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The NATURAL LAWS OF CHILDREN

Why Children Thrive When We Understand How Their Brains Are Wired

CÉLINE ALVAREZ



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Translated by Sherab Chödzin Kohn



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In identifying the primary principles of learning, I relied on the findings and formulations of eminent scientists and international research centers. I would like to express my profound gratitude to all those people, across the world, who are seeking to understand and make known the laws of human development. My sincere thanks to them. I am deeply grateful. It is owing to the fundamental data they provide—year by year becoming clearer and more precise—that we are finally becoming capable of letting human beings flourish and grow in environments that support their complete development.

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INTRODUCTION

What If We Rethink School with the Natural Laws of Learning?

My experience as a schoolgirl and a teenager in the underprivileged neighborhoods of Argenteuil left me with a profound sense of indignation. Year by year I saw our educational system stifling the unique gifts and talents of my friends. Later, many of them ended up having major academic difficulties. I already sensed at that time that this same thing was happening to an unacceptable number of children, but I was still far from imagining the numbers presented in the 2007 report of the French High Council on Education: "Every year, 4 pupils out of 10 (approximately 300,000 students) come out of CM2 [roughly equivalent to American sixth grade] with major learning deficits. Almost 200,000 of them have shaky and inadequate skills in reading, writing, and arithmetic; more than 100,000 failed to achieve basic competence in these areas…. Deficits like these will prevent these students from pursuing a normal scholastic program in *collège* [the four-year program following elementary school in France, for pupils ages eleven to fifteen]."[1] These numbers were confirmed by the council's report of 2012.[2] Thus, 40 percent of our children begin their secondary education with major learning deficiencies.

These shocking numbers tell me loud and clear that our educational system is not taking into account the natural mechanisms of human learning. Our schools are based essentially on tradition, intuition, and certain societal values, but not at all—or very little—on actual knowledge of the laws of learning. Our educational system also shows little awareness of the main principles of child development.

This is quite understandable, since cognitive psychology and the branches of neuroscience that study human learning and development have emerged only fairly recently. Thus, for lack of information, we have made many mistakes in our approach to education. The school environment we offer and the demands we make on our children are for the most part ill-suited to the way children actually function. Though children are neuronally wired to learn without effort, they struggle in the classroom and lose their self-confidence. Their teachers, dedicated as they are to helping them, also end up exhausted.

As long as we impose a system of learning on our children that does not take into account the natural workings of their minds, we will continue to put them in situations that cause them a great deal of suffering. Teachers will continue to have to work in extremely difficult circumstances: they will go on endlessly having to push unmotivated students and to end their workdays totally spent. Imagine driving a car in high gear with the emergency brake on. The car doesn't move and it makes weird noises. You try in vain to get it fixed at one repair shop after another. In the end you must acknowledge that you are dealing with a basic dysfunction—the thing has no power. But just take off the emergency brake and you will feel the amazing power of the engine and the quality of the ride. Similarly, by using inappropriate methods, we are constantly putting the brakes on the powerful learning potential of our children. They have learning problems, so we think they need outside help, and we take them to see specialists who themselves are overwhelmed by the growing number of children they have to deal with. But just provide children with an appropriate class environment, and you will be amazed by the rapidity, ease, and joy with which they are suddenly able to learn.

Rethinking our educational system based on the essential principles of learning and development would certainly be a big help for the 40 percent of our children who are having trouble in school. But let us also consider the other 60 percent. The other 60 percent may not get labeled as failures, but are they really thriving? Are they happy? Has school been a place of joy and freedom for them? Has it encouraged self-confidence and a sense of independence in them? Has it brought out a spirit of initiative, a feeling of freedom, and a sense of solidarity with others? Because we are not cooperating with the natural laws of learning and development, which require children to be able to explore and experiment in ways that motivate them and to be able to enjoy the benefits of a rich social life, the splendid values that our educational system was built on—freedom, equality, and fraternity—have a hard time reaching the hearts and minds of our children.

Starting in preschool, the way we try to get students to understand the idea of freedom is by imposing our own will on them and then evaluating their ability to comply with it. By making them docile and submissive, do we hope to make them feel free? We want them to adhere to the ideal of equality, but we subject them to one of the least egalitarian educational systems on earth, in which differences in the aptitude levels of children are rapidly established. The study by the Program for International Student Assessment (PISA), which every three years measures the performances of the various educational systems of the countries of the Organization for Economic Cooperation and Development (OECD), reported in 2012: “France breaks the record for unfairness. Its schools, supposedly for all, primarily serve the elite and have proved incapable of helping the less privileged to succeed. They are even becoming less and less capable of that.”[3]

So really then, how can we decently pretend that we are instilling a sense of fraternity and solidarity in our children when we insist on isolating them from each other? Traditionally, from preschool on, we separate them according to date of birth the way manufactured goods are categorized by date of manufacture, thus depriving them of a rich and varied social life in which all benefit from the positive and cooperative emulation that is generated when younger and older children spend time together. What chance is there for solidarity when, put into age groups, the children much more readily get involved in mutual comparison and competition? When we place them in conditions that contribute to mutual misunderstanding and encourage individualism, can we realistically hope that they will be filled with fraternal feeling?

Very early on, I had the profound intuition that a pedagogical approach based on real *knowledge* concerning human development would not only lead to rapid and significant reduction of academic failure, but would also cause the values we cherish to arise in children naturally and effortlessly. We will never—even with new programs and lovely tablet computers—be able to resolve the problems of our schools unless we directly attack the causes that bring them about: our system insists on imposing its own laws and tramples on the laws of the child. Schools themselves, by operating in this brutal fashion, create the problems that they later seek to remedy through reforms.

In 2009 I made the decision to put my intuition to the test. Would an environment based on the natural mechanisms of learning reduce the difficulties of both children and teachers? To answer this question, I needed a class. Since

research had already clearly shown that inequalities appear at very young ages and immediately begin to worsen, I decided to carry out my experiment at the preschool level (that is, with children three to five years of age). And in order to counter the completely logical and understandable argument that would have been used against me if I had carried out my experiment in a special private setup—"It only works because the children have been handpicked, or come from privileged backgrounds; and you didn't have to deal with public-school conditions"—I decided to do it *in a public school,* one that was situated in a *zone d'*éducation *prioritaire,* an underprivileged area officially designated as requiring special supplementary resources in order to bring students up to the standard level. Finally, in order to establish my results, I wanted to have them monitored objectively through scientific testing. Every year my children would have to take standardized tests that would enable us to pinpoint their progress in relation to the norm. That way, if the results were as good as I hoped they would be, there would be no excuse for not acknowledging them.

This standardized testing turned out to be crucial. Starting the very first year, our results were so extraordinary that they would have been hard to believe if they had not been objectively measured—that is, the results would have been hard to believe for people who did not know the children involved. In the framework we set up, the cognitive and social intelligence of the children emerged with such force and depth that all existing norms were blown away. This proved the point: if we disregard the natural processes of learning, we ignore the greatness and power of the human intellect and simply crush it underfoot. Individual potential is constantly hindered in its development by ill-conceived school environments in which children develop only to their minimum potential, and we end up taking this minimum to be the norm. But our experiment at Gennevilliers clearly demonstrated that children's potential is much greater than we think or can even imagine.

To carry out this experiment, I had to become part of the public school system and so I had to pass the exam for schoolteachers, which I did in 2009. "But," I am often asked, "how did you manage to get government permission so fast, along with carte blanche for your teaching methods and annual scientific testing of your results?" My answer is simple. Nothing, absolutely nothing, could have stood between me and my goal. The outrage and sadness aroused in me by the waste of human potential I had seen was too deep. I simply could not have cared less about what obstacles I had to face. I was absolutely determined to overcome them one by one. Regardless of whether the challenges were financial, human,

hierarchical, or administrative—there just had to be a solution. Some of life's amazing coincidences also fell out in my favor. A number of times, I was in the right place at the right time, and on those occasions I seized my opportunity without hesitation. Above all, *I had nothing to lose*. I was ready to lay myself on the line to do this thing. I had no career to protect, and therefore I was not afraid to bypass the usual hierarchical levels and present my case directly to the highest authorities.

CARTE BLANCHE FOR GENNEVILLIERS

Two years after I had passed the schoolteacher's exam, I received the green light from the Ministry of Education, which agreed to give me carte blanche to try my teaching methods for three years beginning in September 2011 in a preschool class in Gennevilliers. The ministry authorized my work and encouraged me to arrange for independent scientific testing in order to evaluate the progress of the children.

The experiment began with twenty-five three- and four-year-olds (the ages in the first and second years of French preschool). The main teaching materials we had at our disposal were those devised by Édouard Séguin and Maria Montessori. I managed to rearrange our classroom to allow the children complete autonomy. Materials were placed within the children's reach so they could use and put them away themselves. Many tables were removed to make room on the floor for small mats where activities could take place. The children were given their independence. They could work with the materials presented to them either alone or in small groups. They could freely exchange with one another throughout the day and repeat whatever activity interested them as much as they wanted. This was the way the class proceeded from 8:20 a.m. to 4:00 p.m., with time out for lunch and a daily group assembly period. There were also time-out breaks, but they were not regularly scheduled. We gave time-outs only to pupils who needed a break and only for the length of time they needed.[4]

For this experimental situation, the Versailles school district board, to whom I would like to express my sincere thanks, allowed me to choose the person who would fulfill the officially required role of certified classroom assistant, responsible, among other things, for matters of hygiene. I chose to work with Anna Bisch, who helped me to adapt her official role to support classwork based on the autonomy of the pupils. Basically, we broadened the scope of her work to be more involved with pedagogical duties than hygiene.

Despite having met all these conditions, I still hadn’t obtained the holy grail of certifications. What we most needed to ensure continuation of our experiment was an official document of authorization recognizing our class as “experimental,” explicitly defining the conditions of our experiment, and committing the Ministry of Education to the project for three years regardless of changes in ministers (each one of whom might not want to continue the projects of his or her predecessor). As essential as this certification was, and in spite of my perseverance, I had great difficulty in acquiring this document. In September 2011, although our experiment was already underway, no document had been signed.

A PEDAGOGICAL HERITAGE

I can’t continue without making clear that this approach based on knowledge of the natural mechanisms of learning, as innovative as it might seem, carries on a torch that was lit in the eighteenth century by the physician Jean Itard,[5] whose work was taken up and pursued by his disciple Édouard Séguin. Séguin’s work was in turn developed further by Maria Montessori, who frequently recalled in her lectures how she had taken up Séguin’s educational legacy and supplemented it with the findings of German experimental psychology. Of these three doctors of different generations, each of the latter two were able to expand the work of their predecessors with their own experience and the scientific learning of their day. In 1907 Maria Montessori created what she called Children’s Houses, which brought together forty children from ages three to six. The essential pedagogical principle for these learning places was guided and structured autonomy. The work of Dr. Maria Montessori, based on many concrete experiments, has now largely been validated by scientific research.

Nevertheless, Maria Montessori did not want us to preserve her work in its existing state; rather she wanted her successors to modify it in accordance with advances in knowledge of human development, just as she had done with the work of her predecessors. As she saw it, her work was a scientific contribution to the full development of human potential, and this contribution, by its very nature, would continue to need further research and improvement. She could not have been clearer about this than she was in the first lines of her last book, published two years before her death: “I turn to you today as to a family that must continue along its way.” But this desire of hers was unfortunately not understood by her most fervent admirers, who, while she was still living, did just

the opposite of what she wanted. They made her work sacred, turning it into a *fixed* pedagogical method, frozen into untouchable dogmatic principles. This is *exactly* what Maria Montessori wanted to avoid. In fact Renilde Montessori, her granddaughter, tells us that her grandmother, in the last years of her life, at times when she thought she was alone, would repeat in Italian, *Propio non hanno capito niente, propio non hanno capito niente.* This could be translated into English as, "They really have understood nothing; they really have understood nothing."

When I discovered the writings of Dr. Montessori, they quickly inspired me precisely because of their scientific quality, their nondogmatic and constantly evolving approach. Moreover, they were astonishingly precise, visionary, and profoundly human. I went on to study Montessori's works every day for seven years, supplementing her ideas with fresh updates drawn from current scientific research on human development and French linguistics.

This became the basis for the research I carried out concentrating on the development of the *executive functions* of the child, which are very strong at the preschool age (we'll come back to this point at length); on language activities, which I adapted to the particularities of the French language; and also on group activity sessions, which are essential for consolidating the basics of executive-function development. Finally, and most important, I limited the number of activities presented to the children to prioritize and strengthen social bonding. Our shared activities were lively and warm moments of coming together, rather than rigid and didactic times. We did everything we could to get the children to feel really engaged, to get them to be able to laugh, exchange with each other, express themselves, help each other—basically to work and live together. This social bonding proved to be a true catalyst for development and learning.

FIRST RESULTS

The first year, despite the absence of the official authorization document, the Ministry of Education and the school district authorized us to monitor the children's progress through scientific testing.[6] The results were astonishing. Experts had warned me that it would be impossible to obtain positive results the first year; they told me that more time would be needed. Nevertheless, in June of the first school year, the test results showed quite the opposite: "All of the pupils, with one exception, are making faster-than-normal progress, and many have made very significant progress. The pupil who is not making faster-than-normal

progress has had the highest number of absences over the year." Some children who had been behind in relation to the norm at the beginning of the year not only caught up but surpassed the norm in certain basic cognitive areas and skills.

This was the case for one child who at the beginning of the year had been eight months behind in working memory. We will see later that this skill is quite often predictive for academic success. The tests showed that by the end of the year, this child had made up this deficit and was now twenty-eight months ahead. Moreover, the tests indicated that most of the four-year-old children had begun reading and had already gone beyond what researchers consider to be the "threat level." According to illiteracy prevention experts, this threat level corresponds to the minimum reading level that children must reach by January in the first year of elementary school (six to seven years of age) in order not to be at risk of falling behind the class. By June, 57 percent of our second-year preschool children (four-year-olds) had already gone past this level. The most striking thing was that this progress was achieved, for the most part, joyfully, quickly, and with great ease.

The parents, for their part, noticed big changes. Their children became calm and independent. They showed self-discipline and spontaneous kindness in relating with other children. They were always ready to help when needed. The testimonials we filmed were very telling.[7] The parents expressed their initial reservations and shared how their attitude changed as the children's behavior transformed. All the parents observed the same results in their children: calm, quickness to learn, enthusiasm about going to school, orderliness, autonomy, improvement in language level, and most important of all, major development in generosity and empathy. The parents were stunned. Their children watched less television, were eager to learn, were helpful toward their brothers, sisters, and cousins, and read all the time. Their eagerness to learn sometimes posed unexpected problems. For example, in one case it necessitated stopping on the street at each sign while the child took the time to decipher it. Parents often had to take their children to the local library to satisfy their burning need to have new books to read every evening.

I was deeply moved. I had been right: by changing learning conditions to correspond with the natural mechanisms of the child, reading, writing, and counting quickly became joyful achievements. And what are called *noncognitive* skills—mutual helping, cooperation, and empathy—flourished without having to be explicitly taught. Human beings have unsuspected potential within them, just

waiting to emerge.

THE SECOND YEAR

The following school year, 2012–13, we kept the same group of children. They had started with us in the first- and second-year levels of preschool, and now they all passed to the next level. So the class was composed of children in the second and third levels of preschool, and in addition to them, we now added a third (beginning) level by taking in some new little ones. So the class now contained three age groups. Our positive results continued showing an astonishing progress curve—the most advanced pupils carried the others along with the them. The process of emulation between age groups was doing its natural work.

Nevertheless, the Ministry of Education had still not produced the official documentation we required, despite my ongoing attempts to get it from them. This time the school district decided to deny us our scientific testing until our administrative situation had been regularized. I was hoping that this denial would play out in our favor, forcing things a bit with the ministry. Unfortunately, the end of the second year came and we had still not been made official—we were on the brink of losing our means of objectively measuring our children's progress.

I could not accept this situation. I felt it was absolutely necessary for the mini-miracles I had had the privilege of witnessing on a daily basis to be recorded objectively. So I made the decision—which I would pay for heavily later—to have the testing done anyway, outside of schooltime and with the help of research workers, parents, and an independent psychologist.[8] We had very little time, so we decided to prioritize testing the children of the intermediate and upper sections who were finishing their second year in our class. Thus we were only able to test fifteen students that second year.

Nevertheless, the test results were encouraging, showing a very positive trend line. The psychologist's report indicated, for example, that the children of our upper section exhibited at least as high a level of reading comprehension as students in the second year of French elementary school (seven- to eight-year-olds). In the understanding of numbers, only two children failed to get the maximum scores in both tests. The oral numbers test was passed by all the students of the upper section of our preschool class (five-year-olds) and one child from the intermediate section (four-year-olds). Moreover, this test is

standardized for pupils in the third year of French elementary school (children eight to nine). Children who scored 12 out of 12 on this test achieved the best results not only in their own age group but also in the eight-to-nine-year-old category. In comparison of numbers, “once again, we can report that all the children did brilliantly on these two tests, suggesting an astonishing mastery of numerical quantities for children of their age.”

The general conclusion was that “in the two areas indispensable for scholastic progress—reading and arithmetic—the children of this class often display skills surpassing their scholastic level. This is particularly true of the children’s reading skills. Indeed, in contrast to what is expected even of six-year-olds, all the children in our group can be considered readers. The sole child who could not decipher a text was only in the intermediate section and was nevertheless capable of recognizing letters. The children’s math skills were also amazing. Here again, they went beyond any expectations we could have had for them. We must recognize that these children are at least a year ahead of what would normally be expected of them.”

That second year, we also received visits from numerous scientists. Stanislas Dehaene, a cognitive psychologist of international renown who holds the chair of the Department of Experimental Cognitive Psychology at the Collège de France, came to the class, accompanied by his colleague, outstanding researcher Manuela Piazza. After their visit, of which I have a very positive memory, Stanislas Dehaene shared his impressions of the class with the minister of national education in an email as follows:

> My colleague Manuela Piazza and I observed truly remarkable advances in this class over the course of a morning. This experiment mixes all levels together (the lower, intermediate, and upper levels of preschool). The children, extraordinarily engaged and focused, devoted themselves to their work with enthusiasm, teaching each other in an informal way, stimulated by the pedagogical material placed at their disposal. It is to be noted that half of them know how to read and are a year or two ahead of the CP level [first year of school for six- to seven-year-olds]. They understand the base 10 number system, positional notation of numbers, and addition to four places. I have often repeated that traditional schools underestimate the potential of children—after visiting this class, I no longer have any doubt of it.

