary psychology. Cross-cultural investigators set out to discover something fundamental—which of all female faces have men found most beautiful. The research surprisingly revealed that men did not disagree much wherever on the planet the faces happened to hail from—or in fact wherever the women *they admired* hailed from.[43] Some understanding that ran deeper than cultural conditioning seemed to be at work. Some others have speculated that the prettiest faces in all the world's corners are those that best preserve Golden Proportions. Orthodontists and maxillofacial surgeons whose practices require them to closely analyze facial geometry to realign bites or restore damaged faces have surmised that beauty may be in the "phi" of the beholder.[44] But faces vary almost infinitely over a few themes, and the human heart is fickle. Perhaps the truth is simpler and so requires neither elaborate calculation nor mystical investment: men may simply prefer women with higher cheekbones, a thinner jaw, and bigger eyes—configurations that coincidentally tend toward the golden ratio—because these features suggest youthfulness and perkiness. These prettier faces may also be more prototypical in their geometry, easier even for infant brains to process.[45]

Similar but clearer mathematical aesthetics may be at work for grown-up men who size up "ideal" waist-to-hip ratios. By projecting equilateral triangles between breasts and navel, modern artists have concocted female versions of Leonardo's fifteenth-century Vitruvian man. This may merely be another postmodern joke, but researchers confirm that the women's waist to hip ratio men prefer is a remarkably stable cross-cultural number approaching the Golden Proportion, .71 to 1.[46] These mathematical understandings, however simple or complex, may run deep and significantly into our past if, first, sex is a form of play, and if, second, both beauty and play are signs of fitness that figure into sexual selection—a natural selection that itself propagates the preferences for play and beauty.[47] Culture and biology evolved together after all, they "co-evolved" in a complementary way to enhance the appetite for beauty and for play.

Evolutionary biologists now contend that our minds themselves are "ornamented," outfitted for conspicuous play and entertainment in ways that make us more attractive as prospective mates. According to this viewpoint, beauty may not be truth so much as it is an indicator of fitness. This thinking requires us to de-emphasize struggle as the main driving engine of evolution and lose the prevailing metaphor of "nature red in tooth and claw." The victors always carry off the spoils, true, but war is also always a net loss. Evolutionary biologist Geoffrey F. Miller argues that, instead, we should regard the linked processes of biological and cultural evolution as if it were a romantic comedy: "In action, war, and intrigue, people mostly just die. But in romantic comedy, people sometimes get pregnant. Evolution is a multi-generation epic that depends on some couples courting and having children. . . . Human evolution could be [better] imagined as a million-year-long version of *Bringing Up Baby*, in which ancestral Katherine Hepburns and Cary Grants fell in love through a combination of slapstick, verbal repartee, and amusing adventures with wild animals. Evolution may be heartless, but it is not humorless."[48]

Nor, to our point here, is it artless. Our appreciation for art, the way we take pleasure in it, distinguishes us from even our closest relatives among primates. Mona Lisa's ambiguous smile will not mean much to a chimp. Human artifice, the ability to fashion things, is a million years old or so. It began among our human ancestors four million years after our line split from our nearest relatives, the chimpanzees.

The surviving evidence of visual art stretches back 50,000 years to aboriginal Australia where fortunate accidents of climate preserve rock painting. But no one really knows how much farther back ephemeral forms of body decoration go. Similarly, paleolithic figurines preserve evidence of attractive patterns on fabric that disappeared sometime in the moldy past, and gene sequencing of the nuclear DNA of clothing lice suggests that clothing originated about 170,000 years ago.[49] But again, no one truly knows how long ago we developed a preference for eye-catching, woven fabric. The originals of these pretty things are lost to us, eaten by time. But enough time has elapsed for the preferences themselves to become encoded as shared human leanings. This so perplexes evolutionary psychologists because the ability to fashion and appreciate art seems to offer no survival value for the individual and represents only investment and cost, and evolutionary biologists always prefer to reduce the process to some basic need. And it is hard to argue an evolutionary base for aesthetic appreciation and artistic skill—for why they specifically should have been handed down.

