

Welcome to your Child's Brain

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Foreword

- “Where angels fear to tread,” producing programs and creating materials with claims of building bigger and better brains.

Part one: Meet your child's Brain

Chapter 1 The 5 hidden talents of your baby's brain

- For example, if your infant likes an event that happened while she was sucking and wants it to happen again, she will suck more vigorously.
- In one experiment, a mobile was hung over the crib of a three-month-old baby and attached to one leg by a ribbon. When a baby kicked, the mobile would move. The babies were fascinated by this new toy. They smiled more and looked at the mobile more than they did when a similar mobile was out of their control. After just a few minutes of training, they kicked more. Three days later, they still kicked when they saw the first mobile (but not a different one), even when the ribbon was no longer tied to their legs.
- We don't recommend yelling, but that's mostly because it's an ineffective way to modify your child's behavior.
- Very early on, caregivers begin to influence the direction of a baby's attention. Babies start to follow an adult's gaze as early as four months of age. By twelve months they can point and direct their attention where someone else is pointing.

Chapter 2: in the beginning: parental development

- Building a brain is similar: getting the signaling cells, called neurons, into their correct positions is the (relatively) easy part, and it's done before your baby is born. In contrast, wiring up all the connections is so complicated that the job won't be entirely finished until your child is in college.
- Folic acid deficiency in the mother increases the risk of such neural tube defects.
- Next time you're stressing about your future child, ask yourself whether this stress is really necessary. Neuroscientists are able to discover what stress does by studying its effects on laboratory animals. Maternal stress increases the risk of a variety of problems, including cleft palate, depression-like behavior, a touchy stress response system in adulthood (see chapter 26), and attention deficits and distractibility (see chapter 28). Stress hormones released by the mother act on the fetus directly and also reduce the placenta's ability to protect the fetus from these hormones in the future.
- One group of researchers identified all tropical storms or hurricanes that hit Louisiana between 1980 and 1995 and then determined how many autistic children in the records of the state health system had been in the womb when their mother's home was hit by one of these storms. The risk of autism was significantly higher for children whose mothers had been stressed during pregnancy—though most cases of autism probably result from other causes (see chapter 27).

- Ninth month of pregnancy at the time of the hurricane, suggesting that there is a period when the effects of stress on development are long-lasting
- Similar studies have yielded comparable results. One found that children whose mothers experienced severe stress from a major ice storm while pregnant had lower intelligence quotient (IQ) scores and language ability at age five. The risk of schizophrenia is higher in children whose mothers were in the first trimester of pregnancy when a close relative died or was diagnosed with a serious illness. Children whose mothers experienced an earthquake during pregnancy were more likely to be diagnosed with depression or to be born with a cleft palate

Chapter 3 Baby, you were born to learn

- For instance, many people speak to babies in “motherese”—a high-pitched, sing-song, and slow version of regular language with elongated vowel sounds. Babies prefer to hear motherese and interact more intensely with people who speak this way, as most adults and older children do instinctively. It is probably not a coincidence that the properties of motherese, including clear pronunciation and pauses between words. Are also very well suited for helping babies learn about language.
- Infants learn to hold their heads up, sit, and walk months earlier in cultures that provide a lot of tactile stimulation and help babies to practice motor skills. In African, Caribbean, and Indian cultures, mothers massage and stretch infants after bathing them. These routines can include swinging infants around or tossing them in the air. Babies carried in a sling improve muscle strength and coordination as they adjust to Mom’s movements. Laboratory studies verify that such stimulation promotes motor development. Spinning an infant in an office chair twenty times twice a week over four weeks (a safe and fun way to provide stimulation) or moving the legs passively (twenty minutes daily for eight weeks) speeds the infant’s acquisition of motor skills.

Chapter 4: Beyond nature versus nurture

- More recent work reveals that environmental events can cause similar long-lasting changes to DNA, providing a way for transient experiences to permanently modify gene expression.
- From an individual neuron’s perspective, it would be hard to distinguish between “genetic” and “environmental” influences.
- So the next time you read that intelligence is 60 percent genetic or that researchers have discovered the gene for homosexuality or that children are aggressive only because they’ve learned the behavior from role models, keep in mind that biology doesn’t work that way. Genes and environment are irrevocably entangled throughout your child’s life.

PART TWO: Growing through a stage

Chapter 5 Once in a lifetime: sensitive periods

- **The shift happens** because the neurons that bring in timing and loudness information extend their axon branches to connect with new neurons in a different part of the map. The former connections remain in place, though their synapses are weakened, allowing the owls to return to the old mapping once the prism glasses are removed. This plasticity occurs in a sensitive period, until about seven months of age. In adults, whose sensitive period has ended, it is more difficult

to rearrange connections because their axon arbors are limited to a smaller area of the midbrain and thus the wiring is not already in place to carry signals outside the range established in youth.