François Taddéi, the director of research for the French National Institute of Health and Medical Research (INSERM) and director of the Paris Center for Interdisciplinary Research, also sent an email to the Ministry of Education after his visit to our class. This was also done by Joëlle Proust, director of research at the Jean-Nicod Institute.

> I also had the pleasure of visiting this class and was just as impressed as Stanislas and his colleague by the results, because it is a class with a high number of pupils (twenty-seven) who obviously come from backgrounds that are not those of private-school students. The children were at once calm, engaged, curious, collaborated spontaneously with each other, and were capable of reading children's literature either alone or in groups. If we want to reshape our schools and make it possible for all students to succeed as the government wishes, the challenge is to allow what can be observed in this class to become the general case.
>
> FRANÇOIS TADDÉI

> The purpose of this message is to give you an account of my visit, just today, to the class of Mme. Céline Alvarez. On this visit, I saw a group of around thirty children who were calm, happy to be in school, deeply involved in the cognitive tasks that they had chosen, engaging in them purposefully until they were completed, either alone or in groups of two or three children. Mme. Alvarez's work, inspired by that of Maria Montessori, makes use of an array of activities that are sufficiently rich, structured, and motivating to arouse the interest of the children, who by engaging in them acquire not only basic skills like reading, writing, and mastery of arithmetical operations, but also metacognitive and attentional skills, fundamental for the future of their scholastic careers, such as the ability to concentrate on a cognitive goal and to independently recognize one's mistakes and eventually devise alternative solutions. The children also acquire particularly precious social awareness: they learn to respect the autonomy of their comrades when they are learning some tasks and to collaborate with them when they are learning others. The children of the third level help the younger children and transmit their knowledge to them by

> example. Observing the preschool class at Gennevilliers has confirmed for me the importance of this pedagogical revolution in preschools. In my view, it is more than urgent for us to take the fundamental principles involved here into account and allow schools their full potential in bringing about the cognitive development of future educated and responsible citizens.
>
> JOËLLE PROUST

Liliane Sprenger-Charolles, linguist and director of research emeritus at the National Center for Scientific Research (CNRS), also wrote me a few days after her visit.

> I'm taking advantage of the weekend to get back in touch with you after my visit to your class last Monday. I can only tell you again that I was very impressed by what I saw, in particular the warm and studious atmosphere of the class, which was maintained all morning long without interruption with a group of twenty-seven preschool children coming from a troubled neighborhood! I was also impressed by the quality of the exchanges between you and the children as well as by the exchanges of the children with each other, with the older ones (or more accomplished ones in a particular area) serving as tutors for the younger (or less accomplished) ones. I'm retired now, but I have worked in rough neighborhoods. I never would have thought this possible. Bravo!

THE FINAL YEAR

The third year, I spent a great deal of my time attempting to obtain the official authorization document for our experimental class. My efforts came close to being rewarded when the experiment received the support of Mrs. George Pau-Langevin, who at the time was the deputy minister in charge of success in education. An official visit to the class was scheduled so that Mrs. Pau-Langevin could sign the document of authorization in February 2014. However, just before the scheduled date, the visit was canceled. Mrs. Pau-Langevin had been appointed minister of overseas territories and left soon after she was appointed. I was no longer talking to the same people. Everything was back to square one.

Without the official authorization, the scientific testing was no longer

approved by the school district. Stanislas Dehaene suggested that I have ten children from the class undergo MRI tests at his laboratory where he and his exceptional team were accustomed to following the evolution of neural connections in children as they learned how to read. These fascinating studies advance our understanding of the mechanisms through which humans learn to read. Having the children in our class who were readers undergo the MRI tests would allow us to establish whether spontaneously learning to read at three or four years of age made any difference in the "wiring" of the neural circuitry used in reading when compared with those of children who learned to read later, in the first year of elementary school, at six to seven years of age.

The MRI results indicated neural wiring for reading that was totally normal—just developed earlier.[9] This does not suggest that children should learn to read before they start elementary school, but rather that if they feel spontaneously inspired to do so, they are capable of it.

AFTER GENNEVILLIERS

At the end of three years the administrative status of our experiment had still not been officially formalized. In July 2014, the ministry decided to end it. My materials were to be taken away and I would no longer be allowed to have a class with mixed age levels. Since I obviously would not be able to continue my research within the framework of governmentally run public education, I decided to continue my work outside of that framework. I submitted my resignation in mid-July 2014. This turned out for the best, since after the extraordinary, very promising results our children had shown, I felt an urgent need to share on a broader scale the theoretical content and pedagogical tools that had achieved such positive results with a freedom and speed that would ordinarily have been impossible in the context of our national public education. I wanted interested teachers to be able to understand the procedures we had used point for point. I wanted the process we had established in the Gennevilliers class to be easily reproducible and accessible to everyone.

So I began posting videos of some of our class activities on a blog,[10] along with the basic theoretical ideas upon which I had relied. The urgent need I felt to share my methods and ideas met up with the urgent need of numerous preschool teachers for further evolution in their teaching practices. My blog contains maps that help connect teachers and schools around the world that use a pedagogical approach following the natural laws of learning for young children—which

encourage autonomy, kindness, and a mix of age groups, and is inspired by the methods and ideas arising from the Gennevilliers experiment. The results of this coming together were amazing. Within two years, hundreds of teachers and tens of public preschools in their entirety were beginning to apply the approach I had used. I received many testimonials from teachers whose professional lives had been radically and positively transformed by it. They observed striking positive results in the development of children and in their own teaching ability. The teachers themselves felt personally renewed.

The book you have in your hands is another part of my effort to share the methods and ideas of my experiment. It brings to light the research-based biological principles of learning that I have relied on, as well as discussions of how our teaching should be informed by this research. In the first part of the book we will look at the importance of nourishing the extraordinarily plastic intelligence of children in the first years of their lives by providing them with a quality environment that is rich, dynamic, and complex and that allows the children to be active and engage in activities that motivate them. In the book's second part, we will see the importance of helping children to organize and assimilate the detailed information they receive from the outside world, in particular with the help of teaching materials presenting the fundamentals of geography, music, language, and mathematics in a very concrete way. Then in the third part, we will see that it is of fundamental importance to allow children to develop their innate potential at the very time they are trying to develop it—not before or after. And finally, in the fourth part we will deal with a key environmental condition—human relationship. Varied warm, empathic, and compassionate social interactions are in fact one of the most important instruments for the full development of human intelligence.

The points above are pedagogical constants. By definition, they are invariable. They are common to all human beings and thus they transcend the idea of method. They must become universal common denominators in all educational approaches that seek to support human potential fully and to help it flourish. These primary principles respect our natural way of functioning rather than repressing it. Let us leave behind that antiquated world whose approach was to subject the laws of life to its own will, to its ideas and beliefs. Let us instead undertake a path of knowledge of, and cooperation with, the natural laws of learning. Let us take a humble approach. Let us amend our old way of looking at things and build the world of tomorrow. Undreamed-of marvels await us.

PART ONE

THE PLASTICITY OF HUMAN INTELLIGENCE

Contrary to what we have long thought, it is not the genes we inherit that determine our health, our intellectual capacity, or our social aptitudes. Genetics plays only a small role in the movie of our lives. What we are is essentially determined by our environment. It is mainly the physical and psychological nourishment we take in—the people we spend time with, the words we hear, the words we say, the way we manage our stress, the experiences we live through, the quality of food we eat, the amount of physical exercise we allow ourselves—that makes us what we are.

You are no doubt familiar with this remarkable example from the field of epigenetics,[1] but I can't resist sharing it with you anyway, since it seems to illustrate so perfectly the importance of the environment in the development of young humans. Bee larvae are all predisposed to become little female worker bees. They are all born with the same genetic makeup. But if one of them is fed royal jelly, it becomes a queen. Similarly, young humans, in order to become the best they can be, need an environment that is loving, vibrant, rich, and orderly, conducive to spontaneous exploration and activity, to encounters with others, to peaceful and benevolent interactions, mutual helping, empathy, and generosity. For us, paying attention to these kinds of environmental factors is not an optional matter. They are to the child what royal jelly is to the bee larva. They very directly nourish the best in our children.

The visionary Maria Montessori perceived the environment as a key element before anybody else. She knew that the fundamental factor adults had to focus on to promote optimal development in their children was the environment. She saw the importance of preparing it lovingly, mindfully, and with understanding. She tirelessly insisted on this point, without being understood for the most part by her faithful admirers, who focused primarily on teaching materials and

thereby missed the essential point. When Montessori referred in Italian to the rooms intended for the children, she used the word *ambiente*,[2] which means "environment." In her view—and this is the key point I think we must retain from her work—adults must concentrate their efforts on creating environmental conditions that will nourish and promote the development of their children. Thus Maria Montessori foresaw with precision the importance of epigenetics in the realm of education. The child's environment must be conceived of as an ecosystem conducive to the development of its intelligence. And that is the entire object of this book: to bring to light the environmental and educational constants that are beneficial for this development.

1

Brain Plasticity

Infants are not born without cerebral organization. Quite to the contrary, they come into this world with a remarkable rough layout of the main neural circuitry found in adults. I always had the profound sense that babies were born with embryonic human potential already in place, possibilities that were only awaiting experience in the world to develop. But then to actually be able to see how precise the circuitry of the human brain is at birth thanks to brain imaging techniques was an immensely joyful experience for me. So it is true—human beings are pre-wired to develop profoundly human characteristics. We are born with an innate predisposition to communicate, to construct precise and structured oral language, to memorize, to reason in an orderly and logical manner, to *create,* to innovate, to imagine, to feel a wide range of emotions and to moderate them when necessary; we are even born with empathic abilities, a moral sense, and a very profound sense of justice. Thus human beings arrive in this world with great promise of intelligence and humanity. Isn't that amazing?

Nonetheless—and it's here that the great importance of environment comes into play—this pre-wiring is very immature. Even though human beings are pre-equipped to speak and reason, at birth they have access to neither speech nor reason. They are in some sense born *prematurely,* cast into the world before even having completed the formation of their brains. Thus the development of their innate potential is conditional—without the slightest filtering—upon the quality of their environment. Seeing this immaturity of the brain is rather shocking, in a way, because it means that human beings are extremely vulnerable to impoverished, violent, and toxic environments. So why shouldn't the formation

of the human brain be completed in the warmth, protection, and intimacy of the mother's womb, as it is with other mammals? Other mammals are initially equipped with much more mature pre-wiring that makes it possible for them to communicate, walk, and orient themselves only a few hours after birth. Could it be that nature, usually so skillful, could have "lost its head"?

Absolutely not. This immaturity of the brain is a primary necessity, because human beings, more than any other mammals, have the ability to reason, to imagine, to create. They are constantly innovating. If human babies came into the world with a fully matured intelligence as other mammals do, they would be born *a finished product.* Their intelligence would be finalized, possessing little plasticity. This would make them quite incapable of absorbing the evolutionary leaps of previous generations. Fixed and determined from birth, their lives would be peaceful and secure but totally lacking in the ability to evolve. So by bringing the infant human into the world premature, nature obliges this born inventor to climb aboard humanity's moving train. It provides the child in the first years of its life with the opportunity to incorporate the culture of its parents effortlessly into its still immature neural fibers. Because it is born "too soon," the innate potential of the baby is able to develop directly with and through its encounter with linguistic, behavioral, and cultural innovations accomplished long before its birth. It doesn't even have to learn anything—its intelligence is constructed right on the spot directly out of the experience of its environment.

Thus this premature birth is a real masterstroke, guaranteeing evolutionary continuity. The human child directly incarnates the heritage of its parents in its neural fibers. Thus it effortlessly takes its place in the long evolutionary chain of humanity. And clearly for Mother Nature, the dangers to which the initial immaturity of the brain exposes human beings are greatly outweighed by the immense opportunity for adaptation it provides.

THE REMARKABLE IMMATURITY OF THE CHILD'S BRAIN

We now have a better understanding of why the child's environment, more than its genes, influences the development of its embryonic potential. Since the child's brain wires itself in its encounter with the environment, the environment is what positively or negatively influences the development of its potential for intelligence and humanity. In this we have both very good news and very bad news. The good news is that there is no such thing as genetic determinism: we are all capable, regardless of the genes we have inherited, of developing

extremely sophisticated and positive intellectual and social capacities. The bad news is that the environments children grow up in imprint themselves very strongly in their neural fibers, for better or possibly for worse. In other words, nature lays the groundwork for the newborn by endowing it with latent human potentialities, but it is the environment that determines the quality of development of these innate potentialities. They will flourish or not according to the opportunities provided by the environment. This view is one that is now very widely shared by university centers doing research on child development. I am thinking here in particular of the very pedagogically oriented and committed Center on the Developing Child at Harvard University.

So human beings are not *predetermined* to develop language, reasoning, the capacity for empathy, or any of the other latent innate potentialities; they are *predisposed* to do so. The difference is huge. Nothing guarantees that they will develop the human intelligence existing in them in an embryonic state. They are born with the *possibility* of developing it. And they will have to do it with what their environments provide.

Let us take the example of language. As we have said, human beings from the time of their birth are *predisposed* to develop sophisticated, high-level language. They possess the pre-wiring to do it with. But it is entirely possible they may never achieve this if their environment does not provide them with the conditions that allow them to create such a language. For the potential to be realized, the innate predisposition to language must be fed a rich and varied linguistic diet during the period of life that is crucial for the formation of language, from birth to the age of three. *And there's no more to it than that.* There is no need for introducing other external teaching methods. All the young human needs is vital and dynamic exposure to language in order to shape its immature brain circuitry. But it also works the other way around: if the child's linguistic predisposition is exposed to meager and syntactically flawed language during the first three years of its life, it will not develop fully.

A striking study, appropriately named "The Early Catastrophe,"[1] illustrates the power of this phenomenon. Recordings were made of hundreds of hours of interactions between children and adults from forty-two families from across the socioeconomic spectrum. The children were followed from the age of seven months to three years. The researchers observed that 86 to 98 percent of the words used by the three-year-old children were derived directly from the vocabulary of their parents. But that's not all. The length and style of the

children's conversations were also similar to those of their parents. The parents from the poorest families tended to express themselves in short bursts like "Stop!" or "Get down!" whereas in the more privileged families, the parents formulated more elaborate sentences and had real conversations with their children on a great variety of subjects. Thus the researchers observed that by the age of four, children from more privileged backgrounds had heard something like thirty million more words than children from underprivileged backgrounds. The intelligence of the latter had simply not been adequately nourished at the time it was developing. The poorer children were subjected to a kind of mental malnutrition, which put them at a critical disadvantage, since afterward major efforts and a great deal of rigorous discipline would be required to overcome the deficit brought about by inadequate linguistic nurturing during the period of most intense development.

Environmental disparity of this kind also brings about great disparities in children's overall intelligence. The children in the "Early Catastrophe" study from privileged backgrounds with greater exposure to more sophisticated language had much higher IQs than the others, starting from the age of three. Their school performance was also better at ages nine and ten. And, in fact, today we know that the level of oral language at the age of three is predictive for reading ability at the age of five and reading comprehension at the age of eight.[2]

The first years of life build the foundations of intelligence, and the quality of those foundations is conditioned by the environment. And that is true for all children, whether they come from privileged or underprivileged backgrounds. If a newborn from a highly privileged background, whose parents come from several generations of people whose language is particularly elevated, is placed for a few months of its life in a poor linguistic environment where it is exposed to language that is crude and syntactically flawed, regardless of having come from a long line of eloquent speakers, its language skills will be poor. The child's linguistic intelligence can create language only on the basis of what its environment provides. That intelligence simply cannot create by itself what the environment does not offer. If a newborn from an extremely disadvantaged background is placed from its first months in a stimulating human environment, it will develop the high-level language and skills that its biological parents would not have been able to transmit to it. No matter how well wired and amply pre-equipped we may be, the formation of our intelligence is totally conditioned by the environment. And in the face of this truth, we are all equal. No one escapes the creative power of the environment. It's as simple, inspiring, and

dramatic as that. For the human being who has just been born, everything is possible, the best and the worst. Thus the immaturity of an infant's brain presents extraordinary opportunity and extraordinary vulnerability at one and the same time.

That genetic determinism does not exist for the development of human intelligence is a crucial point for the field of education. What creates inequality is not genes but environment. So if we would like to reduce educational inequalities, we must concentrate our attention on the environmental conditions we provide. Clearly the way we can change the lot of many children is not by changing our teaching methods alone, but by exercising a positive influence on the environment children grow up in, both at home and in school. We have the immense responsibility of creating nurturing environments for our children, environments worthy of their great potential. The child born in the affluent suburb of Neuilly-sur-Seine will automatically learn a rich and sophisticated language that will predispose him or her to academic success, whereas most of the children born in the poor suburb of Gennevilliers will automatically learn an impoverished and crude mode of speech that will strongly limit their potential for self-expression and full development.

THE CHILD'S DAILY EXPERIENCE STRUCTURES ITS BRAIN

Providing rich and positive nourishment for the intelligence during the child's time of great immaturity is fundamental. Everything the child experiences in our company will be encoded as neural connections. From birth until five years of age, 700 to 1,000 new connections are created every second.[3] Every image, every interaction, every event—as routine as it might be—will be fixed in the fibers of the child's brain by connecting neurons. Thus during this period of great cerebral impressionability, the infant accumulates an extraordinary amount of information and lays the first stones of its temple of intelligence. As the work of building a house is begun by constructing its foundations, the human brain begins its work of self-structuring by creating thousands and thousands of neural connections.

And as always, nature acts with skill. At the very same time that the brain requires a tremendous proliferation of neural connections to lay its structural groundwork, the young child has a tremendous urge to explore. When it is touching things, grabbing things, calling out to us, studying us, or intently

observing the world around it, its brain is constructing itself. For that reason it is essential for adults not to get in the way of the child's formative need by restraining it all the time for our own comfort or for the child's safety ("Don't touch that," "Stay where you are," "Sit down," "Wait for me," "Keep quiet," etc.). When we do that, it is not only the child itself we are holding back, but we are also holding back its intelligence in its process of self-development. We must allow the child to explore, to make contact with the world and with other people, to carry on creating billions of neural connections.