But we can find some such explanation in the way that play exercises and nurtures our natural endowment of visual and spatial intelligence. The ability to make things and decorate them, or indeed to ornament ourselves conspicuously, may have served as an indicator of fitness to prospective mates. Much like the peacock's showy tail or the bowerbird's clever bower, the adorned body or the flashy bit of shell on a necklace may have demonstrated that the bearer or wearer had both the surplus time and energy to invest in something spectacularly superfluous and the brains to fashion something pleasing and playful.[50] It was not conspicuous consumption so much as extravagant expenditure that was important to the display of jewelry and body art. This was purposelessness with a purpose. Is there reason to suspect that the evidence of skill, intelligence, security, endurance, prosperity, pride, and nonchalance exhibited by the everyday artists of the Neolithic age were qualities any less attractive to prospective mates then than they are now? The ancient record of art may be most valuable for the way it reveals an appetite for style, a nose for innovation, and a sense of play.

One must vault forward over several thousands of years of art history to learn how Pablo Picasso, the twentieth century's most influential and emblematic artist, spent the better part of his long artistic life playing with form and viewpoint. Gardner observed the artist's "prodigiousness" and "relentless drive" to dissemble form and create a following. He noted, too, how tragedy tended to follow the artist.[51] But he misses entirely the way that play and art traveled as intimate companions for Picasso and the way Picasso's works sometimes preserve moments of pure play and childlike delight. If ambition and tragedy moved Picasso, play had an equally profound impact. Texts and advertisements included in his early cubist experiments often supplied a wry commentary on the principles of visual simultaneity. [52] Sometimes his jokes are spatial: his *Head of a Bull* (1937), constructed the same year as his searing *Guernica*, for example, consists simply of a seat from a road bike combined with drop handlebars. Picasso saw the material for this *objet trouvé* while rummaging in a rubbish heap, and the idea for the sculpture—the long snout, the curving horns—must have come in one puckish flash. Fluted beer glasses and curvy vases looked female to him, and so his ceramics, three-dimensional jokes, carry nude forms with a rear view. This was pure visual-spatial mischief. Reflecting on an exhibit of children's drawings, Picasso wrote "when I was their age I could draw like Raphael, but it took me a lifetime to learn to draw like them."[53]

Grown-up artists may need to work hard to find what comes naturally. But children show us the purest and clearest link of visual intelligence to play. For children, drawing and painting and sculpting are spontaneous and unlabored forms of play. Those crayon drawings of brown horses, red barns, green fields, and bright yellow suns, those squiggly finger paintings, those mountains of mud pies and beaches full of sand castles all express and practice the visual and spatial intelligence. Tinkertoys, Lincoln Logs, Erector sets, and LEGO blocks satisfy the artistic urge to play with arranging space.

Some might argue that a separate aesthetic sense—an eye for beauty—meets Gardner's criteria or signs of intelligence. That is, an aesthetic sense involves isolation as a brain function, a history of prodigiousness, a set of core operations, a development history with expert end performance, an evolutionary history, measurable psychometric and psychological tasks, and— especially—it can be encoded in a system of symbols or images.[54] But to understand the importance of artistic play, we need not think of it explicitly as preparation for an expertise (unless it is training of the kind that field biologist Marc Bekoff and his colleagues paradoxically called "training for the unexpected").[55] We need only to acknowledge that artistic play is the sign of creativity in the visual and spatial realm, that it is evidence of spontaneity and cleverness, and that these are qualities playmates and mates will find attractive.

All Together Now: The Musical Intelligence

Musical intelligence can be the product of dedicated training, intense competition among the innovators, long cultural tradition, and nightly inspiration, like that of American jazz from the late 1940s through the mid-1960s, which fructified in jazz clubs—those smoky think tanks of New York named the 55 Bar in the West Village and the Blue Note in Greenwich Village. No artists trained harder for the unexpected than jazz musicians, for whom playing freely is essential. Miles Davis, a prickly musical genius known best for his trumpet, also kept handy a derelict piano so old and beaten that only some of its keys sounded. When he improvised on it for guests, he invited them to listen between the notes they could actually hear to find the ellipses in the chord progressions, those notes they could not hear. Davis's invitation may have seemed perverse, but it went to the heart of an inspired American music that still taunts us with apparent randomness and surprise. Following jazz, listening deeply, depends almost as much on noticing the parts the music leaves out as enjoying those it includes.[56]