Chapter 6 Born Linguists

- As they acquire experience with speech, babies begin to specialize in the sounds (called phonemes) of their own language (or languages). By six months of age (for vowels) or ten months (for consonants), babies become better at identifying the phonemes of their native language and worse at identifying the phonemes of other languages.
- Babies whose brains discriminate native sounds well (and foreign sounds poorly) at seven and a half months go on to learn language earlier than babies who show the less mature pattern of distinguishing all sounds equally well. The more discriminating babies learn words more quickly, produce more words and more complex sentences at twenty-four months, and produce longer phrases at thirty months than the less discriminating babies.
- Responding with a comment or a touch to your baby's best attempts to communicate seems to encourage efforts to improve these skills
- So if your household is bilingual' the research indicates that this is not a disadvantage for your child's language learning. (Indeed, it may be an advantage for cognitive development; see Practical tip: Learning two languages improves cognitive control, p. 118.) Learning a second language also changes the brain. A region in the left inferior parietal cortex is larger in people who speak more than one language, and it is largest in those who learned the second language when they were young or speak it fluently.
- Children who hear more words while interacting with their parents in the first two years of life learn language faster than children who hear fewer words. These differences in home environments tend to fall along socioeconomic class children heard 1,200 words, and children of professionals heard 2,100 words. These major differences in children's language environment correlate with their later language development and IQ scores—though the finding that highly verbal parents raise highly verbal children may be partly due to genetic factors or the many other advantages of growing up in a professional household (see chapter 30). Later research has shown that you can improve your children's language skills by responding rapidly to their vocalizations, mimicking the turn-taking of conversation even before your baby is capable of forming words. Responding with a comment or a touch to your baby's best attempts to communicate seems to encourage continued efforts to improve these skills. So talk to your baby and put up a good show of understanding what she's saying. It's fun for both of you, and it will help her language skills to develop more quickly.

Chapter 7 Beautiful Dreamer

- Once your baby is born, that rhythm is suddenly lost. As any new parent can wearily tell you, newborns have highly irregular sleep patterns, though it is possible to drive the rhythm a bit through feeding times. Starting around three months of age, your infant's sleep-wake patterns start to be influenced by cues such as the timing of feedings and nighttime routine. So you can make the baby's pattern regular by providing a set daily routine. Even so, for the first few weeks after birth, there is almost no day-to-day pattern. The sleep-wake cycle in infants typically lasts about fifty to sixty minutes, with no relationship to time of day

- As babies grow, sleep changes. The amount a baby sleeps declines gradually, reaching twelve hours per day by age two.
- Your child may also experience a version of this coaching if you ever ask what he dreamed about or wish him good dreams. Your wish is harmless, but it also means that you're inadvertently encouraging storytelling that might not match.
- At later ages, dreams take on more complex qualities. Around age six, dreams become more frequent and acquire active qualities and continuity of events
- Until age five or six, the lull is low enough to require an afternoon nap

Chapter 8 it's a girl! Gender differences

- All over the world, a phase of intense adherence to a sex role seems to be important for the development of a solid gender identity.
- And given that many boys have sharper hearing than many girls, it doesn't make sense to argue for sex segregation on these grounds.
- Children's play may affect their later behavior and interests. You can't force boys to behave like girls or vice versa, but by taking your children's natural inclinations into account, you can help them to practice skills that they might not find on their own. You don't know what the future holds, and we figure that you can't go wrong by increasing the number of options available to them in adulthood. One of the largest adult sex differences is that males are better at mentally rotating objects through space. (This ability affects the way we think about directions, as well as some practical skills like moving a couch through a doorway.) This pattern emerges early in life and is then modified by later experience. Many male infants at three to five months can recognize rotated objects, while few female infants of the same age can do so. Otherwise infants show no sex differences in their understanding of the behavior of objects (see chapter 1). In elementary school, the gap in mental rotation ability is small, but it continues to widen as children mature, reaching a d' of 0.66 to 0.94 (depending on how the test is scored) for adults, meaning that the average man performs better than 75 to 83 percent of women. Performance on initial rotation tests predicts performance on the math part of the SAT (originally Scholastic Aptitude Test, later renamed Scholastic Assessment Test 1) in both male and female high school students and likely contributes sex differences in map reading and navigation ability. It makes sense that different styles of play might improve different skills. Exploring physical objects and their interactions is an important component of boys' play. As they build towers of blocks and knock them down, wrestle, play catch, or ride bikes around the neighborhood, boys are learning about the rules of the physical world. As girls play with dolls and dollhouses, they are practicing nurturing and fine motor control skills. Girls also talk with each other during play more than boys do, which may help girls to become more fluent and have larger expressive vocabularies by the time they start school. Boy-Style play develops spatial skills in all brains. Boys raised in deprived conditions don't show an advantage over girls in their spatial abilities. In one study, boys from families with low socioeconomic status (SES; see chapter 30) scored lower on a mental rotation test than boys from medium- or high SES families and performed no better than girls of any SES. Boys from such families may not get the play experiences required to develop their object manipulation skills. Video games involving navigation or other spatial tasks help boys and girls learn to visualize and rotate objects. Some studies find that these training effects are especially large in