Yes, billions. In fact, the number of neural connections in the young child's brain quickly soars to incredible heights. To give an impression of scale, let us compare, as Tiffany Schlain so aptly does,[4] the number of connections between two neurons in a child's brain to the number of connections between two pages on the world wide web. When two neurons connect, it is called a synapse. When two web pages connect, it is called a hyperlink. We all immediately tend to presume that there are many more connections on the web than in the brain of a child or an adult; however, the internet contains about 100 trillion connections, while the adult brain possesses three times that many, about 300 trillion. The brain of the child possesses ten times more connections than the network of the world wide web—1,000 trillion neural connections! That should give us some idea of the scale and power of the synaptic explosion that occurs during childhood. Everything the child perceives in its environment—absolutely everything—creates a connection. During this period of tremendous brain plasticity, all children need is to freely explore the world around them to learn with amazing speed. Thus children are incapable of *not learning.* Learning for the child is like breathing. The child learns without realizing it, by creating 700 to 1,000 new connections every second.

During these creative years, a minimally nourishing environment could have serious consequences for the child's brain structure. The brain builds itself using what it receives. If it does not receive much, it develops poorly. So it goes without saying that a deficient environment could seriously damage its potential. For in the same way that weak foundations can compromise the stability of a house, weak production of neural circuc01y by a baby will inevitably have negative effects on the adult it will become.

The tragedy of the orphans of Bucharest is a good illustration of this. After the fall of the Romanian dictator Nicolae Ceausescu, the dreadful conditions in state orphanages came to light. Babies had been left to themselves for hours at a

stretch, several at a time heaped in beds with bars, in some cases never seeing the light of day. Their contact with adults was limited to a minimum—there was one caregiver to twenty children providing food and basic hygiene, and the children had no other interactions. Thus the children were almost entirely deprived of relational contact with adults and of environmental stimulation of any kind. These drastic conditions brought about encephalic underdevelopment and very reduced brain activity. The children's brains were smaller than the norm and did not function normally.[5] The human brain, deprived of the world at the time when it should be feeding on it, does not develop correctly. It does not even attain normal size. Although these children were fed physical food every day, they suffered from a veritable psychological famine.

A child's brain establishes an astonishing number of neural connections in building the foundations of its intelligence. However, it does not retain all of these synaptic connections. The least-used connections, those which encode experiences repeated the least often, progressively weaken and are eliminated. On the other hand, the connections utilized the most often, which encode the most regularly recurring experiences of the child, are reinforced. This is called *synaptic pruning*. This continuous pruning gives us tremendous adaptive capacity. It enables us to become specialists in the environment we evolve in.

This continuous and dynamic process of creation, of reinforcement and elimination of synaptic connections on the basis of the frequency of experiences, is called *brain plasticity.* Brain plasticity diminishes progressively after the child reaches the age of five, then more markedly from the onset of puberty; nevertheless it does continue in the adult. The brain constantly creates new circuits, eliminates others, and reinforces still others, all in relation to the frequency of particular experiences. Thus while the brain architecture of the adult continues to be influenced by repeated experiences, repeated experiences not only influence the child's brain architecture, they shape it directly. But there is a key point to be noted here: In its synaptic pruning, the brain pays no attention to the *quality* of what it gets rid of or what it keeps. It confines itself simply to reinforcing the most *frequent* experiences and eliminating the others. This is a point that is important to understand and appreciate. The child's brain plasticity has no critical sense. It engages the environment as it finds it, without any judgment.

LIVING WITH A CHILD IS PARTICIPATING IN THE

SPECIALIZATION OF ITS BRAIN

Given this continuous synaptic pruning operating on the basis of frequency of experience, if a child is most frequently exposed to coarse, slangy vocabulary, even if it occasionally has the opportunity to hear people speaking more elevated language, its brain will reinforce the tracks left by the slangy talk. Regardless of whether you are a parent, preschool teacher, classroom assistant, brother, sister, uncle, or cousin, being with a child regularly means participating directly in its brain specialization. How you are on a daily basis—the way you talk, react, what you do with the child or around it—will literally participate in the *wiring* of its brain.

Thus our responsibility is immense. A day will come when we will hardly be able to keep from laughing at seeing our children behaving just the way we do—talking the way we do, moving or reacting the way we do. It's often a rather funny moment; it could also be a shocking or even unpleasant one, because our children reflect us like a mirror—they reflect the gestures or the attitudes we have taught them without realizing it, just by being around them. We think they are imitating us, but it would be more precise to say that they are manifesting on the outside what they have encoded on the inside. So we have to acknowledge, whether we like it or not, that a host of little things we do that we are hardly aware of structure the inclinations and actions of our children, directly and without a filter. Our attitudes lay the groundwork for theirs. This is something that needs to be said, repeated, and clearly understood. And having seen it, adults must behave accordingly, at home as well as in school.

So what is our daily behavior like, with all its quirks and mechanical reactions? Is it consistent with the behavior and attitudes we would like to see blossoming in our children? Whether we are parents or teachers, let's start with asking ourselves that. Guiding children requires awareness of ourselves, conscious attention to our own gestures and attitudes. If we want to see children expressing themselves properly and easily, with considerate and harmonious gestures and movements, and showing empathy, bringing this about is not complicated—the first step is behaving that way ourselves.

So setting high standards for children means setting high standards for ourselves. This was the golden rule we applied at Gennevilliers; and—I won't hide it—it was the most difficult rule to respect amid the hurly-burly of a class of more than twenty-five children. Nevertheless, when you know that a child has

such powerfully absorbent brain mechanisms that are structuring themselves on the basis of everything the child is perceiving, and when you stop to think that you are spending an average of six hours a day in a class with that child, it's not a matter of choice, it's a responsibility. The way we act, speak, and react has to be exemplary.

In our preschool class at Gennevilliers, first we set very high standards regarding the level of language circulating in the class. As I have already pointed out, a good level of language seems to go hand in hand with good results in the development of intelligence. But before even beginning to think of raising the children's language level, Anna and I had to pay very close attention to our own language. We made a point of speaking correctly and logically, with very precise and appropriate vocabulary, and we made an effort to use logical and complex sentences. So for example, if a child asked, "Is it going to snow?" we never said, "Don't think so" and moved on to something else, but rather we'd say, "I don't think so. I listened to the weather report on the radio this morning, and the announcer said it was not going to snow but that it was going to be very cold. Look at the sky—it's not cloudy enough to snow." We made an effort never to speak in vague, general terms, but always to be precise. We didn't say, "This afternoon after canteen, it's swimming"; we said, "This afternoon, after you've had lunch at the cafeteria, we are going to go swimming." We also tried to use a precise word rather than fillers like "thing," "stuff," or "whatchamacallit." Even if it required an effort, we always took the time to think when the right word did not come to us immediately, and we explained to the children, "Wait a minute. I'm looking for the right word so I can tell you what I'm thinking." We always used the right word, even when that word might have seemed complicated to the children.

In fact the children adored erudite and sophisticated words, like planisphere, South America, Europe, cube, cone, cylinder, spathiphyllum, crassula, rubber plant, gardenia (the last few, rather than just saying "plant" all the time), disk (rather than just "circle," referring to a circular thing), moccasins, sandals, boots, pumps (rather than just "shoes"), mare (rather than "female horse"), foal (rather than "baby horse"), and so on. We always looked for the most precise possible word. All this vocabulary excited and stimulated the intelligence of these children in the prime of their development, and they took delight in getting the words right.

We had a map puzzle with pieces representing the continents of our planet that the children could take out and put back in. Each continent was a different color.

For example, Asia was yellow. Sometimes the younger children said to the older ones, “I live on the red continent.” The older ones would correct this immediately, disturbed by this lack of precision, “The red continent is Europe; it’s not the ‘red continent,’ you live in Europe.”

Our demands concerning language were great and nonnegotiable. We expected the children to take the time to express themselves with precision throughout the day. We took whatever time was necessary to help them do this, whether it was asking permission to go the bathroom or explaining to a classmate the principles of the decimal system. Fluency and quality of expression were really the main priorities in this class, and the children knew that. They took the trouble to help classmates who were having trouble expressing themselves, allowing them the time to formulate what they were trying to say and supplying them with the vocabulary they were lacking.

This vigilance regarding language was very important, because the general level of the children’s language was quite low. My experience the previous year in a preschool in an exclusive upper-class area (Neuilly-sur-Seine) made the enormous gap between the richness of the language of the children from Neuilly and the poverty of the vocabulary of the Gennevilliers children all too clear. In Neuilly, most of the five-year-old children already spoke in an elevated manner. They tended to speak in grammatically correct sentences, and some of them even occasionally slipped in a well-chosen English word. It was impressive. Their choice of words was extremely precise. Thus it was a shock for me the following year in Gennevilliers when I encountered the opposite situation. The children there filled in their sentences with expressions like “that there,” “thingy,” “stuff like that,” and so on. One of them might nonchalantly say to me, “Hey Céline, I’m going to go take a piss.” At the age of three they couldn’t see anything wrong with saying in a clipped, aggressive tone, “Céline, Yassin’s a goddamn pain in the ass!” Or, “What kinda crap they givin’ us for lunch today?” A problem might be expressed as, “At home, my dad keeps yelling his fuckin’ head off at us all the time!” or “My brother puked last night.” And when I showed my discomfort with this colorful vocabulary, the children hadn’t the slightest idea what bothered me about it. For them, this way of talking was completely normal. So it was no simple matter to undo the language that had been drilled into these children (and which in some cases they continued to have repeated at home every day). Nevertheless, we were successful. We got the job done by speaking extremely properly all the time, and by kindly but firmly encouraging them, without creating any sense of blame, to adopt a more appropriate tone in class

and to use more appropriate words, which we suggested if they didn't know them. With the more surly and recalcitrant children, I wouldn't hesitate to say firmly, "No, I won't have that. I will not have you speaking that way in class. Can you find a different way of expressing that?" If the child replied no, I would suggest another way, which the child then repeated.

After a few months, most of the children had changed their tone. They would never know the victory that was hiding, the following year, behind a remark like, "Céline, Victor is bothering me. I've already told him several times, but he won't listen. He just keeps doing it. Would you kindly tell him to stop?"

Aware of the power of brain plasticity, and because the children were constantly talking among themselves, I was very firm about the language level of the older children, whom the little ones automatically emulated. I did not hesitate to interrupt a conversation between the children to ask one of them to reformulate what they were saying more correctly and more elegantly. In this way the children also began to realize that their oral language was of primary importance for us. We spoke correctly among ourselves, we took the time to speak to the children correctly, and we permited them to speak correctly too.

The results quickly became visible at home. Feedback came to us from the parents after only a few months of class: "My son is the only one in the house who talks without swearing," and "He's precise about the words he uses and gets mad when we don't pay attention to how we talk." We will see later that correct and precise oral expression is not only a key to integration in society, but even more important, it is a means of developing a complex, logical, rich, and structured way of thinking. These children not only spoke in a logically sound and precise manner, they also *thought* in a logically sound and precise manner. By making the effort to express themselves clearly and follow a thought to its conclusion, the children had to retain content in their memory long enough to organize it logically enough to be understood. They had to control their frustration at not being able to find the right words. They had to concentrate fully on what they were saying and to correct themselves if the person they were talking to did not understand what they were trying to get across. In other words, just by encouraging and helping the children to take the time to express themselves clearly and precisely, we were not only enabling them to develop important cultural and linguistic skills, but we were also fostering the development of essential cognitive functions, functions that are often more predictive than IQ scores for academic, professional, and emotional success as well as success in relationships. These essential cognitive functions—working

memory, inhibitory control, and cognitive flexibility—are called executive functions. We will talk more about them later. For the moment, let us simply note that getting the children to develop rich, structured, and precise oral language is conducive to good cognitive development.

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We were also mindful of our own behavior in the class. Since we were trying to create a calm and peaceful atmosphere, we moved quietly and spoke softly. Even when a child was talking much too loud, calling out from one end of the classroom to the other, we did not shout at them from where we were standing, saying something like, “Stop shouting, you’re disturbing everybody!” Obviously by doing that, we would be teaching them to shout and would ourselves have increased the level of disorder in the class. Instead, we approached the child calmly and without haste, and we reminded her in composed and quiet tones that she was speaking a bit too loud.

However, if a large part of the group was getting excited and creating general disorder in the class, a firm call to order to the whole group sometimes proved necessary. In the first months of the first year, the children had not yet reached the stage of behaving autonomously, so this situation frequently occurred. At that point we brought the children together in a circle in the classroom and practiced attention and relaxation exercises. We also sometimes went out to the playground at a moment like that. But in all cases, we avoided exhibiting behaviors ourselves that we did not want to see develop among the children.

This meant we also paid close attention every day to the way we handled our teaching materials. We knew that everything children observe is liable to be retained in an engram—that is, to leave an imprint in their neural networks. So, for example, when we were rolling up a mat that had not been put away, and if at that moment we were being observed by a child or two, we were careful to do it with precise and clear movements that they would be able to retain and emulate. In this way, they too were soon able to do an orderly job of rolling up a mat.

During this creative period, we took care throughout the day to present a wide variety of activities in different fields: geography, music, reading, writing, math, drawing, painting, and so on. These activities were presented in a precise, clear manner and in a way that was stimulating for the children. We truly took a great deal of pleasure in sharing all this culture with them. We were really happy to be offering them access to all these topics. Our enthusiasm galvanized the

children’s motivation. We made our presentations either individually or to very small groups of two or three children so as to be able to adapt them to the level and interests of each child, and we then counted on the knowledge we presented spreading rapidly through the group by means of free interactions among the children. This happened because the children were acting autonomously and were not all the same age; the older ones liked showing the little ones what they knew, and in this way they were able to consolidate and refine their own knowledge. As for the little ones, they very quickly absorbed what the older ones transmitted to them.

No teacher can compete with the ease with which knowledge is transmitted among children of different ages. The fascination exercised by a child of five on a child of three is extraordinary, just as is the older child’s spontaneous enthusiasm for helping his or her classmates in need. Knowledge circulated among the children with amazing speed. The enthusiasm aroused by their social interaction turned out to be the royal road to learning. This road was kept open by the fact that the children were autonomous, independent, from morning until school was out; they could communicate freely with each other throughout the day. They had many exchanges with each other and taught each other all kinds of things. Carrying on this way, they joyfully made the culture and language their own, and with astonishing speed.

Thus we created favorable environmental conditions, conditions that provided rich and positive sustenance to the still immature intelligence of these children. Our language, our behavior, our way of moving and reacting, and the knowledge provided by all the activities we presented spread in an extremely powerful and effective way among the children.

When the right conditions are not available at home, preschool can play an extremely positive role—the children spend six hours a day there! School, therefore, as much as family, is a place of specialization that, by providing sufficiently rich conditions, can considerably attenuate differences in social background. We can do that. It’s within our reach. We should exercise a positive influence on the development of children, not so much by acting on them directly, but rather by acting on their environment. And it is essential to do that at the earliest possible moment, because it is in the first years of life that the human intelligence lays down its foundations. And solid or not, it is on these foundations that human beings must build their future intelligence.

So this was the main principle on which the experiment of Gennevilliers was

based: since it is the environment that directs, specializes, and determines the development of latent potential from preschool and even before that, we had to place our main focus on environmental factors. We kept careful watch on our behavior, our language, our actions and reactions, and setting very high standards, we did it with a great deal of rigor and determination. We wanted to give these children the very best. So we created conditions that allowed their eyes, ears, and hands to be nourished by interesting and challenging language and activity during their three preschool years.

THE CRITICAL PERIOD OF THE FIRST TWO YEARS

Experts in child development have a very clear message for us today: the first two years of life are truly crucial. It is during this period that children form the basic elements of their intelligence. By its second birthday, a baby already has behind it a great number of linguistic, social, cognitive, sensory, and motor achievements, which it will later rely on in the application of its intelligence. And in making these acquisitions, the child's brain has passed through significant and decisive stages of specialization where radical pruning has occurred. Certain connections have been heavily reinforced, and others have been fully eliminated. This kind of pruning occurs, for example, in the development of linguistic skills. We know that at nine months, the baby is still capable of hearing all the sounds of all the languages in the world. But three months later, at twelve months, it hears only the sounds existing in its own language. Its brain has become specialized in the sounds of its environment. The baby no longer hears the sounds of all languages; it has become a specialist in its own language.[6]

After having accumulated a very large quantity of impressions of the world, the human brain does some housekeeping. We should not forget that growing up entails going from 1,000 trillion synaptic connections to 300 trillion. Thus growing up means losing two-thirds of one's possibilities and reinforcing the third that are most used. Growing up means specializing. Adults are not less intelligent than children; they are more *specialized*—in their language, their culture, their thinking, and their social behavior. We might find it shocking that this happens so early, but nonetheless, when a human being reaches two years of age, its brain has already had time not only to store an extraordinary amount of experiences but also to select out the most frequent ones. The experts speak of a critical period after which certain primary foundations have already been

established and become more and more difficult to reshape.

The experiment with the children from the Bucharest orphanages shows this clearly. After the discovery of their extreme situation, the children were placed in welcoming foster families especially prepared to deal with the needs of these children. Researchers compared the development of the children placed in these families before the age of two with that of other orphans who also received the same kind of foster care, but after the age of two. Their results showed unequivocally that the children who had been placed in foster care before the age of two displayed little or no cognitive and social differences when compared with children of the same age who had been raised by their biological parents: at the age of eight, the electrical activity in their brains was normal. A rich and nourishing environment before the end of the period of major plasticity at age two is determinative and leads to resilience. At this point the brain still has the resources to reorganize and repair itself.

As for the children placed in care after age two, by age eight they were still suffering serious consequences. As we have already said, after the age of two, the brain has already laid its foundations, and reshaping it becomes more difficult. To be sure, the brain evolves and creates new connections throughout life, so it is never “too late.” But as pointed out by the Center on the Developing Child at Harvard, “It is easier and less costly to form strong brain circuits during the early years than it is to intervene or ‘fix’ them later.”[7] If brain architecture is to be established on strong foundations, the earlier the better. It is therefore of primary importance to give special attention to this period—that is, to the period before the child’s brain becomes too specialized.