Conservatories and universities also nurture grown-up musical talent and do it more formally, but the musical intelligence they work with tends to emerge early in the musician's life, the inclination toward understanding pitch, rhythm, dynamics, timbre, voice, and patterns of musical phrasing forming the basis for future musical careers.[57] For Arthur Rubinstein, one of the twentieth century's most celebrated concert pianists, playing the piano began not as work, but as play: "The drawing room became my paradise. . . . Half in fun, half in earnest, I learned to know the keys by their names and with my back to the piano I would call the notes of any chord, even the most dissonant one. From then on it became mere 'child's play' to master the intricacies of the keyboard, and I was soon able to play first with one hand, later with both, any tune that caught my ear. . . ."[58]

Unlike Rubinstein and Davis, most people are not born musicians. But the basics, such as understanding tonal values and musical intervals, are standard human equipment. The ability to listen for information conveyed through language is human equipment so standard and familiar that it is easy to forget that we coo and sing before we talk. Even "absolute" or perfect pitch may be an inborn talent—a musical intelligence that we all share as infants. This extraordinary natural ability survives the growing brain's pruning process, however, only when nurtured.[59] Nurture enables nature. And it is the nurturing, the musical education, that makes all the difference in expressing this intelligence at play.[60]

This musical intelligence can clearly serve a social function. In his study *Bowling Alone,* sociologist Robert Putnam charted the steep decline in personal and face-to-face relationships in America at the turn of the twenty-first century. Putnam found that many fewer people were schmoozing at restaurants and gathering to play cards. The waning of bowling leagues—which demand coordination to organize and friendly association to sustain—seemed especially diagnostic of the weakening of face-to-face social contacts. But Putnam was careful to note how participatory sports and music bucked the trend and helped create "social capital," the wealth that accrues from personal relationships and common purpose. "Singing together," Putnam observed, is like bowling together in that it "does not require shared ideology or shared ethnic provenance."[61]

Choral singing helps overcome the grim decline in neighborliness and the decay of social trust that bedevils the narrowcast modern polity mainly because choral singers depend on each other.[62] Mutual dependence is enriching, too. A chorus singing together mutes individual shortcomings. Stephen Jay Gould, the late evolutionary biologist who made a practice of joining choirs sang Mozart's *Requiem* wrote, "I do not care to imagine how much poorer my life would be without such music."[63] The enrichment was musical and intellectual, of course, but it was social, too. He recalled how his first experience singing with the New York All-City High Chorus in 1958 under the baton of the school district's autocratic music director was also a democratic and egalitarian exercise. "He forged our group of blacks from Harlem, Puerto Ricans from the great migration then in progress, Jews from Queens, and Italians from Staten Island into a responsive singing machine."[64]

If we learn to chortle and hum before we talk, it is likely that music itself as a social phenomenon existed before speech among other mammals. (Whales may have been "singing" for as long as sixty million years.) Singing itself may have preceded language in the history of humankind, and again, prosody surely preceded grammar. From its ancient inception, too, singing likely served to help our societies cohere.[65]

The benefits to the individual, the side effects of learning to play and sing are just as striking. Music trains the brain as it requires us to concentrate and so exercises and sharpens our ability to listen and memorize. Learning music requires us to pay attention to sounds and their order and to distinguish these over split seconds. And singing and playing an instrument helps us understand counting as a function of time. Surprisingly, researchers also note that singing and playing nurtures language skills; specifically, learning to play and sing helps tune our ears to rapidly changing syllables when we process the language we hear. And so musical exercise may even help children learn to read, or cope with dyslexia, or master foreign languages. And it can sharpen the ability of elderly people to pick up and follow conversations.[66]

Music helps stroke victims suffering from aphasia regain their ability to speak and understand language. English music therapists organized a campaign called "Singing for the Brain" after they noticed how music buoyed the spirits of Alzheimer's sufferers and helped them remember; lyrics last longer in the memory than unaccompanied words. Others hold out the possibility that because music has the ability to summon emotion and cheer us, it could play a role in the emerging field of psycho-immunology.[67] This certainly would not be the first evidence found to link play and resiliency or of play to Gardner's musical intelligence.