girls. Playing sports may also be helpful. College athletes of both sexes have an advantage over non-athletes in mental rotation tasks and other spatial skills, though this may be because people with good spatial abilities are more likely to play sports. Researchers have not yet demonstrated that these experiences lead to real-world improvements in spatial skills, but that will be the next step. How can parents help all their children develop a broad range of abilities? Encouraging girls to play video games could improve their spatial reasoning (as well as their comfort with computers). We also suggest getting girls involved in sports (see chapter 15) when they're young, as self-consciousness may inhibit teenage girls from wanting to learn new physical skills. Parents can help boys to develop better language skills by talking and reading to their sons, starting in infancy (see chapter 6). Boys may also benefit from extra help with phonological awareness in the preschool years, which parents can provide by discussing which letters make which sounds as they read. Similarly, you can take advantage of young boys' attraction to the computer to encourage them to write stories onscreen or choose books about fighter pilots or dinosaurs to engage their interest in reading. You can find many other suggestions for helping girls and boys grow into well-rounded adults in the neuroscientist Lise Eliot's book *Pink Brain, Blue Brains*

- **It even** occurs in monkeys and apes. If there are only a few children available, boys and girls will play together, but when possible, they usually split the group by gender.
- Sex differences in behavior give girls a medium-sized advantage over boys in the classroom, where girls get better grades in high school and college. Girls' brains mature earlier than boys' brains, with the peak volumes of most brain structures occurring one-three years sooner in girls.
- On average, girls are a bit more advanced in some areas of verbal development when starting school. Boys lag at fine motor coordination ($d' = 0.6$), giving them a moderate disadvantage in the ability to write letters, the largest sex difference in academic performance as school begins. These gaps persist through high school, with boys continuing to score lower on tests of both reading and writing.
- One example is the idea that boys make moral decisions based on justice ($d' = 0.19$), while girls make moral decisions based on relationships ($d' = 0.28$). Similarly, girls are only slightly better than boys at identifying emotions in other people's faces.
- Even if you're concerned about your daughter's weight, criticizing her body is likely to be counterproductive. In one longitudinal study (in which the same people are followed over a period of time), teenage girls and boys who reported being teased about their weight by family members were much more likely than average to have developed an eating disorder or to have become overweight five years later. Similarly, in another longitudinal study, repeated dieting in fourteen year-old girls (many of whom were not overweight when the study began) increased their risk of becoming overweight a year later by almost a factor of five.

Chapter 9 Adolescence: it's not just about sex

PART THREE Start Making Sense

Chapter 10: Learning to See

- **Children** who spend more time outdoors are less likely to become myopic. One study compared six- and seven-year-old children of Chinese ethnicity living in Sydney, Australia, with those living in Singapore

- It does not seem to matter exactly what the children do while they are outside. A U.S. study found that two hours per day of outdoor activity reduces the risk of myopia by about a factor of four compared with less than one hour per day.

Chapter 11 Connect with your baby through hearing and touch

- At birth, babies are still less sensitive than adults to quiet or high-pitched sounds. A normal conversation sounds to a baby about as loud as a whisper sounds to you. By six months, frequency sensitivity is fully mature, allowing babies to hear high-pitched sounds.
- With standard iPod ear buds, you can safely listen at 80 percent of maximum volume for ninety minutes per day, or at 70 percent of maximum for four and a half hours per day, but at full volume only for five minutes per day. Your kids should be especially careful when listening to music in a noisy environment, such as on an airplane or in the subway, which generates a temptation to turn the music up too loud. You can protect your children by downloading software that limits the music player's volume, or by investing in noise-canceling headphones (if they don't look too dorky for your child's sense of style). Your kids may not appreciate it now, but at least they'll be able to hear their own kids' complaints someday.

Chapter 12 Eat Dessert first, flavor preferences

- Sam and his wife traveled to Japan in the second trimester of her pregnancy. Sam's wife adores sushi. As a physician, she knows that sushi is safe for babies in utero—and perhaps even beneficial for brain development (see Practical tip: Eat fish during pregnancy, p. 20). So she ate a lot of it on that trip and afterward. When we started reading studies showing that children's food preferences are influenced by what their mothers ate during pregnancy, we thought we might have found the connection.
- Just consuming a food multiple times is sufficient to reduce negative reactions. Infant taste is particularly plastic during the first few months. Babies fed a relatively bitter non-milk (such as soy-based) formula are more tolerant of broccoli as children
- Combining a new flavor with a well-liked familiar flavor is another powerful way to build a new preference. Researchers have found that the two tastes cannot be given more than nine seconds apart
- But when kids eat dessert right after a meal, something odd happens: their preference for foods eaten earlier decreases. Why? Recall that our brains want us to like foods that are high in calories. And the gut detects calorie content many minutes after we eat. So, because the calories from foods eaten earlier are still being processed when dessert arrives, the earlier foods actually encourage a preference for the taste of dessert rather than the reverse.
- One solution to this problem would be to give dessert before the new flavor—ideally within nine seconds. There's a converse problem if you give dessert too early: your kid's not likely to be hungry come spinach time
- A notable reflex in this general category is the gastroscopic response, in which the eating of food, especially if it is fatty, helps trigger defecation after about half an hour (in babies and grown-ups). This reflex can be useful in making diaper-change time more predictable.
- Learned preferences for food accumulate over the first few years of life. A liking for salt emerges by age two, and eventually for more complex flavors such as cherries.