THE NECESSITY OF A LOVING ENVIRONMENT

What must we do to help children build solid foundations? It’s simple—nothing special. We have to love them, be there for them, let them be part of our lives and not isolate them, respond simply to their demands for interaction without overstimulating them, talk to them, reassure them when they’re stressed so that the stress hormones don’t damage their little immature brains, let them explore, respect their rhythms, respect their physical needs by providing suitable food and allowing for appropriate sleep cycles. In the end, it is just doing the things that parents do naturally for their children.

We already know what we must do—the point here is just to remind parents of

the importance of these everyday acts, of their spontaneous "scaffolding"[8] in raising their children from birth to age two. All the little interactions—ordinary things like reciting nursery rhymes—are absolutely essential. Parents just have to keep on doing what they naturally do: talking to their children at bath time, making up stories to go along with playing with bath toys, naming the foods or objects their children point to, speaking to them in precise and correct language, singing songs, reading stories, listening to music together and dancing, painting, modeling with Play-Doh, helping them eat by themselves, comforting them when they are overwhelmed by emotions or stress, and joining in their triumphs by encouraging them without ever forcing.

So when it comes to providing a suitable environment for children under two, there's no need to seek out new experimental methods. Nature is already taking care of the situation, and we just have to respect that. Babies don't need anything other than the company of people who love them, beginning with their parents and family—kindly interactions, support, protection, and encouragement. *Above all, babies need human bonds.* And they will seek them out like a traveler lost in the desert trying to find an oasis. In a more natural, more down-to-earth, and less "civilized life," young children grow up in the company of children of different ages—maybe three-, six-, ten-, or fifteen-year-olds—and also benefit when necessary from the presence of adults other than their parents or caregivers. As I see it, this human variety is what is most cruelly lacking to young children today who are dropped off in the morning at childcare.

The second thing that seems essential to me, after the social connection, is connection with the environment—the *real* environment. Because the child's job is to specialize in his or her environment, let's make the best possible environment available. Let's provide a place where children can hear and take in high-quality language, where they can observe the everyday life of the group they were just born into, where they can watch us cooking, having lunch, cleaning house, communicating with each other, all while having the opportunity to carry out their own experiments in discovering the world and their natural surroundings. And of course in doing all of that, taking all the time they need. In other words, let us give them a loving, warm, and welcoming environment, but also a real one, one that is not cut off from the world but actually presents the world to them.

Many childcare centers today are working in this direction, and they need to keep it up. Let's make sure our young children in the peak period of brain

development have places to be that are alive, open, familial, warm, and intimate and that offer a wealth of experiences, social bonding, high-quality communication, culture, and nature; and also peace and time. These places need to be beautiful, intimate, and sacred, because they are the places where the intelligence of humanity is formed.

CHILDREN LEARN JUST BY LIVING

You would be surprised to learn what a child barely one year old, not yet walking, can already do without the least effort, just because of its extraordinarily plastic learning mechanisms. The abilities of babies and newborns now being revealed to us by science show us to what extent we have been underestimating our young. Before even reaching the preschool age, they have already acquired high-level cognitive skills.

An experiment[9] conducted at the Max Planck Institute in Leipzig demonstrated, by measuring the brain activity of babies, that at only *four months of age* and *in fifteen minutes*, babies are capable of recognizing whether a sentence in a language they have never heard is syntactically correct or not. In this experiment, the researchers had the infants listen, in a language unknown to them, to a series of phrases like “the sister is singing,” or “the brother can sing.” After listening to these simple phrases for three minutes, the researchers had the babies listen to another series of phrases, this time grammatically incorrect ones, like “the brother is sung,” or “the sister can sings.” The brain activity of the babies was different when they heard incorrect phrases: they detected that something was not normal. The brain of a baby is therefore capable of picking up with exceptional speed some sense of the complex implicit rules of language just by listening to us.

Judit Gervain, an expert in cognitive neuroscience at the Université Paris Descartes, in an interview with *National Geographic*,[10] observed the following: “For a long time we had this linear view. First, babies are learning sounds, then they are understanding words, then many words together. But from recent results, we know that almost everything starts to develop from the get-go. Babies are starting to learn grammatical rules from the beginning.”

Most of the time when children—whose brains automatically seek out implicit rules—make a “mistake” in speaking, their mistake actually points to an irregularity in our language. When a child says, “they goed,” she is showing us

her genius as well as the inconsistency of our language. Her brain has perfectly well understood that the past participle of a verb is normally constructed from the present indicative of a verb by adding the sound “d”—for example, “they cry”/ “they cried.” There are many other examples. So “they goed” is quite logical. “They went” is irregular. And even though children obviously hear “they went” all around them, their brain, which loves regularities, continues to prefer conjugating the verb in the way that seems appropriate to them.

Along the same lines, research shows that young children are capable of intuitively deducing basic laws of physics. From the age of three months on, babies know from their own experience that if you toss an object in the air, it’s going to fall back down. If instead of falling back down, an object stays in the air, the baby will show an expression of great surprise. A fundamental law that until now has always been corroborated by its informal experiments has just been contradicted right before its eyes, and its intelligence is stunned. A child of less than a year will show the same surprise if you throw a ball and it passes through a wall, if an object gets bigger as it gets farther away, or if a toy car rolling on a table keeps on rolling after it goes past the edge of the table.

Don’t laugh. Scientists have very seriously carried out experiments of this nature[11] in major international laboratories with babies from three to eleven months old. And the reaction of the children is always the same—they are totally stupefied. At this age, a baby is barely able to pronounce words as simple as “mama” or “papa,” but nevertheless, they have already intuitively mastered some of the basic laws of physics.

Some amazing studies have even shown that when barely one year old, a baby is already capable of predicting not only the trajectory but also the speed of an object.[12] Researchers rolled a ball in front of some babies. The ball went behind a screen, and the babies looked on the other side of the screen *at the exact moment* when the ball should have come out and *in the exact place* where it should have been. They were able to predict the exact time and place where the ball ought to have reappeared. If it did not reappear or reappeared too late or in the wrong place, the babies were upset and checked to make sure that the ball was not where it was supposed to be if it had followed the right path.

I am telling you all this not just for the sake of pointing out to you what great geniuses babies are. Basically, you knew that already. But I am trying here to call your attention to one particular point: to learn and understand all these phenomena, babies don’t have the slightest need for curricula, schoolbooks, or

teachers. Babies come into the world like us, with a kind of natural self-education software. They are capable of getting a good and quite precise grasp on the nature of the external world simply by being active in it and learning from their predictive mistakes. All the knowledge of grammatical, physical, and social laws that children acquire is deduced from their own living, down-to-earth, and dynamic experiences, not received from some lecture we have been generous enough to give them.

It would have been futile to sit our three-month-old child down at a table and say to him, “Pay attention, you have to know this, this is important. Watch this apple—see, it’s falling. That’s what all objects do. It’s called the law of gravity. Tomorrow, I’m going to talk to you about the place of verbs in sentences. Then the day after tomorrow, we’ll get into social interactions. I’ll explain to you what people call people they love. And finally, in conclusion, we’ll talk about different tastes: tart, bitter, sweet, and salty.” Fortunately, we have never done this. It would have been a total waste of our time and energy, and of the child’s attention. We have only just lived with our children, gone through their active experiences in their surroundings with them, commenting when necessary. Our children have thrown things, touched the sand, put their bare feet in the water, on the grass, on the tile floor. And we’ve laughed with them, we’ve pointed out to them how warm the sand is when the sun has been shining on it, we have told them how to catch and throw the ball they could barely hold. They have bit into the lemon wedge we left on the table, and we have pointed out, “You see, it’s sour.” Our children have explored, but they have also just attentively watched what was going on around them. We have spoken to other people in their presence, and we have reacted in front of them to the behavior of their brothers or sisters. They have been in a position to witness the way we behave and how we react to different social situations.

And every time our children explore or observe attentively, their brains reorganize—new neural connections are created, and others are eliminated. Knowledge acquired from previous experiences is brought up-to-date by new discoveries. Children have no need of formal explanations or lectures. They need to live and work with the continual series of shocks they encounter through their experience of the world.

When I was living in Spain, I gave hours and hours of private French lessons to young children whose native language was not French. In spite of my persistence and enthusiasm, these children never spoke French as well as other non-French-speaking children who never attended a single class but who

benefited from the company of a French nanny who lived with them and did not speak a word of Spanish. No course or teacher can possibly compete with the remarkable effectiveness of the environment. I get many emails from people asking me, “How can I teach my children a foreign language?” The answer is simple, maybe too simple—it often disappoints. Teaching is not the way to go here. Language need not be taught. What we have to do is create conditions of immersion for children so they can analyze and develop the new language effortlessly by themselves. Of course, timely and appropriate scaffolding is also necessary. And that’s all. The children’s remarkable plastic intelligence will take care of picking up the implicit rules of the new language, which will never be foreign to them again.

The natural mechanism of human learning, especially flexible and adaptive in the first years of life, capable of engaging and analyzing the complexity of the world without effort, is today an extremely popular object of study for engineers throughout the world, who are trying to create an artificial intelligence that is equal to it in power and autonomy—so far without success.

2

The Natural Laws of Learning

Today neuroscience is making it possible for us to gain a better and better understanding of how the human brain is able to learn such complex things so young and so fast. As a result of a child's repeated practical experimentation, its plastic intelligence accumulates and encodes a great many pieces of information. On the basis of all these data, it can infer probabilities, and this gives the child the ability, quite unconsciously and very rapidly, to *predict the probability* of an event—social, linguistic, or physical—occurring or not occurring.

We have seen that a baby of four months needs only a few minutes to derive linguistic probabilities and statistical data that it then expects to encounter again the next time it hears speech, even in a foreign language. And if its prediction turns out to be at odds with reality, as in the experiments we referred to earlier, then the baby manifests surprise. In real life, experiencing such a divergence from reality generates in the child a very intense need to explore. It tries to reproduce the anomalous event and understand what it missed about it before so that it can adjust its knowledge as soon as possible.

The powerful urge that pushes the child to make adjustments for the discrepancy between what it knows and does not know is called curiosity. This is far from being a bad quality. It would even seem to be a constitutive element of our learning mechanism. Moved by curiosity and its desire to understand, the child does not hesitate to put itself in danger or transgress prohibitions. Adjusting its internal model of reality and homing in on the actuality of the external world is its priority. It *must* understand and adjust. Thus when researchers amuse themselves by presenting children with surprising experiences

that violate the elementary laws of physics, children immediately grab hold of the toy car or the ball that has defied their internal model. They explore these objects with great seriousness and try to understand what could have gone wrong.

When children reproduce a new kind of event in an attempt to understand it, their brain reorganizes itself so that it can readjust its knowledge and its calculation of probabilities. As children carry out their endless variety of practical, concrete, and dynamic experimentation, their neural connections are very quickly reorganizing themselves in order to bring them into the greatest possible agreement with the external world. We as adults still possess this autonomous learning mechanism, which makes it possible for us continually to revise our knowledge in accordance with indications we get from the small shocks and sometimes larger lessons of life. However, unlike children, we may well fail to take note of the contradictions we observe between our internal models and reality, and therefore our prior state of knowledge remains intact, unchallenged. This is quite regrettable, because this lack of flexibility often takes the fixed form of an ideology. By contrast, children never stay caught for long in the net of dogmatism. Alison Gopnik, internationally renowned specialist in infant learning, writes, “What children know is always potentially ready to be challenged.”[1]

Just by living and engaging with the world, children learn and refine their knowledge with remarkable speed. Every morning, they know more than they did the night before, and their knowledge will continue to increase all day long. As a result, children at the age of four know much more than at the age of two, and two-year-olds in turn know a lot more than babies of one. Now you know why children need to sleep so much! It is quite normal for them to drop frequently from exhaustion. We don’t see it, but when we are talking to them, or when they are simply in our company, they are analyzing and deducing the universe’s basic laws of physics, grammar, and relationships with a speed and efficiency that would make a Nobel Prize winner in both physics and literature blush.

We should also point out the extraordinary intelligence of the child’s learning mechanism. Nature drives the child to learn in the most potent possible way: by giving it a *built-in* desire always to be learning more. This is how it works: every error in prediction generates a feeling of curiosity that translates in the brain into a secretion of dopamine. Dopamine is a molecule that activates the pleasure

circuits and provides a sense of reward, and this drives the child to continually reduce the discrepancy between what it knows and what it does not know. But that's not all. Dopamine also activates the memory circuits! In other words, when the child sees a mistake or a discrepancy between what it knows and what it would like to know, it feels pleasure at the idea of learning, and at the same time its capacity to remember also becomes optimal. Thus when we see interest, curiosity, energy, and enthusiasm in children, we should learn to help them go all the way in what they are trying to accomplish. They will never learn as robustly as they do when they are moved by a spontaneous sense of exploration. Neuroscientists are very clear on this point: the more curiosity is present, the more strongly memory is activated, and the greater the level of accomplishment in learning then becomes.[2]

In Gennevilliers, we saw an amazing thing: the knowledge acquired by the children in the course of activities they chose themselves and were themselves motivated to continue was not only retained after a vacation break but, to my great surprise, was *strengthened.* Children who were moved some days before the February vacation by an endogenous urge to figure out on their own how to read a few words were able to read still more words when they got back from vacation! Their knowledge had not only taken root, it had developed further![3]

LEARNING THROUGH ACTIVE EXPERIMENTATION

Humans learn through active experimentation by making predictions. At times when they are attentive and engaged, their intelligence can be surprised by a discrepancy between their projections and reality. The brain then readjusts its connections and its set of probabilities. When we are not actively engaged, we do not make predictions, and cannot therefore readjust them. Little or no learning takes place. Experiments show, for example, that mice that are moved in a little cart through a maze in order to show them the right way through afterward have much more difficulty finding the way out than mice that have been able to explore the space themselves and make many mistakes. The mice that were actively engaged in getting through the maze made predictions and learned—the others did not.

So here is the first law: to learn, we must be actively engaged and must immediately perceive our mistakes in order to adjust our knowledge. In this regard it is quite interesting to note that activities in which children engage

spontaneously provide immediate error control. Children adjust their predictions by themselves, without being dependent on an adult. Learning is then extremely rapid.

No teacher, no matter how learned and how good a speaker, will ever be able to transmit his or her knowledge directly into the brains of students just by talking. Children must be able to engage their own learning mechanisms by making predictions independently and letting themselves be surprised by their mistakes, which then encourages them to readjust and correct their knowledge. We learn from the mistakes and experiences of others only with difficulty. We must experience things for ourselves. “Experience is a candle that only illuminates the one who is carrying it,” said Confucius. Therefore teaching has to be active. Humans learn by doing and not by listening. For those still doubtful about this, a meta-analysis of more than 220 studies comparing traditional lecture-style teaching to teaching based on autonomy and active engagement of the students shows extremely clearly that learning is markedly better when it is arrived at actively. These positive results held true for all tested fields: biology, chemistry, psychology, computer science, geology, mathematics, physics, and engineering.[4] Today we know, both theoretically and practically, that to learn, we have to be actively motivated and engaged.

However, I would like to make clear at once that though research indicates that autonomous activity on the part of children is the best option for learning, it also clearly indicates that methods of pure discovery that let children discover concepts entirely on their own are not a good idea. The researcher Richard Mayer[5] brought together ten studies indicating that children asked to discover on their own the principles governing a particular field—like computer programming, the alphabetical principle, or mathematics—had great difficulty in doing it and thus ended up learning in a much less efficient manner. These studies cover several decades and provide a very interesting perspective. Though humans may be wired to learn through their own activity, they are nonetheless not predisposed to learn alone, without any help. Here then is the great paradox: young humans have to learn by themselves, but with the help of others.

THE INDISPENSABLE GUIDANCE OF OTHERS

The sciences of human development today highlight the indispensable social dimension of learning. Children possess extremely efficient learning software,

but they need the help of others to make it work. They need the guidance of others who are more advanced than they are, who can point out to them what is important for them to look for and then take into account.

And it seems also that adults are wired to respond to this need on the part of children. Adults quite naturally take on the role of teacher from the moment a child is born. They start teaching whether they want to or not, they have no choice. Have you noticed, for example, the way we talk to babies, even if they aren't ours? "Hellooo there, sweeetie pie, you're sooo sooo sweeeet, aren't you, just tooo tooo cute." Apparently infants love this instinctively repetitive mothering voice, this "baby talk," and much prefer it to the kind of voice adults use in speaking to each other. Researchers think this way of talking that emphasizes vowels allows babies to better perceive the tonalities, the rules, and the sonorities of their language. Even other children spontaneously talk this way to babies! Newborns are wired to learn very fast, but it seems that we others are wired to help them do it. When we spontaneously provide a running commentary on what a baby is doing, we are inadvertently helping it to organize the world, to plan its movements, refine its language. "There, you're picking up that block and putting it on the other one. Whoops, it fell off! Ah, you're picking it up and starting over!"

Research shows that the baby is highly attentive to this natural teaching mode that adults enter into. It very quickly identifies a situation in which an adult is trying to transmit something to it; its attention is heightened, and it spontaneously adopts an attitude of learning, taking in seriously and trustingly what the adult is trying to transmit. A baby might, however, completely fail to notice this learning moment if the adult does not take the time to make eye contact with it, speak to it in warm tones, or point to something in the environment. Direct eye contact, pointing, and a warm voice are called "ostensive social signals." They indicate that important information is about to be presented to the baby. In response, the baby's attention is optimized, its brain plasticity mechanism is activated, and it is now receptive to whatever is being transmitted to it.

On the other hand, if the child does not receive these signals, its attention does not focus and it might completely fail to notice that something significant or even a major change is taking place in its environment. We know today that in the absence of joint attention between the adult and the child, there will be no—or very little—language learning on the child's part.[6] Young children do not

retain new words they hear if an adult does not point to an object or does not otherwise attract the child's attention to an object at the moment the word for that object is being uttered. This is unfortunately the case with animated films—even the ones that are certified as educational for babies. Unless these films also provide a real adult along with the DVD—which I doubt will happen—these media are going to be completely ineffective or only negligibly so. If the young child is left alone in front of a screen, it will retain very little, perhaps nothing.