The Naturalist Within: The Eighth Intelligence at Play

Resilience, adaptability, and fitness comprise some of the benefits of the final talent, the naturalist intelligence that Gardner delineated. This naturalist intelligence underpins our understanding of the environment, our appreciation of the relationship among its species, and the advantage we take of that understanding. For Gardner, this is the faculty that enables us to separate friend from foe and food from poison. As a survival tool, "making and justifying distinctions"—the emblem of this naturalist intelligence as Gardner narrowly sketches it—evidences a general talent for classification: "The young child who can readily discriminate among plants or birds or dinosaurs is drawing on the same skills (or intelligence) when she classifies sneakers, cars, sound systems, or marbles."

Child-development specialists note how sequencing invites sorting, and they urge parents to "turn bath-time into math-time" by separating and identifying the floating toys by color and type and exploring contrasts like "full" and "empty."[68] Children play a similar sorting and classifying game on their own with the perennial Fisher-Price stacking toy that features plastic doughnuts of varying colors and diameters made to fit in order on a cone; the toy encourages a correct answer. Two-year-olds going on three can begin to compare and explore contrasts with more complicated items, like the products on grocery-store shelves and the pots and pans in the kitchen cabinets. When playing outdoors, they begin to understand quantitative concepts like big and tall, small and smaller, many and fewer and spatial concepts such as over and under. Grown-up hunters, gardeners, fisherman, mechanics, and chefs are obliged to become talented recognizers of patterns too. To judge by career-counseling websites, astronomers, weather forecasters, anthropologists, explorers, and air-quality officers are heavy users of this last among the multiple intelligences.[69]

For Gardner, this naturalist intelligence is best exemplified literally, by the example of celebrated naturalists such as eighteenth-century Swedish taxonomist Carl Linnaeus, nineteenth-century English natural historian Charles Darwin, and two prominent twentieth-century American scholars, paleontologist Stephen Jay Gould, and the founder of sociobiology, E. O. Wilson. But here it is most interesting to note how Darwin, Gould, and Wilson all actually first demonstrated and developed their prodigious talents as children at play.

Darwin, who described himself as a "born naturalist," reported his childhood "passion" for shooting and a "strong taste for angling;" he collected minerals and beetles "with much zeal," and "took much pleasure in watching the habits of birds." The young Darwin hunted, fished, bird-watched, and collected "with keen pleasure" two decades before he signed on as ship's naturalist for the HMS *Beagle*, and a half-century before he published *The Origin of Species*.

Leonard Gould ignited a passion for natural history in his five-year-old son Stephen in monthly trips to the American Museum of Natural History in New York. The rearticulated skeletons of dinosaurs fired the boy's budding imagination, and by age eleven Gould was reading texts in evolutionary biology. As an adult, Gould challenged the gradualist view of evolution that Darwin shared with the geologists of his day. He grew to become one of America's great popular-science writers and an associate of the very museum that was his childhood playground.

Gould's colleague and rival at Harvard, E. O. Wilson (who discovered genetic strategies behind the apparent altruism in the division of labor among social insects), had turned, when a child, to nature "as a sanctuary and a realm of boundless adventure." "Wilderness," he reported in his autobiography *Naturalist*, "became a dream of privacy, safety, control, and freedom." Blinded in one eye by the sharp fin of a flopping fish but gifted with acute sight in the other, he reveled in examining the small insects around his Alabama neighborhood.[70]

We are now most likely to cite the virtues of outdoor play that nurtured the naturalists when we note its recent precipitous decline. Children have long banked the dividends of unmonitored play outside in several accounts: increased physical strength, better coordination and improved stamina, enhanced social ease and sharpened negotiating skills, heightened self-reliance, augmented powers of observation and three-dimensional problem solving, a cleverer eye for patterns, and greater understanding of and pleasure in the natural environment. If we are comfortable projecting what we observe of hunter-gatherer societies into the past, we will conclude that most children in most places for most of the time in the history of our species were left on their own at play to discover and learn of their natural and social world.[71]

Over the last thirty years, however, burning curriculum demands and the professionalization of school sports have chipped away at the time available for free play. Landowners' concerns for liability have closed informal private play spaces, and large settlements have tamed playgrounds. Real and imagined fears of lurking neighborhood dangers have forced children inside. And both television (which is mesmerizing but passive) and video games (which are active but even more magnetic) tend to keep them there. If anything, the social and cultural trends that have diminished children's contact with the natural world (or that now may deprive them of it entirely) give us reason to expand both the reach of Gardner's "naturalist" intelligence and the urgent need for its nurture.[72]

Adults, too, derive a long list of emotional, physical, social, and intellectual bonuses from beachcombing, camping, fishing, gardening, golf, hiking, horseback riding, hunting, kite flying, kayaking, mountain biking, sailing, scuba diving, skiing, stargazing, swimming, trail running, tree climbing, wind surfing, walking the dog, and other playful pursuits. While playing outside, they train and express this naturalist intelligence.