- In one longitudinal study, teenage girls who reported dieting repeatedly or being teased about their weight by family members were much more likely than average to have developed an eating disorder or to have become overweight (from a normal starting weight) five years later, suggesting that strict parental efforts to control their daughters' weight were typically ineffective—or even counterproductive. Girls who reported eating regular family meals in a Pleasant atmosphere were less likely than average to develop an eating disorder or become overweight.

PART FOUR: The serious business of play

Chapter 13: The best gift you can give: self-control

- At the age of three or four, resisting temptation is always a visible struggle. Finding a good strategy is a key element to success—and the good news for parents is that strategies can be taught. Indeed, earning self-control strategies at an early age can pay off for years afterward
- Young children's play contributes to the development of their most important basic brain function: the ability to control their own behavior in order to reach a goal
- Preschool children's ability to resist temptation is a much better predictor of eventual academic success than their IQ scores. The classic test for this ability, devised by psychologists, is to put a marshmallow on the table and tell the child that she can have two marshmallows if she can wait a few minutes without eating the first one. Alternatively, she can ring a bell at any time to bring the researcher back into the room and get just one marshmallow. The average delay time is about six minutes for a four-year-old. A child who can hold out fifteen minutes at that age is doing exceptionally well and definitely deserves both marshmallows without further delay.
- More than a decade later, those preschool delay times correlate strongly with adolescent SAT scores—predicting about a quarter of the variation among individuals in one study. Delay times in preschool also correlate with the ability to cope with stress and frustration in adolescence, as well as the ability to concentrate.
- As it improves with age, self-control continues to predict academic success. In a study of eighth graders, self-discipline at the beginning of the school year— measured in part by the students' ability to carry a dollar for a week without spending it in order to earn another dollar—predicts grades, school attendance, and standardized achievement test scores at the end of the year. The students self-control ability accounted for twice as much of the variation among individuals on all these measures as their IQ scores.
- Toddlers develop the ability to inhibit behavior on command between their second and third birthdays.
- Two related skill sets depend on similar brain regions and thus tend to develop in parallel with effortful control. One is cognitive flexibility, the ability to find alternative ways to achieve a goal if the first attempt does not succeed, and to adjust behavior to fit the situation, like not running near the pool. The other is working memory, the ability to remember task-relevant information for a short period of time, such as recalling which solutions to a puzzle you already tried.
- Four-year-olds who do well on the marshmallow task typically distract themselves from thinking about the tempting object during the delay period. They cover their eyes, turn their backs on the marshmallow, or try to think about something else

- An average four-year-old child who is asked to stand still for long as possible can manage it for slightly less than one minute. If he's asked to pretend he is a guard outside a castle, though, he can hold his pose four times that long.
- To play school, you have to act like a teacher or a student, and inhibit your impulses to act like a fighter pilot or a baby. Following these rules provides children with some of their earliest experiences with controlling their behavior to achieve a desired goal.
- Becoming bilingual gives children cognitive advantages beyond the realm of speech. Learning multiple languages is challenging in part because the person must direct attention to one language while suppressing interference from the other. This interference causes bilingual people to be slower at retrieving words and have more "tip-of-the-tongue" experiences than monolingual people. There are benefits to meeting these challenges. Bilingual children outperform monolingual children on tests of executive function. Before their first birthday, bilingual children learn abstract rules and reverse previously learned rules more easily. They are less likely to be fooled by conflicting cues, such as a color word like red written in green ink, which psychologists call the Stroop task. This pattern continues into adulthood and even shows up in nonverbal tasks. Selecting appropriate behavior in two different languages seems to strengthen bilingual children's ability to show cognitive flexibility according to context—an aspect of self-control.
- Bilingualism may also protect the brain from cognitive decline in aging. People who have spoken two languages actively for their entire lives experience the onset of dementia four years later, on average, than their peers who spoke only one language.
- You can help by encouraging your child to exercise as much self-control as possible in the context of enjoyable experiences like playing board games. The rules of the game require your child to resist such impulses as moving his piece when it's not his turn. If you stand over your child and manage every step of the process, you're depriving him of the experience that will allow him to learn how to organize his own actions. On the other hand, if your child consistently fails to control himself, the game may be too difficult for his developmental stage. Succeeding at challenging self-control tasks builds more success, but repeated failure may instead teach the child that there's no point in trying.

Chapter 14 Playing for Keeps

- YouTube videos of Komodo dragons swallowing whole pigs
- In young squirrel monkeys, lower levels of Cortisol are associated with high amounts of play, suggesting either that play reduces stress, or possibly that unstressed monkeys are more likely to play. In bear cubs during their first year of life, survival over the winter is highly correlated with the amount that cubs played during the preceding summer. This suggests that play might be an indicator of health or resistance to stress.
- Play activates other brain signaling systems as well, including the neurotransmitter norepinephrine.
- But even here, play may be practice for real life. Risk taking in children's play may be an important developmental process. It tests boundaries and establishes what is safe and what is dangerous. In the U.S., playground equipment has been made very safe, leading to the unanticipated problem that children lack experience with such boundaries, which may lead to trouble later in life.