This is what we learn very strikingly from a study directed by Patricia Kuhl, a neuroscientist who specializes in infant language learning. Let us review for a moment. As we pointed out earlier, there is a critical period of synaptic pruning between nine and twelve months. At nine months a baby is capable of hearing all the sounds of all the languages in the world, but once this period is over, *only three months* later—that is, at the age of twelve months—the baby no longer hears sounds to which it has not been regularly exposed. The brain has become specialized. In their study, Patricia Kuhl and her team wanted to test the capacity of the human brain to retain traces of another language if a child was regularly exposed to it before the end of the critical period—that is, before twelve months. Babies of nine months from English-speaking families were regularly exposed to Mandarin Chinese. The babies underwent twelve sessions of twenty-five minutes each of listening to Mandarin.[7]

It's at this point that things became extremely interesting. The babies were separated into three groups: one group of babies received visits from real Chinese-speaking adults, who read them stories and interacted with them; a second group of children was exposed to the same adults and the same interactions but in the form of videos; and finally, the third group of babies only listened to the soundtracks of the videos. The researchers expected the first two groups to be equally able to hear the sounds of Mandarin after twelve months. To their great surprise, this was absolutely not the case. The babies who had been in the actual presence of the adults were in fact able to perceive the sounds of Mandarin as well as Chinese babies. This was not the case for the other two groups. The babies who had watched and listened to prerecorded adult voices and those who had watched and listened to filmed video sequences had learned nothing whatsoever. Without the human presence, even with a well-made and attractive video, the babies retained absolutely nothing.

"We were stunned," acknowledges Patricia Kuhl in *National Geographic*.[8] "It fundamentally changed our view of the brain." Without the elements of the

natural teaching mode, such as having things pointed to and joint attention with an adult, the learning mechanism of the child, no matter how sophisticated, is simply not capable of making anything out of the sensory information it receives.

This is exactly the kind of experiment that tells neuroscientists that linguistic, cognitive, and emotional development happen in a *social framework.* Adults have to be able to follow the gaze of a child in order to name the object it is looking at and point to it with their finger, because this immediate response is what allows the child to achieve real language learning. Moreover, the child is on the receiving end of a tremendous amount of information, and the scaffolding provided by the adult is what helps it to hierarchize that information, to focus its attention on the most important aspect of it with the help of the gaze, the voice, and the pointing finger of the adult. When the child encounters these signals—that is, having the adult point to an element in the environment, look at something specific, or change the tone of voice in which the child is being addressed—the child's attention is heightened to an optimal point, and its brain plasticity process is set to learning mode.

It is therefore of critical importance for us adults to heed the spontaneous instinct that encourages us to seek out a state of *joint attention* with a child when we want to show it something. And let us be clear here: this social scaffolding, which is indispensable for learning, is really at its most effective when the interaction between the adult and the child is *individualized.* Dealing with several young children, it becomes difficult for the adult to make eye contact with them and to provide the right scaffolding for each child. It is really time to review our educational vision so that we can provide the human intelligence in its stage of most intense development with what it needs to thrive. It needs highly individualized guidance, and it has to be human guidance. We are social beings, and thus our learning is primarily social. There is no longer any doubt on this point. As powerfully equipped to learn as children are in the first years of their lives, their capacity to learn is totally conditioned by the quality of guidance we provide as they go through their active experimentation with the world.

So people who might be tempted to present their children during this period of heightened plasticity with supposedly educational games in the form of smartphone apps or interactive DVDs, thinking they are providing them with greater opportunities for learning vocabulary, math, or foreign languages, should realize that on-screen material—even if it is certified "highly effective" or

labeled “Montessori”—is almost completely ineffective for teaching young children. Moreover, screens have two drawbacks that in my view present major problems for our public health.

First, being preoccupied with screens deprives our children of human interaction, which is something they need in order to learn. All that time spent looking at a screen is time lost with regard to really learning something through the motivational process of human bonding.

Second, it completely distorts children’s attentional processes. We see our children with staring eyes, completely hypnotized, and we think what they are doing is focusing and training their attention. This is totally false. Their wide-open eyes indicate that the mode of attention they have entered is an *alert mode,* not a learning mode. Their brain is virtually stunned by the unaccustomed flood of images it is receiving and therefore activates the attentional mode that prepares humans for attack or defense. This attentional alert system, which is really not supposed to last more than a few seconds, exhausts children’s nervous system when it continues for a long time, and they have a hard time focusing their attention afterward when we want to teach them something important. Obviously it ends up being quite a problem if children are incapable of being attentive when we reach out to them in teaching mode. We know that the ability of babies and young children to join their attention to that of an adult is predictive for the quality of their language development and their future social skills.[9]

Being captivated by screens can create an unfortunate vicious circle in children. How many teachers and speech therapists are discovering this today? I will not go into detail about the major woes caused by premature exposure to screens, but nevertheless I feel I must add my own testimony to the heap. Our experience clearly showed us that exposure to screens is an obstacle to child development. The children who watched television the most—who even went to sleep watching it—were identifiable by their behavior after only a few days of class. They were totally incapable of focusing their attention on a task or on anything that we were trying to get them to take notice of through eye contact, tone of voice, or pointing. Their process of attention seemed completely unstable. These kids were overexcited and exhausted at the same time—they were “wired.” My exchanges with their parents soon confirmed my intuition—these were indeed children who spent at least four hours a day in front of television, on a smartphone, or on a computer, and did so after six-hour school

days. Some of them had even spent the first year of their lives watching cartoons. The result was serious delay in the development of their attentional, linguistic, motor, and social processes.

Their parents absolutely meant no harm. On the contrary, they simply thought that visual programming for babies and children was an appropriate and relevant pedagogical support, something that would be especially helpful in developing their language skills. Some children's programs in fact make that claim. Applications marketed as "Montessori" have recently come out for the smallest children. The marketers have certainly figured out how to make even the most concerned parents believe that screen media are an excellent educational choice.

Alison Gopnik, a cognitive psychologist who specializes in learning in young children, tells us:

> One benefit of knowing the science is a kind of protective skepticism. It should make us deeply suspicious of any enterprise that offers a formula for making babies smarter or teaching them more, from flash cards to Mozart tapes to Better Baby Institutes. Everything we know about babies suggests that these artificial interventions are at best useless and at worst distractions from the normal interaction between grown-ups and babies.[10]

The failure of educational authorities to take a position on this subject has been quite harmful, as many professionals are discovering on the ground today. However, scientific studies on the subject do not shrink from taking a position: hundreds of them from all over the world have sent out a clear warning.[11] They tell us that prolonged exposure to screens throws the attentional systems of children into complete disarray. In addition, a few hours a day spent in front of a screen robs them of precious time when they could be *active* and engaged in interactions with grown-ups. By being involved in active explorations that interest them, they could be developing another kind of attentional system that we call *executive*. The bottom line here is that the more children are exposed to the attentional disturbances arising from spending their time in front of screens, the greater the difficulty they will have concentrating later on in real life.

In our class in Gennevilliers, at eight in the morning we could regularly pick out a child who had spent the last thirty minutes watching cartoons. He would show obvious signs of fatigue. When he arrived in class, he would either fall asleep immediately in the library corner while an adult was reading a story, or he

would be totally on edge, incapable of keeping his attention on any activity for any length of time. I remember a child who was not even capable of sitting quietly on a chair for more than a minute. It was obviously impossible in a case like that for us to get the child's full attention for more than five seconds. The consequences of this attention deficit were inevitable—this child learned nothing, or very, very little. For two years we tried to help him in whatever way we could. Anna spent a considerable amount of time with him daily trying to train his attention through interesting and precise activities. But after two years of vain attempts, I had to yield to the evidence: if the attentional system of this child continued to be under damaging attack for several hours per day, he would simply be unable to recover and stabilize. This child was adorable and full of life, but he spent his days annoying others, talking very loud, and was unable to control himself. I alerted his parents to the problem several times and asked them to reduce his screen time for a few weeks. But my request went unheard—the little boy continued watching television for several hours a day.

After two years, the best thing I could do for this child was to tell his parents in all sincerity and with the greatest possible kindness that I couldn't do a thing for him without some help from them. The other children had already been showing remarkable development; they were engaging in the learning process with great ease and joy, so their child was an exception. The parents of the boy were upset, and this time they heard my message: "Excuse me," I said to them, "but I have tried everything, everything! I've even gone so far for the last two weeks as to give my full attention to your son alone for six hours a day, trying to get him to concentrate on some activity—any activity that might possibly interest him—trying to improve his ability to pay attention. But I have to tell you, my efforts have been futile, and they will continue to be futile as long as it's just me alone working on the symptom and you are not helping me with the cause. It's already the second year that I've been trying to help your son, and you know that I have been doing everything in my power for him. Now after two years of trying everything, I truly believe that there's nothing I can do for your child as long as he continues to be exposed to a screen for so many hours a day. And in his case, I don't think it will be much help just to reduce his screen time. I'm convinced that at this point it has to be cut off altogether."

His parents heard me out very kindly and attentively. They had known me for two years and were aware of my total commitment to their child and his classmates. We had a bond of trust and mutual respect. They clearly saw that I was not unfairly judging their child but instead that I had an immense desire to

help him. So they agreed. I asked them to give it a try for three months. The following weekend all TV sets in the house were taken down to the basement. We were far from imagining the results we got. After only three weeks of no screen time, this little boy progressively began to calm down and to develop his attentional capacity to the point where he was able to begin reading on the level of his classmates of the same age. As far as I know, the screens never came back up from the basement.

So in order to learn and effectively specialize in the world around them, children need us. They don't learn by sitting watching a screen, or, on the other hand, by being abandoned to wild and uncontrolled exploration of their environment. Finding the most suitable approach for helping them conquer their world is not fundamentally very complicated. All we have to do is to go along with our natural tendencies—which stress, our smartphones, and the speed and pressure of society sometimes make us forget. When we are together with our children, we simply have to take the time to pause and share with them all their little surprises and questionings—a pretty flower, a butterfly, the attitude of a friend, the taste of a particular food—and to comment on them straightforwardly, responding precisely to their questions and allowing them whatever space they need to express themselves. When we are fully present to the relationship and available to exchange with them, we give them the best technical and pedagogical support for the development of their intelligence that could possibly exist—our compassionate, individualized scaffolding. The role adults play in the orientation of children's intelligence is so important that it is considered to be the key element in their learning process. I find particularly interesting the term used by present-day researchers to designate the teaching/learning mode that children and adults spontaneously and mutually adopt. They call this phenomenon "natural pedagogy."[12]

This kind of joint attention seems to be the natural mode of transmitting knowledge. Through it, children quickly learn what they need to know about the world around them. In our preschool class in Gennevilliers, we tried to respect this natural mode of communication between child and adult as much as possible, particularly by giving totally individualized guidance. Every activity, every important aspect of the classroom environment was either presented to each child individually or to a small group of two or three children. In this way I was able to give each child full and warm personal attention in a fashion appropriate to his or her needs and interests. This approach to enabling individual bonding with the environment was only possible because of the

autonomy of the other children, who throughout the day could freely choose among activities that had already been presented to them, activities they could engage in alone or with one or two classmates.

Scaffolding on our part is necessary, but research also shows that if our attention is too heavy-handed, it hampers exploration; and if there's no space for discovery, the child will not be motivated and will not get involved in activity. Therefore our job is to guide our children through timely scaffolding that is not too invasive. We should provide the keys and let our children open the doors. Let us take the example of reading. It's enough to point out the correspondences between the letters and the sounds, and then let the child spontaneously explore the deciphering process herself—for example, by making a game with some classmates out of discovering the meaning hidden behind a sequence of letters. This approach is much more effective in getting children to learn to read than giving them the sounds of the letters and then pushing them, through overly structured instruction, to systematically decipher a series of syllables in a primer. This overly structured approach leaves no room for active exploration, for enthusiasm, or for discovery.

Thus for adults who want to provide appropriate guidance for their children, it is a must to find the right balance. You have to help, but not too much—you don't want to dampen your child's enthusiasm. The right balance can be learned only by trial and error—you see that this one time you helped too much, but that this other time you didn't help enough. Going forward empirically, little by little, you adjust your style to the reality of your child.

Adults who set out on such a program of guidance must have a great deal of compassion toward themselves. You have to allow for making lots of mistakes. It is mistakes and mistakes alone that make it possible for you to clarify the way you work with your children. For the sake of your and your children both, it is essential to surround yourselves with other people who won't be judgmental about your "mistakes," which in reality are not mistakes. What we call a mistake and consider a negative is in fact the only gateway to developing expertise. Real knowledge is built up through many errors. Learning is being wrong, recognizing the error of your prediction, and changing it. There's no other way to evolve other than by this series of collisions with reality. Living beings who don't make mistakes don't learn. They remain stagnated on the same level of knowledge.

THE INDISPENSABLE MIX OF AGES

It has been demonstrated that children of different ages naturally adopt with each other the natural teaching approach we have been discussing. They guide each other in their exploration of the world by pointing out elements that are important to consider. They communicate their experiences and their knowledge in a natural, progressively changing, and well-adapted way. They teach each other and adopt an attitude of learning from each other naturally, without even realizing it. Researchers have observed this phenomenon among siblings.[13] Siblings who are more advanced in a particular area teach it in an informal way, and their "pupils" receive the teaching quite seriously and attentively, and they retain what they have learned extremely efficiently. Among siblings or classes of mixed ages the children are autonomous; they have the benefit all through the day of this informal teaching that occurs between them, and they absorb the knowledge gained in this way with a great deal of enthusiasm.

We saw this in the class in Gennevilliers, which brought together children of three age levels. The age mix greatly multiplied the availability of the scaffolding required for the learning process, and the interactions of the younger children with their older classmates also provided lots of opportunities for them to see their mistakes. A single teacher could never have provided so much individual attention and so much feedback. It's almost as though the children were getting the benefit of having twenty extra teachers who were ready to show them their mistakes in a neutral and informal way. They corrected each other constantly and learned with amazing speed. I was stunned every day to realize that one of them had assimilated something remarkably advanced without any help from me. Sometimes it was even hard for me to follow the children's progress. So the situation was completely turned on its head: instead of having to push the children to learn, I had to concentrate hard to keep up with them! It can be rather disorienting for an adult to go from one extreme to the other like that. Nevertheless, it was a happy way for me to lose my bearings. I was witnessing an explosion of life and vitality, and it was a joy to be knocked off balance by that particular force. The fascination the young children had for the older ones gave them wings. They wanted to learn everything the older ones knew the same way younger children want to learn from their older siblings. Their older classmates provided them with teaching on a level that was stimulating but not overwhelming, something on a level close to what Vygotsky has called "the zone

of proximal development."[14] They found that highly motivating!

On the other side, the more advanced or older ones consolidated their knowledge in an extraordinary way by sharing it with their classmates. Through spontaneously and naturally teaching others, their neural circuits were reenergized, and the result was powerful consolidation of their knowledge. Thus the mix of ages is not only beneficial for the younger ones. The older children also quickly notice what words they are lacking in trying to help the little ones. They have to learn to be clear, adaptive, flexible, patient, and empathetic. By doing this, they not only clarify and consolidate their knowledge, but they also develop cognitive skills absolutely essential to full self-development and success: self-control, memory, planning, and cognitive flexibility.[15] And that's not all. They also learn to respond to the needs of others with empathy; and moreover, they often show considerable creativity in helping their classmates in difficulty to find solutions suited to them.

In this way, children become real experts in the activities they like to teach, in addition to becoming alert, compassionate, flexible, patient, and creative teachers. When human beings reconnect with their true social nature and are liberated from all the constraints of vertical repression, they elicit our deepest admiration and respect.

The natural pedagogical mode the children adopt is not the only factor that speaks in favor of a mix in ages. Such a mix also permits the little ones to benefit from the progress of the older ones by studying and emulating their more evolved actions and accomplishments, especially their linguistic accomplishments. This rapid transmission of knowledge, which takes place naturally and unconsciously, is not possible in a traditional class with pupils of only one age. Clearly, children will not be able to absorb a higher level of language or autonomy through contact with classmates who are hardly more autonomous or linguistically fluent than they are themselves. Educational institutions dare to do what nature apparently considered too risky or too limiting —to designate one person as the teacher. Thus, perhaps to exaggerate slightly, the main source of transmission of knowledge for the child in preschool is a single individual, and this, apart from being unacceptable to a brain that requires generous nourishment at the height of its maturation process, is toxic for the health and well-being of the adult who has to exert him- or herself to the point of exhaustion in order to provide this nourishment alone to more than twenty children starved for fresh input.

So let’s turn the current vertical energy flow—exhausting for the adult and not very nourishing for the children—on its head. Let’s move to a horizontal flow by giving the children full autonomy. This way we can liberate both the children and the adults. Let’s make it so that growing up is once again a happy process of mastering one’s world, supported by calm and compassionate individualized support on the part of adults. This will be highly beneficial for all concerned. First for the children who, in spite of the greatly increased number of interactions they will have and experiences they will go through, will be less tired out, because they won’t have to contain themselves all day in order to conform to the rhythm of the adult. It will also be hugely liberating for the teacher, who will be more relaxed and in a generally better state of mind: she will no longer have to take responsibility for managing a stressful and wearing process of vertical control, where *everything* depends on her. She can relax, freed of the straitjacket of constantly having to push and control. She can now let her light shine out and work with the children in accordance with the rhythm of their interests and individual pace. She no longer has to bear the sole responsibility for the little ones’ development, since the older ones are eager to take over this exciting work.