Conclusion: Intelligence at One with the Dividends of Play and at Odds with the Means of Instruction

To inspect Howard Gardner's work through the lens of play with an eye to its benefits is to be reminded of how difficult it is to separate one intelligence—one kind of understanding—from another. Play enhances our skills and aptitudes and deepens our talents and capacities by exercising them in concert. In the nearly three decades since Gardner first published *Frames of Mind*, explanations of the brain's architecture and its neuro-chemical systems have leapt spectacularly forward. These have helped make the old assessments of intelligence by narrow verbal and mathematical measures seem even more quaint and misleading, and they make Gardner's work even easier to admire now for its insight and foresight. And as it happens, studying play has proven key to discovering the ancient connections of mind and body.[73] In fact, we are beginning to understand at the level of neuro-chemistry and neuroanatomy how humans instruct and develop our various talents by playing.

In spite of this revolution, recess withers in our schools, and a scripted curriculum replaces free play. This shift is peculiar since, until about age six, we trust children to learn the most complex human skills such as language, pattern recognition, eye-hand coordination, socializing, and so on—all by way of play. But after that, our schools teach to the test, dissecting knowledge from context. If we take both intelligence and play seriously as emergent processes rather than products, ongoing strings of events rather than end states, we can better see how they are part of the same complementary expression of our original endowments.[74] If we are serious about enhancing and expressing the multiple intelligences, curriculum designers and policy makers should look for strategies and opportunities that enrich and express these various talents.

Because children learn best when they are interested, curricula should emphasize projects and investigations that spark student curiosity and embrace choices among all the intelligences including activities such as group storytelling, spelling bees, creative-writing exercises, speed sentence diagramming, and debates. Students should write and perform songs, sing in foreign languages, stage dramas, declaim poetry, reenact great trials and battles, imagine counterfactual histories, and compete in geography trivia and current-events competitions. They should play math games, conduct surveys, and count in base two. Teachers and children should engage in film making, designing exhibits and three-dimensional graphics, and solving computer-enabled math games and "braingames." They should study paradoxes and brainteasers. They should cook, draw, build models, tune a bike, collect insects, and play at a hundred other difficult, instructive, and demanding intellectual errands. Learning, again, "must never be imposed as a task, nor made a trouble." We should complete the revolution that began in the 1980s as a rebellion against IQ testing. Children should play to learn.[75]

The good news is that we need not trade rigor for joy in learning. Profundity does not entail gravity. To believe in the utility of the multiple intelligences to describe the range of human talent is to accept the instructive value of play. We thrive by learning the rules of formal games and succeed by adapting to shifting guidelines of impromptu contests; meanwhile we strengthen our interior reserves and brighten our social lights. The play group will build an evolving story moment by moment. A dinner party will thrive on banter. The lonely poet will search inside to find a universal sentiment to share.

All these, in Gardner's terms, are "products" of play, but it is the *process* of play that keeps us sharp. Chess players gauge intentions, anticipate moves, and seek to understand and then master other minds at play; win or lose, the players share a sense of underlying principle. To drive a straight ball down a fairway, loose an arrow, or throw a strike harmonizes the actual and the intentional and demonstrates in a spatial frame control of matter and mind over distance and time. To learn to sing on key and on cue in a chorus is to understand at a bodily and sensory level how the harmonious social whole can become greater than the sum of its atomized parts.

Play does not merely depend on this kind of sensitivity and mutuality, play fosters it. When the motley, diverse playground crew builds tolerance for give-and-take through rough-and-tumble, it paves the way for a strength that derives from solidarity and understanding: it is easy to forgive a friend. Players hope to prolong the fun. And so by common (often unarticulated) understanding, they agree to sort themselves and restrain themselves. Playful equality figures into their mutual interest.[76] This capacity for sharing play arises in the context of exercising diverse talents through words, sentiments, calculations, actions, tunes, explorations, and visual and spatial representations—the wandering expressions of our ancient endowments, our "multiple intelligences" at play.

Notes

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