Chapter 15 Moving the body and brain along

- A few small intervention studies show that exercise modestly reduces anxiety and depression symptoms in children, as it clearly does in adults.
- Although “parents sometimes worry that physical activity will take up time better devoted to academic effort, no study has shown a drop in academic performance as a consequence of increased activity
- In childhood, aerobic fitness is correlated with math and reading achievement, while muscle strength and flexibility are not.
- To gain the benefits of exercise on the brain, children of all ages should have fun moving their bodies for at least an hour a day.

Chapter 16 Electronic entertainment and the multi-tasking myth

- Both of us are young enough to be distracted frequently by e-mail or the Web when we’re trying to work, but we’re old enough that our brains didn’t develop under those conditions. In contrast, many of today’s children are growing up with continuous access to electronic media, from the TV in the bedroom to video games for the road. In the U.S., the average baby starts watching TV at five months of age, before he can sit up by himself. By seventh grade, 82 percent of children are online.
- **Your child’s** brain is wired to seek out and pay attention to new information because our ancestors’ survival often depended on detecting changes in the environment—from the arrival of a lion to the new expression on a mate’s face. But what happens to our brains when getting new information becomes too easy?
- A basic principle of neuroscience is that brains become better at doing whatever they do frequently. Video game players are an excellent illustration of this point, as they typically invest hundreds or thousands of hours into practicing games that require the rapid detection of targets and their discrimination from non-target distracters. Daphne Bavelier and her colleagues showed that this effort improves response speed (across a variety of tasks) and visual attention abilities of players’ brains. Although you might imagine that video games would train bottom-up attention, in fact the benefits seem to be mainly improvements in the effectiveness of the top-down attention system. Unfortunately, only shoot-‘em-up rapid action games, of the type that parents hate, seem to have these effects
- By doing multiple things at once (text messaging while watching TV or listening to music while playing video games). Almost all of us believe that we can multitask
- Two or more hours per day of screen time before the first birthday is associated with a six-fold increase in the risk of language delay in Thai children.
- In a longitudinal study, children who watched violent shows before age three were more than twice as likely to have ADHD at age’s five to eight.
- France recently banned programming directed at infants, but it is unlikely that the U.S. will follow suit. Instead, parents need to protect their babies by keeping them away from the TV until they are at least two years old.
- Under no circumstances, though, is it more efficient to do multiple attention-demanding tasks at once than to do them separately.

- For example, children who watched Dora the Explorer or Blue’s Clues at age two and a half had better language skills, while those who watched Teletubbies had worse language skills than average
- Children need exercise (see chapter 15), they need face-to-face interaction (see chapter 20), and they need to spend time outdoors (see chapter 10). In that light, your mom’s suggestion to “Go outside and play” is backed not only by common sense but by modern brain research. Dandelions need to see the sun every so often

PART FIVE your child as an individual

Chapter 17 nice to meet you, temperament

- Indeed, personality traits are as effective as IQ (see chapter 22) or socioeconomic status (see chapter 30) at predicting the probabilities of various life events, such as divorce or work success.
- Firstborn children are self-reliant, traditional, and successful, while last-born children are easygoing, creative, and rebellious? Actually, no. Despite the bottles of ink that have been spilled defending this idea, siblings show no consistent personality differences based on their place in the family. Thousands of psychology papers have been published on this topic—most of them flawed.
- First and most important, your relationship with your children is its own reward. How you get along, both as they’re growing up and after they’re adults, depends on how well you care for them. Second, your children’s behavior at home depends a lot on your household rules and how you enforce them (see chapter 29). This can have a strong effect on the happiness of their (and your) home life. Third, you can teach your children a wide variety of skills that are useful in adulthood, from cooking to financial literacy to car repair. You can also give them opportunities to discover their passions. Fourth, you can help your child learn strategies to live comfortably and productively with his or her individual temperament, especially if it’s one that you both share.

Chapter 18 Emotions in the driver’s seat

- Children show great gains in self-control during that same period, and individual children who have better self-control also show more empathy and a more developed conscience.
- Finally, parents who explicitly coach their children on the experience of emotions, by labeling and validating feelings and suggesting constructive ways to deal with them, tend to have children who are better at regulating their emotions later in life.

Chapter 19 Empathy and theory of mind

- As the neocortex develops, children make the transition from rat- and monkeylike empathy to apelike empathy. As many parents and caregivers know, the presence of one crying baby in a nursery often starts the others crying. As children grow older, empathetic responses become more complex. Children imitate the distress behaviors of other children, as if trying them on to see how they feel
- They soon shift away from feeling personal distress and start showing helping behaviors. In the second year of life, toddlers comfort younger siblings in distress by patting, hugging, or kissing them. Similarly, they may bring a security blanket to an adult in pain.