The mix of ages and this kind of horizontal approach also make it possible for all the children to encounter a greater variety of social behaviors. In this situation, they can naturally encode and come to understand the workings of social relationships in a much richer way than when they are dealing only with classmates of their own age. This was how the children at Gennevilliers were able to develop remarkably advanced social intelligence. They learned to help and communicate with others; they were able to familiarize themselves with the different mental processes of a variety of children as well as absorb the social skills of the older pupils. Little by little, they were able to produce more refined social and emotional responses that were better adapted to the needs of their classmates. We had a tremendous amount of feedback from the parents to this effect. The children were no longer afraid of other children. They were sociable and polite, and they knew how to provide the right kind of help to other children and even to an adult in difficulty. Thus a mix of ages is not only a catalyst for academic learning; it is also, and even more essentially, a catalyst for the development of emotional and social intelligence. Forcing children to live mainly with individuals of their own age represents for them not only a great cognitive privation, but also a major social and emotional one. In our preschool class at Gennevilliers, children of three, four, and five were together all day. We

were not allowed to go beyond that, but in the future, as we continue with our experiment, we will considerably increase the range of our age mix.

We also observed that this social diversity provided a very strong sense of togetherness and security. The youngest children were comforted and excited by the presence of older children. At the beginning of the year, only a few of the three-year-olds who were starting school for the first time cried from being separated from their parents. As soon as they entered the classroom and saw the older children already animatedly and happily engaged in activities and interacting with others, their grief disappeared and was replaced by curiosity. They stood there, raptly absorbed in the scene. They were allowed to stay that way, without any particular expectation on our part, observing what was going on in front of them. They were not pushed to engage in activities or to follow any planned-out rhythm that would have rushed them into anything. They had all the time they needed to acclimatize themselves to this new environment by watching how their older classmates related to being there.

The warmth that develops between the children is irreplaceable. It generates a tremendous sense of well-being and security that carries them along and allows them to explore or engage in learning processes with confidence. The sense of security and the spontaneous impulse toward mutual help that also develops does not appear so easily and so strongly when children are arbc02arily grouped together on the basis of their date of birth. I was often moved by witnessing what was happening all by itself in our class. The scenes of natural mutual helping were the ones that touched me the most, not because the children were exhibiting loving and generous behavior, but because their altruistic, patient, and kindly acts arose naturally, without our having tried to make them happen. We simply provided the conditions that *allowed* the natural tendencies of the children to show themselves. The first necessary condition was simply to let children of different ages evolve together. The second condition was the strongly pro-social behavior that Anna and I adopted every day and that the children unconsciously emulated. Anna and I tried our best to always be calm, patient, understanding, always listening, available, and compassionate, in relating both with each other and with the children. Nevertheless, we were strict and firm when necessary—our aim was certainly not to allow the human intellect to develop in an atmosphere of disorder and chaos.

Our empathetic, calm, and conciliatory approach was also essential in helping the children develop good social skills. As we have already pointed out, children are endowed with great brain plasticity, and they form our daily behaviors and

attitudes into engrams. Consequently, we set very rigorous standards for our own actions and reactions. We always took the time to listen to children who were overwhelmed by emotion. We helped them to formulate their feelings and to understand them, and we tried to provide the most appropriate possible response in a nonjudgmental manner. In the case of conflicts or emotional distress, we made an effort to help the children get some perspective on their emotions by naming them. Once the main emotions were identified, we asked the child experiencing them to express them to the child who had provoked them. Verbalizing their emotions to their classmates had two immense positive effects. Not only did it immediately appease the offended child, but it also an opening for the development of empathy in the other child, who was made aware, without anything further being asked of him in return, of the consequences of his behavior for his classmate. By expressing their emotions calmly and providing the other with an opportunity to feel them as well, the children remained connected, even in times of conflict. We always worked to see that the human bond was nourished and strengthened rather than broken. Preserving this empathetic connection at times of dispute was difficult for some of the children during the first weeks; but with time, trust, and repetition, they were able to do it.

The point here was not to get a child who had upset his classmate to say “I’m sorry,” but to get him to listen to the emotions of the other child. Sometimes the “I’m sorry” then came naturally and with great sincerity. Sometimes the offending child would burst into tears seeing the feelings he had brought about in his friend. He did not feel judged either by the adults or his classmate. He was not in a defensive state and therefore was able to take in the emotions of the other child. Even though I was aware of the power of the children’s brain plasticity processes, I was still very moved and surprised to see the children spontaneously take this attitude toward one another. What a great feeling it was for us then, only a few days after our experiment had gotten underway, when certain children began to take responsibility and care for classmates who were in need of comforting, even if they were of the same age, sometimes by using the same words and showing the same attitudes as Anna and I had! We even saw younger children comforting children older than themselves. What a sight! How delightful! The most lasting image I have of my experiment is that of the kindness and warmth the children showed each other. Their love-filled impulses were very moving to see and restored our faith in humanity.

Now, having experienced this extraordinary experiment, I see an environment

for pursuing my research in which, as in real life, the children benefit from the wisdom and experience of older people as well as from the presence of little babies. This would be finally to recreate a real-life space, one in which human beings, who are hardwired to live together, would no longer be separated but reunited.

This mix of ages does not have to be seen as an option exclusively for schools. Outside of the school framework, we would never see large groups of three-year-old children holding hands and happily teaching each other. Quite to the contrary, children seek out the presence of people of different ages, both younger and older than themselves. Imposing on children a collective life with classmates born in the same year represents a severely restrictive social and cognitive privation.

Human beings are wired to learn from other human beings both younger and older than themselves. The pleasure children get out of being together, from teaching each other and being taught in an informal manner, fills them with a joy and peace that makes it seem like all of nature is urging them on. A classroom then becomes a place of mutual emulation and freedom, a place of collective liberation.

ENDOGENOUS MOTIVATION

Active engagement, caring support, and a mix of ages are the three fundamental elements in the education of young children. But let’s be clear: they are not enough by themselves. If I ask you to learn to knit just by knitting on your own, you will be engaged. If I show you a few key points through which you can explore a great part of this craft, you will also benefit from my support. But if knitting is of absolutely no interest to you, though you will have engaged and been guided, you won’t learn very much. The point is, without personal curiosity, your memory will be activated only weakly. In order to learn, we must also be interested in the activity in which we are engaging; only then will our memory be optimally activated, and only then will we feel the kind of positive energy that can take us very far, very fast.

I have met many adults who, because they had no interest in the subjects being taught in school, were stymied academically from a very early age. The information presented to them did not become fixed in their neural networks. They considered themselves stupid and incapable of learning—until the day

when one or another of them discovered an inner enthusiasm for a certain subject. They were surprised to find that they were capable not only of learning, but also of retaining an extraordinary amount of material in a very short period of time.

I would like to make it clear that this motivation has to be endogenous to be really effective—that is, it has to come from within the individual, as a spontaneous inner impulse. A motivation of this sort takes ahold of us; it carries us along, refocuses us, and fills us with enthusiasm. This is the kind of motivation that enables us to repeat the activity in question many times without even noticing the passage of time.

There is another kind of motivation that comes from outside, which is called *exogenous*. This is the kind of motivation that, for example, pushes us to learn something in order to get something in return: to get a good grade on one's report card in order to be rewarded with a new pair of sneakers—as opposed to learning a subject because we are inspired by it. In the case of this exterior motivation, the child will no doubt get a better grade on his homework than he would have gotten with no motivation at all, but it is very likely that his newly won knowledge will disappear along with the wrapping paper on his new pair of sneakers.

It's wrong to think that in an environment where children are left free to choose the activities they are motivated by they would not gravitate toward the kind of knowledge we call "academic" or "scholastic," like math, history, or geography. Quite the contrary is true. Children get enthused about their culture when it is presented to them in a living and concrete manner. Their minds are predisposed toward grasping it in its reality as a whole. The example of Gennevilliers proves this. Left free to choose their activities, the young children took a lively interest in reading, math, geography, geometry, and music that was equal to the interest they took in painting, free play, or drawing. Why? Because all of this culture was presented in a down-to-earth, broad-based, attractive way. We will deal with the presentation of some of these activities in the second part of this book. It is of course true that some of the children showed greater passion for one subject than others did. In our class, some of them spent the greater part of the day reading, whereas others put together extremely complex puzzles of the different continents, learning the name of each country (some children knew the names of all the countries in Africa, as well as their exact location), and still others spent long periods of time painting, doing origami, studying the names of plants, talking, or thinking. The important thing was that each child could learn

the basics of every field while at the same time having the freedom to nourish his or her own inner passions. This approach allowed the children to develop their own individuality, their own personality, without questioning the different personalities or different levels of their classmates. Everyone is as he or she is, and possesses different areas of particular competence. Within this kind of environment, diversity is perceived as completely normal and obvious, because quite simply, it is.

THE IMPORTANCE OF ERROR

Error is an inevitable path, a first iteration, a normal and necessary confrontation with reality that lets us readjust and refine our data and our predictions. Research is quite clear on this: "Individuals only learn when an event violates their predictions."[16] Error is thus an essential component of the learning process. Often it is perceived as a fault or mistake, and we try to avoid it. This avoidance considerably inhibits the learning process. Moreover, starting with preschool, error is often punished—perhaps by a grade, perhaps by a judgment or an evaluative remark. Even a positive evaluation attributes a status to error it should not have. Error should be neutral. It is simply a matter of informational feedback that indicates that a prediction has to be readjusted. A child who doesn't make errors should not be treated more lovingly or with greater compassion than any other. On the other hand, such a child really needs to move on to something more difficult if she is not to become seriously bored and spend her energy on comparing herself with others. By censuring error and holding up for praise children who don't make errors, we are blocking the learning process—for everyone.

Thus our traditional educational system tends to do exactly what is required to prevent human beings from learning. It imposes activities on children that don't motivate them, and when children do engage in these activities, their inevitable mistakes are negatively judged. This judgment paralyzes risk-taking and does nothing less than block the natural mechanism of learning. The vicious circle of boredom, frustration, and self-depreciation, even of anger, is set in motion. But if we create a high-quality, rich environment, present a great variety of activities carefully selected by a grown-up (always leaving open the possibility of letting the children propose new ones that they are enthusiastic about but we never would have thought of) and designed to *expose errors in a neutral and informative manner,* the children can not only choose the activities that interest

them but also see their errors without feeling bad about them. They can then correct themselves and start over as many times as necessary to satisfy their need for self-development. This spontaneous repetition will also lead to consolidation and automatization of the learning process. Within such a framework, children learn well—quite a lot and very fast.

No longer afraid to make mistakes, children develop a unique, strong, stable, confident, and *creative* personality.

THE RICHNESS OF THE REAL WORLD

Since the brain builds itself by feeding on vital and dynamic experiences in the world, isolating a child from the richness of *real* life is a very risky bet. Recent studies show to what extent an impoverished, routinized environment that never presents new activities and that offers few social interactions and physical activities resembling natural physical activities is an environment that is highly damaging for the development of intelligence. It freezes brain plasticity, even in adults. On the other hand, an environment that resembles a *natural* environment —that is, one that offers a variety of social interactions, normal physical activity, and a variety of cognitive promptings—sets plasticity back in motion and thus gives us back our ability to learn.[17]

Thus it makes no sense to create a novel or overstimulating environment for children. All we have to do is not cut them off from the world, from reality and its riches. We have to present them with a *natural, vibrant, and dynamic* environment, within which they can live with their culture, participate in daily activities, have a variety of exchanges and interactions with people of ages other than their own, play outside, and observe and study the nature around them, while at the same time satisfying their personal passions and need for daily physical activity. This physical activity does not have to be prepared in didactic sequences. Let’s just give children back the chance to climb trees, shinny up trunks, and clamber up small hills and piles of stones. It has been shown that children who get the opportunity to play in nature this way attain increased motor skills, especially a sense of balance, coordination, and agility. They also get a better sense of taking risks within the limits of their abilities.[18]

Let’s not invent extraordinary new setups. Let’s be content merely to bring life back into the place where our young children are going to develop. What children need and want is not some new pedagogical method, but *the world that*

already exists. They want to play in nature, plant things, be with animals, participate in the upkeep of their environment. They want to assimilate the culture and knowledge acquired by humanity in the countless generations preceding them, and they want to do this in a living way that is not sequentially programmed. They want to learn to speak, count, read, write, to discover geography and the mysteries of the universe, to learn music, mathematical code, biology, history, all about dinosaurs, and so on. And if we take the trouble to present this whole reality to our children in conditions that make sense to them, we will be very surprised at how quickly they leave their toys aside when they distract them from their real task: studying the *real* world that they were just born into, understanding it, becoming specialists in it.

Now, in spite of the extraordinary efforts made by teams of educators, school still remains an environment that is too cut off from the variety, dynamism, and richness of the world. Teachers work hard to regularly present new, varied, and rich activities, often with considerable self-sacrifice. But it must be said that it is very difficult to compete with the fascination of the activities presented by a natural environment where children are free to be active in discovering the world —the real world. Our traditional activities and the lovely visual aids we come up with can never communicate the texture, the complexity, and the grandeur of real life; rather, they exhaust our children's brains, which are wired for the complexity of the real, living world.

The institutional environments we have constructed starve the extraordinary plastic intelligence of our children, who are left to do what they can on their own to nourish it with whatever they happen to run into. And we find that very annoying; "They have to touch everything," "They talk all the time," we complain. "As soon as I turn my back, they get into an argument or do something wrong!" Children who break the rules we make for them are really showing their vitality. Their unsatisfied intelligence simply won't give up and is trying to find a way to feed itself no matter what it has to go against. Against us, if necessary. Breaking the rules made by an adult and risking being punished is nothing compared to what is gained by committing the transgression. This is not insolence; it's life standing up for itself and resisting.

Across from my house, there's a primary school. From the street, you can see only the grade-school part. It's completely gray, with lots of concrete and narrow, rectangular windows all in a row. Two trees in the schoolyard have the heavy task of offering a little life to this place that safety considerations have left completely bare. The only touches of color in the scene are those of the French

flag hanging on the facade of the building. The three wonderful ideas it represents—liberty, equality, and fraternity—have never seemed so sinister as here. How grim! Every time I pass by a school building of this sort, I can't hold back a sigh of pain. How could we have let ourselves present creatures at the peak moment of their development with such an arid environment? One evening, I found out in a surprising way that I'm not the only person who thinks this kind of setup doesn't look at all like a place where anything might flourish. It was about six in the evening. Passing by the school on my way home, I came across a little boy of about two and a half who, wrinkling up his brow, was saying to his father, "What's that, daddy, a jail?" "No, darling, it's a school," his father replied.

Fortunately, all schools are not as grim as that one, but still far too many of them are.

I recently received an email from a person who was full of high intentions for helping teenagers from underprivileged backgrounds. She explained to me that there was an NGO partnering with the Ministry of Education that was proposing, in time for the beginning of the 2016 school year, to recruit a team of twenty-five high-level volunteers to act as consultants for two years in the special-education high school in a poor area of the Créteil school district. She declared that she had a degree from one of our best institutions of higher learning, the Paris Institute of Political Studies, and went on to say: "Several years ago I applied to be certified as a French teacher with the intention, among other things, of reaching an understanding of the inequalities that exist in our schools, of analyzing the workings of the French school system, and experimenting with teaching methods involving visual aids." Her message ended by asking my opinion of her proposed method based on visual aids. I replied as follows:

> Please forgive my candor, but here's what I think of that. You can use all the visual aids in the world, but what these children really need to learn and develop is love, freedom, social bonding, and a sense of meaning. Not images. We can carry out all the structural and pedagogical reforms we can possibly think of, put up lots of screens, and build the most beautiful buildings on the planet, but as long as we are not working to annihilate the huge gap that separates the children from themselves and their real life, all we will end up doing is making that gap bigger. I grew up in this kind of neighborhood. I have been in these teenagers' shoes myself. I have

> to say that having to deal with these kinds of pedagogical tweaks and manipulations was a particular source of discouragement for us, and moreover, it was horribly irritating.

I sincerely believe that the riches of the real world and individual experiences within it can never be replaced by any kind of visual aids, personnel, or well-meant lectures, not even by thousands of computers. The Program for International Student Assessment (PISA) report of 2015 confirms this. "Countries that have made major investments in ICT [Information and Communications Technology][19] in the area of education have shown no significant improvement in their students' results in reading comprehension, mathematics, or the sciences." Let's really take this in. This means the solution will come not from any sort of improvement to the system but only from a total overhaul. It is the totality of the environment that has to change. A human being, whether child or teenager, is a being intrinsically hardwired to learn through living in the intensity, dynamism, and complexity of the real world.

RECONNECTING WITH NATURE

Reconnecting children to the richness of the real world also means allowing them to reconnect with nature. They spend so much time within four walls, separated from the wealth of nature, eyes fixed on a screen, that today they are capable of recognizing a thousand business logos, but less than ten plants native to their region.[20] Let's reconnect our children to the nature they are part of and without which their survival is impossible. Today it has become absolutely necessary for children to grow up understanding, sensorially and intuitively, the primary laws of our planet, so that as adults they will be able to live by utilizing its natural resources in a respectful and sustainable manner.

For example, it seems to me important for children to learn little by little how to plant vegetables and other plants, making proper use of the resources and energies of the earth. A child of seven should already know how to grow radishes, potatoes, or tomatoes, pick them when they're ripe, and prepare them so they can be eaten enjoyably. Let's begin by re-naturalizing and enlivening our schoolyards: trees, fruit trees, vegetables, grass, earth, flowers, water, natural light, animals. Let's provide our children with large gardens they can take care of themselves, in the midst of which they can observe the thousand forms of plant life and the insects they harbor; let them pick fruit from fruit trees, take care of

vegetable gardens, and take care of animals and live with them.

Most of our children learn about the seasons the way they learn a foreign language in school—completely out of context. They only perceive some aspects of the seasons—the cold, the heat, the humidity—without grasping the depth of them, the nuances, the odors, the characteristic sounds. They have trouble grasping the true nature of the seasons, and that's completely normal, because they are only partially exposed to them. I speak from personal experience here, since it was only after elementary school that I myself began to experience the rhythms and signs of the seasons other than through the lens of my urban life. Before that, like many city kids, autumn was the color of the stress of going back to school; winter was cold and Santa Claus; spring meant the possibility of taking off our coats and playing in the yard; summer was heat and freedom. We couldn't know the signs of the seasons—the flowers, the fruits, the foliage—we couldn't know them because we didn't experience them. And the most beautiful seasonal sights were not even present. I discovered the colors of the seasons only much later, when I had a chance to experience them directly. It's the same as if, for example, you wanted to understand the country of England. You can grasp the depths and subtleties of a foreign country only by spending at least a month there. Eight years of schooling with lovely pictures and videos just wouldn't convey them at all. The human brain cannot comprehend what it does not immediately experience—no description or image can replace the sensual, living spectacle of nature.