- In one classic test of theory of mind, a child is told a story of two girls named Sally and Anne. Sally has a basket with a lid, and Anne has a box. While they are together, Sally puts a marble in her basket. Sally leaves, and while she is away Anne moves the marble to the box. When Sally comes back, where will she look for her marble? Most preschoolers will indicate Anne's box, where the marble really is. Only around the age of four will children start indicating the basket, where Sally is likely to wrongly think her marble still is.
- Your children exercise this sense when you pretend not to know something. The ability to reach this state—and perhaps see it in playmates—may be a stepping-stone to a full-blown theory of mind

Chapter 20 playing nicely with others

- Those two moments when you feel in sync with your baby, as you trade gestures, facial expressions, words, or just silly noises back and forth. Are crucial for early brain development. To you, it's a fun game of peekaboo. To your baby, it's an education in self-control, as well as his first experience of relationships. A sensitive adult can regulate the baby's arousal level, which young infants can't do for themselves, by responding to cues (such as turning toward the partner) that indicate when the baby wants more interaction, and to other cues that indicate the interaction has reached its best intensity (smiling) or that the baby is overstimulated (looking away). Even sensitive parents frequently misinterpret their baby's cues, so that the baby gets a mixed experience of synchrony and missed connections
- Initiating joint attention to an object is one of the earliest indications of social skills, and babies who do a lot of it at nine or ten months
- In a study of economically disadvantaged mothers, babies were more likely to form secure attachments if the mothers used a harness to strap the baby to their bodies than if they used a car seat to hold the infant
- Notably, for most children, the evidence shows that going to day care does not interfere with secure attachment. A longitudinal study in Sweden found only positive effects of day care, though a similar U.S. study found that children with insensitive mothers were more likely to form insecure attachments if they also went to day care before one year of age.
- A difference as meaningless 'as giving children shirts of different colors can create a feeling of membership that causes them to like children within their own group better than children of the other group. Unless parents actively teach children not to attribute characteristics to people by race, they are likely to socialize preferentially with others of their own race
- You might think that children would be more likely to obey strict parents, but this approach is actually more likely to produce a rebel. Parents who repeatedly assert their power interfere with the development of guilt and later conscience, producing children who blame external factors for their faults. The parents who receive the most obedience are the warm ones. Whose children comply willingly with their parents' wishes from a desire to make them happy (see chapter 29). Mutually positive parent-child interactions are a strong predictor of later moral behavior, particularly in securely attached children.

PART SIX: Your child's brain at school

Chapter 21 starting to write the life story

- Students often wait until the last minute, then make up for lost time in a marathon study session. This approach flies in the face of one of the most reliable results in research on learning: the power of spaced study. The brain retains many kinds of information longer if there is time to process the learned information between training sessions. Two study sessions with time between them can result in twice as much learning as a single study session of the same total length. Spaced training works with students of all ages and ability levels, across a variety of topics and teaching procedures. In general, the longer the gap between study sessions (up to a year in some cases), the longer people will remember the material.
- Because memories are reconsolidated when they are recalled, tests actually improve learning (and slow down subsequent forgetting) by compelling the student to actively recall the course material. Passive reading is much less effective for learning. Multiple-choice tests do not improve learning, while short-answer questions do. You can take advantage of this fact by quizzing your child at home during study time to improve her performance at school and by teaching your child to test herself as a study strategy. A third way to improve your child's learning is to mix it up. Children who see ten similar examples in a row learn considerably less than children who see ten different examples. This strategy works across domains, affecting the way we learn sports, art history, math, or any other subject. Varying the timing and location of study sessions also improves recall, probably because learning is contextual, so learning in multiple contexts gives your child's brain a deeper connection to the material.

Chapter 22: Learning to solve problems

- If your child believes that intelligence is a fixed characteristic, that belief will make her act less smart. Children who think a test measures their innate competence do not try as hard or perform as well as those who think that effort is the major determinant of success or failure. Because children who believe intelligence can't be improved tend to see failure as a sign of low ability, they are likely to give up in shame when faced with a challenging task. In contrast, children who believe that hard work can improve their cognitive abilities often welcome difficult tasks and bounce back from failure, feeling that they have learned from the experience. For this reason, emphasizing the importance of importance to children may paradoxically reduce their chances of success.
- Accordingly, interventions to change students' views of intelligence can improve academic performance. In one longitudinal study, math test scores were static over two years in students who entered seventh grade believing that intelligence is fixed, while scores improved over time in their peers who believed that intelligence is influenced by experience.
- The researchers then went to a different school and offered seventh graders an 8 week class (half an hour per week) on brain function and study skills. One group's lessons included the idea that intelligence can be modified through practice, which leads to the formation of new connections in the brain. The other group got a lesson on memory. Later, the first group scored significantly higher on math tests than the second group, though the two groups had performed similarly before starting the class.
- Still, parents (and teachers and everyone else) should keep in mind that intelligence accounts for a bit less than half of the variation among individuals on most cognitive tests. The remainder of the

test variance is attributable to mood, motivation, specific cognitive strengths and weaknesses and experience with the particular test and with testing in general.

- Even those that do no damage directly are displacing other activities that may benefit children more, such as free play (see Practical tip: Imaginary friends, real skills, p. 117) or time spent outdoors (see Practical tip: Outdoor play improves vision, p. 84).

Chapter 23 take it from the top: music

- Significant parts of this book were written to the soaring accompaniment of Sam's three-year-old daughter belting out the songs of the ABBA musical *Mamma Mia*, over and over. When your child makes music, you've probably noticed that he seems able to stay focused for a long time—and that he finds it great fun. Whether it's singing a favorite tune or banging away on an instrument, there's something about music that can keep his attention for as long as half an hour, an eternity for a small child (and perhaps those listening to him).
- Do these interventions do any real good? Based on research, the answer I mixed. Listening to music does not make children any smarter, but it does improve their moods, which leads to some secondary benefits. In contrast, there is some evidence for direct cognitive benefits from learning to play an instrument.
- Babies absorb major features of music, like language, well before they can produce it. One example is rhythm and meter. In *Kindermusik*, a method of early childhood education in music and movement, infants are exposed to rhythm by activities such as being bounced on the knee in time to a simple, repetitive beat. After two minutes of bouncing to every other beat, the baby is more interested in new rhythms of that type, as opposed to rhythms that emphasize every third beats in a waltz like fashion. The same effect happens in reverse if babies are bounced in a waltz rhythm. So movement influences auditory rhythm perception in infants. And classes such as *Kindermusik* may enhance the development of culture-specific rhythm preferences.
- The effect size was modest $d' = 0.35$ (see p. 64). That is, the average child receiving music lessons scored better on the IQ test than 62 percent of the control children.
- In this regard, students of music achieve levels of memorization, recall, and technique that are aided tremendously by music's capacity to guide and organize brain activity. Music provides scaffolding for mental feats that are otherwise hard to attain.

Chapter 24 go figure: learning about math

- People's performance changes a lot if they're reminded of a stereotype just before an exam—even by checking a box for male or female. Any relevant negative stereotype can impair performance, especially when people believe that the test is designed to reveal differences between groups. Stereotypes can be activated even if test takers are not aware of the reminder, for instance, when African American faces are briefly flashed on a computer screen. Even more curiously, these effects can occur in people who are not members of the stereotyped group: young people walk more slowly after hearing stereotypes about the elderly.

Chapter 25: The many roads to reading

- In kindergarteners, the ability to make left-right distinctions is correlated with readiness to read, and children at this age routinely reverse letters. The relationship between left-right detection

capacity and early reading disappears by first grade, suggesting that most children clear this hurdle by the age of six.

- Access to books is strongly linked to educational achievement. Among families with similar incomes and parental education, the number of books in the home is a good predictor of children's reading ability. On average, across multiple countries, children with many books stay in school three years longer than children without books.

PART SEVEN bumps in the road

Chapter 26 hang in there, baby: stress and resilience

- Young monkeys who are separated from their mothers for one hour a week grow up to manage stress more effectively than monkeys who were ever separated from their mothers.
- She makes up for a brief separation by grooming the pups more, but after a long separation, she tends to neglect them.
- Parents who are overly protective of high-reactive children may interfere with their development of coping skills
- As parents help their young children to cope with stress, the quality of their support regulates the children's HPA responses. Physiological stress responsiveness declines over the first year of life in normally developing children.
- The strongest stress responses are found in children with disorganized attachment relationships, in which the parent often makes the child afraid, either through aggression toward the child or by being extremely anxious. Such children also have the highest risk of behavioral or emotional difficulties.
- It's tempting to think of high-grooming mothers as the "good" mothers, but that would be a misconception. Instead, both types of mothers are matching their pups' adult behavior to local conditions, one of the key aims of neural development. Remember that not all stress responses are bad. Pups born into difficult circumstances may survive better if they are vigilant and their HPA system is reactive.
- Children seem to develop their coping skills most effectively if they are exposed to a moderate amount of stress: high enough that they notice it, but low enough that they can handle it.

Chapter 27 mind blindness autism

- Collectively, these so-called autism spectrum disorders affect about one in 150 children, 75-80 percent of whom are boys.
- Signs of the social and communication deficits in autism can be seen at one year of age or even earlier. At this age, infants with autism are less likely than non-autistic mentally retarded infants to respond to their own names, to look people, or to use gestures to communicate.
- The Autism Diagnostic Observation Schedule survey can be given as early as twelve months, but there is some risk of making a premature interpretation
- Despite reports to the contrary, it is a myth that autism can be triggered by vaccination. In the 1990s, specific blame was leveled at a particular vaccine. MMR, which is typically given at the age of twelve months.

- For autistic children, the strongest contribution that parents can make is to recognize the potential for problems early in life—and to act by the age of two, or earlier if possible. In most cases, babies simply mature on their own timetables, but for this disorder, intervention can make a critical difference. The challenges posed by autism spectrum disorder are considerable and will be with us for the foreseeable future. However, considering the possible benefits seen in their non-autistic relatives, some of the genes that make children autistic may also help others to thrive and contribute to society.