At Gennevilliers, as in most schools, the playground was covered with concrete. It had a totally sterile look. Not even the smallest blade of grass had been left. The white walls were old and the paint was peeling. The facade, decorated with the flag of the Republic, was gray with pollution. Thus there was no way the children could benefit from daily contact with the freshness and purity of nature. I have to frankly admit that this was a major limitation in the experience we could offer the children. We felt what a big loss it was not to have such contact available for them; we knew how greatly the children would have been soothed and refreshed by it. Numerous studies indicate very clearly that contact with nature calms, inspires, and revivifies our minds; it alkalizes organisms that have been acidified by social and environmental stress, and develops motor and cognitive skills; it is a mood stabilizer that regulates negative emotions and even fosters the development of creativity.[21] The children of Gennevilliers were clearly not sufficiently able to profit from this wholesome, physiologically beneficial contact with nature. They never had the opportunity to

take care of a vegetable garden, to enjoy the sight of the earth covered with red autumn leaves, to smell the fragrance of the flowers in springtime, or to witness the sweet and generous abundance of summer. They never had a daily chance to observe the many varieties of insects that burrow in the earth or live in the greenery, so we could never bring such things up in class at discussion time. All the same, we know what bursts of joy children can surprise us with when they find or catch an insect! This joy manifests the ebullient sense of satisfaction experienced by the human intellect when it makes a discovery. A child's intelligence needs to be in contact with the world. It doesn't want to just be told about it; it wants to live it and embody it on its own, through its own explorations.

As I write these lines, it has just finally stopped raining. It's warm out, but it rained all day long. I have the good fortune to be surrounded by lush vegetation, and just now when I went out, I witnessed a magnificent spectacle—the wet plants glittering afresh with sunlight. The odor of the trees and the earth is dense, pure. Snails are coming out everywhere. For three years in Gennevilliers, the rains presented nothing but the unpleasantness of wet ground and soaked benches in the courtyard. How could I have gotten the children to feel the beauty and the charged quality of the moment I just experienced, in which the rain, after ending, exhales such fragrant odors?

We did what we could to bring a bit of nature into the classroom. We decked it out with plenty of green plants, really large ones and smaller ones too, which the children could care for themselves all through the day—cutting off the dried and wilted leaves, turning over the soil, and watering. Parents contributed generously to this greening of the classroom, bringing some of their plants from home. For sure, it was far from perfect, but that was not the main thing. Although our offering of contact with nature was extremely limited, it was already a big step for the children.

A RICH BUT NOT OVERLOADED ENVIRONMENT

The idea of the "richness" of an environment should not be confused with one that is overflowing. What really makes an environment rich for children is not the quantity but the *quality* of the activities they are offered. Because if under-stimulation is bad, overstimulation is just as bad. It overloads the neurons with information and provokes a great deal of stress in children. So it's out with multicolored toys with sounds coming out of every part of them and every part

of which has a different texture.[22] It's goodbye to screens, cartoons with a super-speedy flow of images, and tablets and television sets. If children sit spellbound in front of these objects with staring eyes and fast-beating hearts, it's certainly more of a case of shock than of contemplation. Don't be surprised to hear them shrieking aloud afterward and not being satisfied with anything. Their brains become habituated to overstimulation, and they have a great deal of trouble focusing their attention.

A recent study from Carnegie Mellon University in Pittsburgh, called "When Too Much of a Good Thing May Be Bad,"[23] indicates, for example, that classrooms with too much decoration are a source of distraction for young children and directly affect their cognitive performance. Being visually overstimulated, the children have a great deal of difficulty concentrating and end up with worse academic results. On the other hand, if there is not much decoration on the classroom walls, the children are less distracted, spend more time on their activities, and learn more. So it's our job, in order to support their attention, to find the right balance between excessive decoration and the complete absence of it.

For the class in Gennevilliers, I spent a lot of time thinking about the organization of the space, which I wanted to be simple and clean. I got rid of everything that seemed superfluous and put the emphasis on what seemed essential. I had very little up on the walls—a map of the world in the geography corner; a long chart, or frieze, with a row of numbers on it below which we could move the photo of each child in accordance with his or her mastery of the counting song; a beautiful picture (that we regularly changed) over the individual drawing table; the twenty-six letters of the alphabet cut out of sandpaper; and a string across one wall on which we could hang the paintings that some of the children wanted to show the class.

Kim John Payne, in his book *Simplicity Parenting*, also suggests that our children have too much stuff, too many choices, are subjected to too much information, and live "faster" lives, all of which disturbs their attentional system. He conducted an experiment consisting of simplifying the lives of children suffering from attention deficit disorder by changing their environment—fewer toys, fewer extracurricular activities, fewer screens, more free play and fewer activities supervised by an adult, more time spent in nature, and more time for just daydreaming.[24] In only four months, the attention problems had disappeared in 68 percent of the children. Their scholastic and cognitive skills also increased

by 37 percent. These positive effects are not observed with the use of Ritalin, which is intended to produce calmness in children. But it should be noted that in the United States, one child in eight is treated with this drug.

The bottom line here is we must provide our children with time, with freedom, with a connection to the real world, as well as with the opportunity to reconnect with themselves. It's about simplifying our children's lives, doing away with superfluous activities in order to make their lives richer and qualitatively better.

TAKING THE TIME TO DO NOTHING AND DAYDREAM

When we take the time to do nothing—that is, to look off into the distance and daydream or rest stretched out in the sun—our brain continues to be active in a form neuroscientists call "default mode."[25] This default mode replays, analyzes, and makes inferences based on past experience. It is no doubt for this reason that, when we are on vacation or in the shower, we suddenly get bright ideas. The brain, freed from the tasks that require it to focus its attention, can finally get its house in order. These moments of rest—in the absence of screens—are thus highly productive ones and as necessary for the proper functioning of our brain as sleep is. It is important to respect these times of observation, contemplation, or rest—they are very good for us.

In our class, the children had a nice wicker chair that we had painted bright yellow and on which there was a little cushion that made it quite comfortable. The children were free to use this chair to "do nothing," to just look around, to daydream. Some of them also used the library corner to put their head down on a cushion and rest for a while. Others, seeing their classmates doing this, would take a little time to rest themselves. The children were not required to be doing something visible from the outside. We tried, as much as possible, to respect their needs, which manifested, often several times in the course of the day, in "doing nothing."

THE IMPORTANCE OF SLEEP

We have seen that in the first year of life, the brain forms an extraordinary amount of neural connections based on the child's experiences. We have also seen that pruning occurs at the same time, and the most frequent connections end up being reinforced. This pruning is what allows the human to learn and to

become specialized. Current research provides us with a fundamental piece of information: the main part of this reorganization seems to take place during sleep. It has been shown that the density of neural connections augments considerably during the day, but after a night of sleep, it is reduced. So the brain does its sorting out while the child is resting. Experiments thus demonstrate that if a baby or young child can satisfy her need for sleep after a period of teaching, when she wakes up, the new knowledge she has acquired is consolidated. On the other hand, if after a period of teaching, her sleep is cut short, disturbed, or prevented altogether (even if she shows clear signs of fatigue), the reorganization phase does not take place properly, and the new knowledge is not adequately consolidated.[26] Studies indicate that children who don't show signs of fatigue and don't normally take a nap do not need to sleep in order to achieve adequate retention of new information. However, children who do show the need to sleep must be able to do so. Their brain is asking for a rest time so it can register and consolidate the new information it has encoded in the course of the day.

Sleep is fully integral to the process of learning. Since children form a considerably larger number of neural connections during the day than adults do, thus gathering a huge amount of information in record time, they need more frequent and longer rest periods than adults do in order to sort and organize it all. That is why children, especially babies, sleep more often and for a longer time than adults. When our young children begin to nod off, it's because they can't cram any more information into their brains and a time of rest is needed to allow their brains to make a little room. After a busy day, full of lively and dynamic stimulation, our children rapidly fall asleep. Sleep, as well as the length of time for sleep required by each child, must be respected. Their sleep times correspond to a phase of brain maturation they cannot do without.

In our class at Gennevilliers, we followed this principle quite rigorously. A tired child was invited to take a rest, no matter what time it was or the child's age. If a child arrived exhausted at 8:20 a.m. during the dark mornings of winter, with his eyes still full of sleep, there was the opportunity for him to take a mat and lie down in the same space his classmates were already busy in. And at naptime, all the children who wanted to—not only the three-year-olds—were allowed to take a rest. The need for sleep was king.

It is interesting to note that children who have attention and learning problems can attain the same learning levels as their peers simply by improving the quality

of their sleep.[27] Thus a measure as simple as going to bed early without prior exposure to screens (which activates the children's nervous systems and keeps them from sleeping) can allow children to overcome problems with attention and engaging in the learning process.

CHILDREN RETAIN CONTENT THAT MAKES SENSE

But note well, even with good quality sleep, the brain filters what it is going to consolidate and keep. It drops whatever makes no sense to it. A study shows that if we have a child memorize a series of finger movements on the piano without drawing his attention to the melody it makes, his brain does not retain this motor sequence. It seems useless, arbc02ary, and meaningless. On the other hand, he will remember the motor sequence if his attention is called to the melody it makes.

This seems to me to be an essential reminder for us adults. When a whole class of children has great difficulty in retaining what we are teaching, perhaps we ought to reconsider the way we are teaching. Does it really make sense to the children? We should be aware that when we cut material up into small bits, we lose the big picture, the meaning, the depth—and at the same time we lose the interest of the children. We shouldn't take this personally at all. The fact simply is that human beings seem to be unable to retain content that makes no sense.

Learning the letters of the alphabet is a striking example. I noticed that children immediately retained the sounds of letters, rather than their names. Why? Because the sounds make it possible to immediately begin deciphering small phonetic words, whereas the names of the letters is arbc02ary cultural terminology that makes no sense and doesn't provide any help toward reading. The names of the letters are simply designations for arbc02ary graphic symbols. They make no sense to the children. I have noticed that many children in the latter part of preschool—that is, five-year-olds—have difficulty learning the names of the twenty-six letters of the alphabet, even in high-advantage neighborhoods like Neuilly-sur-Seine, which is rather astonishing in light of the complex vocabulary that these children are able to manage. How could these twenty-six names pose such problems? The fact that they designate the graphic signs that decorate the classroom walls is of absolutely no significance to the brain of a child. They lack meaning, depth. Thus it takes the full three years of (French) preschool for children to learn the twenty-six letters, whereas it takes

less than a week for them to learn the twenty-nine first names of the other children in their class. In the class at Gennevilliers, when the children showed that they wanted to learn to read like their older classmates, we told them the sounds of the letters that they asked about. “Céline, what’s the sound of this letter?” they would ask, impatient to know them all. A few of them took only a few days to remember them all. They knew that these sounds were going to give them access to very exciting and somewhat “magical” activities: an older classmate, for example, wrote a series of letters on a scrap of paper for a younger child, and without any talking, simply by decoding the signs placed on the paper by his older friend, the younger one knew what the older one had been thinking. For them, it was like a magical means of communication.

It’s not learning that tires children out. They are wired for that. What does exhaust them, on the other hand, is carrying out tasks that are not worthy of their intelligence. Please listen, teachers and administrators: the human brain is a marvel. It seeks *meaning, life, intelligence, and depth.* It is wired to retain what is beautiful, great, living, dynamic, and inspiring. Provide it with that.

Thus for my preschool class in Gennevilliers, I made a radical choice: any activity whose objective did not seem to make sense to the children was eliminated. Guiding me in my choice, the children’s joy as well as their urgent desire to engage in an activity were irrefutable criteria. When the children showed no enthusiasm and were in no hurry to engage in a proposed activity, after a while the activity was withdrawn from the pedagogical program.

THE IMPORTANCE OF FREE PLAY

Today it is very clear that children playing freely together—rolling on the ground, running around together, being rowdy—promotes healthy brain development. According to researcher Jaak Pankseep, a specialist in play among mammals, play is a physiological means that promotes brain development and emotional balance among the young. Thus it seems to be a fundamental need to provide a space where children can engage in free play when they want to, without any adult supervision. Quite obviously, it is difficult to supply this in the middle of a classroom. To accommodate this need on the part of the children, rooms for free play adjoining the main classroom to which the children could adjourn when they wanted to would be ideal. They could then play games of their own devising, laugh, invent imaginative scenarios, play social games—all without disturbing their classmates engaged in activities requiring focused

attention.

At Gennevilliers, we had such times of totally free play on the playground at recess, and we did not hesitate to prolong these periods when it seemed necessary—weather permitting. The children liked that a lot. It was not, however, an ideal solution—far from it. It would have been much more interesting if the children had been able to satisfy their need for play individually at times when they felt the need for it and for as long a time as they found necessary. But as I find myself saying again and again, we have to make do with the possibilities and resources at hand, without putting too much pressure on ourselves. The point is not to create a perfect, model situation, but to progressively move toward more appropriate conditions as best we can. This intention alone already makes all the difference for the children.

It would also be interesting if the circulation between the inside and the outside, a yard or garden, could be facilitated, so that the children could go out and get some air and play freely whenever they needed to, or even work outside on a mat or table on some sort of porch so they could benefit from fresh air and good weather any time of the day. Present-day school buildings do not allow for that, and it’s a pity. Nonetheless, children, as we do, need to take regular breaks between their activities, and at a variety of different intervals. And as we do, they need to benefit from the open air and natural light as often as they feel it’s necessary for the proper balance of their metabolism.

THE TOXICITY OF STRESS

Initially, stress is a very healthy and helpful reaction on the part of the organism. Stress made it possible for our distant ancestors to survive. In the face of imminent danger—for example, the sudden appearance of a ferocious animal—our brain and our adrenal glands initiate the secretion of cortisol and adrenaline, which accelerates our heart rhythm and increases our blood pressure, contracts our muscles, slows our digestion, and increases our blood sugar level to give us a lot of energy. This incredible mobilization of our whole organism allows us to flee or to fight off the enemy. Stress, when it lasts for only a short time, makes us more agile and permits the organism to perform at a higher level, whether we find ourselves in a new situation, a competition, or an exam.

But today, the cause of stress in our daily lives is no longer wild animals, but rather the urban environment, social pressure, or else personal and professional

problems. In the face of these factors, the fight-or-flight reaction is no longer altogether appropriate. Rather than fight or flee, we have to make use of our ability to step back and gain perspective, to analyze our emotions, to de-dramatize the situation, and to find solutions. Stepping back in this way lowers the level of the stress hormones, and our body calms down.

We grown-ups can calm ourselves in this manner because our prefrontal cortex—which is located behind our forehead and houses our capacity to analyze, step back from a situation, and exercise self-control—is mature. By contrast, in young children this is not at all the case. Thus when they are subjected to anxiety, to stress, or to a strong negative emotion, when their brains rapidly trigger a secretion of stress hormones, they are unable to take a step back, exercise self-control, and analyze and de-dramatize the situation. Unlike us, they are incapable of calming themselves on their own. Over time they will be able to do so as their prefrontal cortex matures, but this part of the brain doesn't reach full maturity until the beginning of adulthood—around the age of twenty-five!

So when a child is confronted by stressful situations that she doesn't know how to cope with, such as when a classmate suddenly grabs a toy she was playing with out of her hands, she goes through a series of emotions—fear, sadnesss, anger—that she is unable to calm by herself. She is totally immersed in them: her fears become big fears, her anxiety becomes enormous anxiety, and her anger becomes major anger. Children thus undergo what are known as *emotional storms.* In these situations, stress hormones are secreted continuously and without regulation. The stress becomes *toxic.* Cortisol is unleashed in great quantities, and it directly attacks the child's brain, destroying the neurons within very important brain structures. The hippocampus, the memory zone, is one of the first regions affected. A child who regularly undergoes stressful situations or who does so for an extended period of time can end up with memory problems in this way. Stress directly affects the learning centers. The prefrontal cortex, which enables us to reason, to take a step back, to exercise self-control, to make decisions, and to show empathy, is also one of the first regions to be affected. The development of all these essential capabilities is hobbled.

Repeated or prolonged stress thus seriously damages a child's still immature brain wiring. The damages thus generated trigger a vicious circle: the more a child is subject to stress, the more the maturation of his prefrontal cortex will be slowed, and the more difficulty he will have in managing his stress episodes, which will then become more and more numerous and increasingly difficult to

control. For this reason, the habit of letting a baby cry until it is seized by very intense emotions with the idea of letting it calm down by itself is a very big mistake. By doing this, we get just the opposite result from what we wanted. The development of the baby's prefrontal cortex will be hindered or impaired, and it will have ever-greater difficulty controlling its emotions on its own. When the baby reaches adulthood, her capacity for regulating her emotions and for reacting to the various stressful situations of life may well be diminished. We should also point out that although children regularly left to deal with emotional storms on their own will certainly quiet down in the end, we should not think that this is a sign of autonomy. In order to preserve its sanity and not be overcome by what they are feeling, children instinctively cut themselves off from their emotions and will probably have a great deal of difficulty connecting with them when they reach adulthood.

How should we protect children's brains from toxic stress? The main means is to avoid exposing them to repeated or prolonged stressful situations. Regularly shouting or arguing in front of them, for example, is a source of chronic stress whose consequences for their brains is considerable. Research shows that under these conditions children's brains secrete stress hormones as though they themselves were involved in the conflict situation.[28] Both at school and at home, it is important to protect children from such toxic stress by regulating our own emotions, even in the most difficult moments. Not subjecting our children to negative judgments or humiliating words is just as essential. Verbal violence, insults, and humiliating tirades generate a kind of far-reaching stress that can even damage the neural networks connected with speech. Talking to children this way literally injures them.[29] As for traditional scholastic testing, examination, and grading systems, they are also significant stress factors to which children are continually exposed. Therefore, it would be a good idea to avoid these situations of top-down and prescriptive stress.