Chapter 28 old genes meet modern world: ADHD

Chapter 29 Catch your child being good: behavior modification

- When it comes to getting your kids to pick up their toys, we have good news and bad news. The good news is that children's behavior is strongly influenced by the positive or negative consequences that immediately follow from certain actions. If you can set appropriate expectations for behavior and get the consequences right (more on that later), your children will follow your household rules—most of the time, anyway.
- The bad news ... well, it's the same news. If whining or throwing tantrums gets your kids something they want, that's what they'll do. You may not think lagging as a way of rewarding your child for misbehaving, but even yelling can actually encourage the behavior you're trying to stop, especially if that's the best way for your child to get your attention. Completely ignoring the problem behavior is usually the most effective way to get it to stop—if you can stick with it long enough
- If you spend much of your time with your child nagging and correcting, it's worth giving some thought to how you can both get more enjoyment out of the relationship. That should improve both the quality of your home life and your child's behavior.
- Broadly speaking, when parents talk about discipline, they want children either to do something or to stop doing something. One of the most effective methods of reducing the frequency of an unwanted behavior goes by the scary sounding technical name of extinction, which is nothing more than ignoring the behavior. Your child whines; you act as if you didn't hear her say anything. Once you start that approach, though, you've got to hang tough until the child stops in after many hours of persistent whining—which is what a lot of kids end up learning, once their parents' resistance is worn down.
- For that reason, it's easier to stop difficult behavior before it's become entrenched. You should be very skeptical of the phrase "just this once" when it pops into your head in moments of parenting stress. Frankly, whatever you're thinking of doing, you're unlikely to do it only once.
- Along the same lines, learning to anticipate and head off approaching problems before they become serious can save a lot of wear and tear on everyone. It's usually easier to intervene early by changing situations that lead your child to bad behavior—whether that means choosing the candy-free checkout line at the grocery store or suggesting that your child run around for a while before getting in the car for a long ride—than it is to deal with the resulting problems after they've occurred.
- **Even negative** attention is still attention. Like rewards, the time-out should immediately follow the behavior, or it will not be effective. Lecturing or touching your child during a time-out defeats its purpose and will probably act as an attentional reward. Brief time-outs of a minute or two are

sufficient to change behavior. If at the end you briefly praise your child for cooperating with a time out, she will be more likely to do so again the next time. If your child refuses to take a time-out when asked, it is time for her to learn the act of time-out itself Use positive reinforcement on “dry run” time-outs while you are both calm (see Practical tip: Getting to good, p. 252).

- For instance, if your child is whining too | much, it’s not enough simply to ignore the whining. You have to also encourage positive behavior: when your child asks nicely, once, for what he wants. Reward him. If he does that, even one time, jump on the opportunity to praise the behavior—and if possible. Grant the request. Teaching your child a positive replacement behavior reduces the odds that the extinguished negative behavior will come back.
- Consistent, small rewards for small achievements work much better than large rewards for big goals, especially for younger children. After all, you wouldn’t expect your child to learn to read if you paid him no attention until he’d finished his first book. Why set such a high expectation for behavioral self-control? Food and toys are often the first rewards that come to mind, but they are not the most effective. Your approval, expressed enthusiastically and accompanied by a pat on the shoulder or a high-five, should produce more behavior change than a cookie.
- The self-esteem movement had strong effects on parenting practice in the U.S.—but not necessarily good ones. Children do not benefit from routine empty praise, like the cries of “Good job!” that ring out over modern playgrounds. East Asian and South Asian parents (Sam s included) are known for strictness and are sparing in their praise, yet children from those cultures do not have particular self-esteem problems. Indeed, when an adult praises for small accomplishments, children over the age of six perceive it as a slight; they see the praise as reflecting the adult’s low expectations. Praise is most effective when it is specific and refers to something that your child can control. “You’re so smart!” doesn’t give your child any hint of what to do next time and may reduce perseverance (see chapter 22), while “Wow, you really worked hard on that math homework!” carries a clear message about the desired behavior. Parents who communicate high but achievable expectations, along with detailed guidance about how to get there, give their kids the tools to achieve real success in the world—which turns out to be the best route to self-esteem.
- Explaining exactly what you’d like your child to do is the first step in behavior change—not the last, as many lecture-happy parents seem to believe. Prepare children for situations and let them know what is expected of them in advanced

Chapter 30 a tough road to travel: growing up in poverty

- People who are satisfied with their standard of living and feel financially secure are healthier. Regardless of actual income, occupation, and education, than people who are unsatisfied and anxious about the future.
- How we interpret the circumstances of our lives also has a strong effect on our stress responses (see chapter 26)—often stronger than the effects of our actual economic circumstances,
- Children who live in noisy environments, such as near airports or highways, are delayed in learning to read compared with other children of the same SES. Chronic noise exposure also causes deficits in attention and long-term memory.