At the same time, it is of fundamental importance to help children progressively manage their high-intensity emotions and their stress by themselves. How? The first thing that needs to be done sounds obvious, but nevertheless, it cannot be emphasized enough: when children are immersed in an emotion that overwhelms them—such as anger, pain, grief, anxiety, and so on—it is important to reassure them through our loving presence and comfort them. We just have to pick them up and hold them in our arms and their brains secrete an extraordinary molecule, called *oxytocin,* also known as the "love molecule,"

which has the marvelous ability to stop the secretion of cortisol. The oxytocin secretion triggered by our kindness interrupts the vicious cycle of stress and sets in motion a veritable virtuous cycle by bringing about the secretion of endorphins, serotonin, and dopamine. These secretions generate well-being, calm, pleasure, enthusiasm, energy, and serenity. It's as simple as that—love protects and arouses the most basic, innermost structures of the brain.

Once their unpleasant emotions have been soothed away by affection, it is very important to help children *name* what they were feeling to help them calm down still further. Neuroscience research tells us that naming an emotion makes it possible to bring calm to a brain in a state of alert. Little by little, the child will recover her composure. By allowing children *to analyze the situation and take a step back,* we help their prefrontal cortex to develop more rapidly. In a sense we serve them by being an "external prefrontal cortex," and in this way we protect their prefrontal cortex and contribute to its maturation. Little by little, children will become increasingly capable of calming themselves on their own and will have less and less need of our help. Research does indeed show that supplying children with this kind of support is favorable to the development of their capacity for self-regulation and the development of their prefrontal circuits.

Here's what we did at Gennevilliers. We first calmed children with a soft, sweet voice or a comforting touch—for example, by taking their hand. We would then help them to name their emotion. Was it anger, grief, or frustration? Once the right emotion had been named, the children would calm down rapidly. Their alert system, along with the secretion of cortisol, had already been deactivated. Then we invited them to express their emotion. If a child had been offended by another child, we encouraged her to express her emotion to her classmate and propose a remedial solution if that proved necessary. Studies have shown that adults who have benefited from this kind of support during their childhood are more capable than others of calming the emotional flights caused by their alert systems. They manage their stress much better than others and thus are much less exposed to its harmful consequences.[30]

Thus, during all of childhood, it is the reassuring, understanding, and compassionate guidance of grown-ups that makes it possible for children not only to regain their good cheer after a crisis but also to develop their capacity for self-regulation. The immature brain of the child is thus totally dependent on the brains of the grown-ups who surround them. That might seem paradoxical, but this is a fundamental truth: we cannot grow up to be functional and autonomous

without the help of others. Stable, well-developed, balanced, and robust autonomy is autonomy that has been built with the love, patience, and attentive presence of other people.

This kind of compassionate and patient support was the pedagogical foundation of our preschool class at Gennevilliers. What is the use of presenting a rich, quality environment suited to the plastic intelligence of children if its benefits are negated by stress? The immediate management of stress the moment it appeared was therefore one of our main priorities. Every situation of conflict or grief became an occasion for us to guide children toward emotional autonomy and to help them toward the maturation of their prefrontal cortex. Obviously, this emotional autonomy does not come about from one day to the next. It comes about with time and regularity along with the development of the children's prefrontal cortex. Nevertheless, after a few months the children were able to manage their conflicts by themselves without having to call for adult help. They knew how to identify their emotions, express them, and propose a solution in order to defuse the conflict.

In addition, research shows that a daily connection with nature reduces stress in children, and that the consequence of this is significant improvement in their memory, their attention, and even their emotional stability. Children who are regularly able to benefit from contact with nature also have more peaceful relationships with other children.

KINDNESS

To those people who think that kindness is a nice but optional pedagogical supplement and perhaps a little bit on the frivolous side, I would like to say: you are mistaken. A positive social bond between people, empathy, and generous and altruistic behavior are conducive to the formation of new neurons and augment the number of synaptic connections. And this is true for those who exhibit pro-social behavior as well as those on the receiving end of it. Would you like to increase your learning ability? Be loving and surround yourself with loving people. Would you like to help your children increase their learning ability? Love them. Quite simply, just love them. Be warm, caring, empathetic, and affectionate. Our kindness nourishes the brain development of our children quite extraordinarily. When we manifest a kind, warm, and affectionate attitude toward a child, the neurons in his hippocampus proliferate new connections. His

memory as well as his capacity to learn develops considerably.[31] But that's not all.

As we have already pointed out, with kindness the circuits of the child's prefrontal cortex mature, and its capacity for analysis, reasoning, and self-control become stronger. In the orbitofrontal cortex, which notably contains the circuits for empathy, decision-making, and the moral sense, new connections multiply. In other words, our kindness generates development in our children's moral and empathic capacity. It also triggers the secretion of oxytocin in the brain. Oxytocin fosters empathy, commitment, bonding, and confidence. As Dr. Catherine Gueguen explains,[32] secretion of oxytocin also triggers the secretion of a whole cascade of beneficent hormones: dopamine, serotonin, and endorphins. Dopamine generates energy, motivation, enthusiasm, pleasure, and creativity. Seratonin is a mood stabilizer. And endorphins bring on a strong feeling of well-being. Kindness is not just an option in teaching. It is a major catalyst of development.

In our class at Gennevilliers, the children benefited from the highly positive effects of kindness in a particularly powerful way: both the grown-ups—Anna and I—and the children behaved in an empathetic, warm, and understanding way. The children's development was striking and brilliant. We will expand on this point in the fourth part of this book.

3

The Gennevilliers Example

In our class, we tried, within the measure of our means, to provide for the children conditions that corresponded to the primary laws that govern learning and development. Obviously we had to make concessions and organize the class within the constraints imposed by the school board and the structure of the building. Thus we had to work within limitations of scheduling, architecture, light, and space.

I very quickly saw that autonomy and freedom of movement for the children would require much more space than was available in a preschool classroom arranged in the traditional manner. So although our classroom, with an area of nearly six hundred square feet, was much more spacious than the average French preschool room, it was still not big enough for two adults and twenty-seven autonomously active children to live in together six hours a day. The children were going to be moving around all day long from one place to another, sometimes lugging cumbersome materials with them, and might be working in a sitting position, standing up, or lying on the floor. Therefore we tried to arrange our space in the best way possible to facilitate circulation and movement. We did this by removing all superfluous furniture and materials. The adult desk, the group benches, the tall cabinets and shelves that were too high to be accessible to the children, and the large “whiteboard” were the first things to go.

Another thing we were unable to provide for the children was a garden with earth, trees, vegetables, animals, and so forth, so they would be able to step out for some fresh air at any time of the day and so they could be in contact with nature and have the opportunity to take care of natural things—a garden where

they could also play together at any time of the day. They also did not have the opportunity to go into a variety of rooms set up for different activities, nor could they participate in workshops in small groups led by dedicated outside teachers. The range of age groups, in my opinion, was still too limited, the schedule was too rigid, and more natural light certainly would have had a positive impact on the general state of the children's health.

Nevertheless, we were able to go forward in certain areas, such as autonomy, having a mix of three age levels, and positive, empathic, and supportive social bonding. Moreover, we were able to offer attractive and ambitious cultural activities—in geometry, geography, sensory refinement, music, mathematics, and language.

The three normal preschool ages (three, four, and five) were brought together in our class. The children were autonomous all day long; they could interact freely and choose their activities, which were distributed over different spaces—the language area, the mathematics area, and other areas for sensory refinement, geography, geometry, music, and botany. The class offered a hundred different activities. We used sensory materials devised by Jean Itard, Édouard Séguin, and Maria Montessori. I will describe the teaching materials later on. One area was dedicated to the creative arts, with an individual easel for painting and an individual table for drawing, as well as an individual table for modeling activities. All of the activities and materials were situated on low shelves or tables, at the children's level. The highest shelf was no higher than twenty-eight inches so that the smallest of the children could reach the materials on it. The shelves were situated along the walls of the classroom, leaving the maximum amount of space free in the center of the room.[1]

In the center of the room, the children had individual tables available to them that were distributed harmoniously over the space. This made it possible for them to work individually and quietly. When any of them wanted to engage in activities with another child, they could push two tables together or use a small stool that one of them could put next to the individual table. In that case, only one table was used for two children. We made the decision to make available less individual tables than there were children. This decision freed up floor space so that children could roll out mats and engage in activities on those.

A TYPICAL DAY

When the children arrived at school in the morning, Anna was posted at the entryway. She greeted the parents and worked out little administrative details: snacks, lunches, attendance questions. At the same time, I was in the classroom, ready to welcome each child individually. The children took off their shoes on the bench in the hallway and put on their slippers. I insisted on this detail, which provided an indirect invitation to the children to center themselves before entering the classroom, to adopt calmer and more orderly movements and behaviors, and to consider the classroom as a warm and convivial place that they should take care of. Next they greeted Anna, *always.* And then when they came through the door, they entered a calm, serene atmosphere, where I greeted them with the greatest kindness and the fullest possible attention. I took the time to greet them each individually.

“Good morning, Selma.”

“Good morning, Céline.”

I asked each one how they were and if they had slept well, I listened to what each one had to say, I helped them formulate their sentences, and I took in their emotions and their moods. This small morning exchange was a special moment, which gave me a chance to rapidly assess the state of fatigue, the mood, and the emotional state of each child.

I then asked each of the children to choose the activity they wanted to begin the day with. In order to follow the children’s progress and to create orderly conditions, this had to be an activity that had been presented to them before and whose objective was familiar to them. (Some of the activities might have been presented to them by one of the older children.) Some of them needed a bit of help making their choice. In this case, I went over the contents of the shelves with them, reminding them sometimes of an activity that had interested them the previous day or a few days ago. That might well be all that was needed to trigger their enthusiasm. If a child really didn’t know what to do, which often happened toward the beginning, she could always just watch her classmates, talk with a friend, or simply sit there and take some time to think before gradually getting started on the day. Some of the children who had gotten out of bed in a hurry needed more time to wake up. They could settle down in the library corner or at a table and take time to rest a little while longer.

The parents accepted this way of doing things, which we explained to them at the back-to-school parent-teacher’s meeting. They knew that this initial moment represented a totally individualized moment of entry into the teaching situation.

Thus they took care to speak to their children in lowered voices when arriving and did not mind telling Anna any messages they wanted to impart to me. They knew Anna would share the messages with me, and that I would take the time to talk with them after school.

Once all the children had arrived, Anna helped me give individual guidance to any children who were still trying to choose an activity. To make this easier, we had a small wall chart on which we had noted the activities that particularly excited children who had difficulty making a choice. While Anna continued to guide children toward a choice, I began to explain activities to children individually. Depending on the morning, I made three to ten individual presentations. Each one was marked with a point on a follow-up graph on the line corresponding to the child who had received it. That way, I knew exactly what presentations each child had received. In the case of language or mathematics activities, when I saw that the goal of the activity had been reached by a child, I colored over the point on the chart with green. These evaluations were always informal and the child was *never* aware of my validation. It was purely a reference point for me, so I would know if the goal had been clearly reached or not and whether or not it was a good idea to propose a task of the next level of difficulty. I then simply asked the child a few questions and sometimes asked if he minded if I sat down and did the activity with him. The only feedback I offered the children was my joy at seeing them succeed at something they had not been able to do the day before or my encouragement to go on to the activity of the next level of difficulty. *That's all.* Between two presentations, if I spotted a child having trouble and near to being discouraged, I sat down next to her and did not hesitate to resume the activity along with her for as long as necessary, if the state of calm in the class allowed.

All morning, the children continued to choose their activities. When they finished an activity, they put the materials back on the shelf. Some would then pick out a new activity while others took the time to do nothing, chose to watch one of their classmates, or went to the library corner to listen to their favorite story for the tenth time that week. We adults took great pleasure in reading these stories to them. The children could move around the classroom however they liked as long as they did it in a quiet and orderly fashion. They could engage in their activities sitting in a chair, squatting, or kneeling next to a mat. Some of them did not hesitate to lie down, and we let them do it as long as it didn't create disorder. This freedom of the body is fundamental. Research shows that our brains learn better when our bodies are not fixed and stiff.[2] I presented

individual activities whenever possible, took the time to observe the children so I could respond in the best way to their needs, and I provided guidance in a timely fashion to children who needed more sustained support. Anna remained available to help children get started in an activity, made sure the class stayed orderly, and when possible, played short and entertaining sound games (a traditional Montessori activity) with a group of the littler ones. As for the children, most of them were engaged in an individual activity, some were doing an activity in a group of two or three around a mat, and others were reading books aloud in the library corner under the attentive gaze of a few of the little ones. Some would sit watching the activities of other children or would stay close to me while I was presenting an activity; and finally others would be whispering jokes to each other and laughing.

So the children were drawn to activities that motivated them, and they were free to explore, make mistakes, and repeat them for as long as was necessary. I have often had people say to me, “So in short, in this class, the children just do whatever they want.” Absolutely. But not in the casual, chaotic, or disorderly way implied by this comment. To be clearer about it, let’s say that the children did not do “whatever they wanted,” but rather that they wanted to do what they were doing. And we helped them to find the way to real autonomy and freedom. We helped them find an activity that was really going to nourish something in them, and we helped them understand that this voluntary, enthusiastic, personal, and creative approach—in cases where a child had already been disconnected from this basic biological programming—should once again become his or her natural way of functioning.

Thus the children did not just do anything any which way. On the contrary, the guided freedom that we offered them within a structured framework and with very clear and explicit rules guaranteed them the sense of security, autonomy, and order necessary to progressively reconnect with the deep vital energies within them. When the children rediscovered this natural approach, a collective harmony emerged—each child was in his or her place, and out of the flowering of each individuality a focused community began to take form, rich and incredibly “orderly.” Each child naturally found his or her place in the group and harmoniously contributed to it his or her own color and uniqueness.

The classroom resembled a happy hive, each child pursuing an objective that he or she was motivated by, at his or her own rhythm, in his or her own way, alone or with another classmate, respecting the one and only rule of collective life, which we clearly and firmly recalled when needed: *don’t ever disturb*

another person's activity in any way, whether that other person is a child or an adult.

Once they felt secure and re-centered on their confident, individual energies, the children set themselves amazing goals that a teacher never would have dared requiring of them. I remember a little boy of four who several days in a row persisted in a counting chain activity all the way up to 1,000. He began by rolling out the chain to about 200 beads. Seeing that he was continuing to count farther the following day, I had to act fast to create a mat that would allow him to count out the remaining 800 beads. The 1,000-bead chain was in fact around 23 feet long. This long narrow mat, holding the precious counting materials, remained rolled out in the classroom for several days, the time it took for the child to reach his very ambitious goal. His classmates, who were busy with their own projects, stepped over the mat when they were walking across the classroom without showing the least bother. Some of them hung around him to offer encouragement or just watch. "Is he going to make it all the way?" their looks seemed to say.

I also remember a child who was very enthusiastic about writing. This little girl rushed over to me one day holding out her writing book to me: "Look, Céline," she said timidly. This child of four and a half had spontaneously copied out the entire text of a short children's book. I never would have dreamed of asking her to perform such an exercise.

I also see again in my mind's eye little Kevin, who had just turned four and who had made up his mind to make the ten examples of origami that were presented in a book all by himself. He spent several days pretty much doing only that, and he succeeded. We are talking about a very difficult task here—I myself was unable to make some of the examples. But fortunately, the little boy very patiently showed me how to do it. He had taken the time to make a great number of mistakes and now knew exactly what direction to fold the paper in.

We will see in the third part of this book that the cognitive skills children develop when they set themselves a goal and attain it become the foundational skills of their intelligence. These skills will later allow them to learn whatever they want. For example, three children were able to begin reading spontaneously, and in a few weeks they were capable of reading any children's book they were interested in. Fully attaining this new goal had not been more complicated for them than counting to 1,000, laboriously copying out a children's book, or making ten origami forms over several days.

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At the end of the morning, around eleven o'clock, it was time for us to regroup so we could all be together. At that time we asked the children to clear away the materials they were working with and tidy up the whole classroom if necessary so they could come sit in a circle in the middle of the classroom. I would sometimes see children still so absorbed in what they were doing that they didn't hear our clear, loud calls to join the group. In such cases, we didn't interrupt their intense concentration, which without a shadow of a doubt was in the process of creating something in these children. So we formed our group a fair number of feet away from them. When they came to the end of their task, they would raise their eyes and seem to be rediscovering the world and also to be surprised to see us all sitting in a circle. They would then come and sit with us, taking a moment to come back to themselves. It is obvious that if we had insisted on forcing them to join us immediately, they would have fended off our intrusive and disrespectful intervention, and moreover, we would have hindered what was being developed within them. Once we were all together, for twenty or thirty minutes, I orchestrated short discussions on various subjects in such a way as to not bore the children and to keep their attention. I took three minutes to express my pleasure at having observed this child succeeding in holding her pair of scissors, or that child persevering at a difficult task. Most of the time, one of the children would pipe up at this point and say something like, "What I saw, Céline, is Yunes spilling water on the floor; but then he wiped it all up with Jumana, who came and helped him." This short group time, regular but never systematic, created confidence, compassion, and a strong sense of emulation. All our successes were important to us.[3]

Then the children went to have lunch at the cafeteria or at home. When they came back, the little ones took a nap. Some of the middle-level ones and the older ones did as well. As we said before, a tired child, no matter the age, has to be able to rest. Therefore when an older one showed obvious signs of fatigue, I didn't hesitate to say, "Kevin, you look tired. Would you like to lie down for a while? You can leave your activity the way it is, nobody will touch it." Most of the children were happy to accept this. Their nap might last an hour or fifteen minutes. The length of time was not important. The children rested for the length of time they needed. Since sleep is a fundamental physiological need, it was fine for everything else in class to wait. On the other hand, if there was a little one who didn't want to nap anymore—and who visibly didn't need to—she could

choose to stay in the class without napping.

Apart from the number of children, which was smaller because some of the pupils were napping, the afternoon was in no way different from the morning. The children chose their activities, and I spent time with several of them to present material individually. These presentation times were always a moment of encounter, of sharing and joy. We very often laughed, and I did not hide my enthusiasm for these special moments with the children individually or in small groups. We took great pleasure in experiencing these warm and often enjoyable times together. Then the little ones, one by one, ended their naps and came back to the rest of the class. When all the children were back in the class, we generally, but not routinely, went out to the schoolyard. It was often about three o'clock. We used these times outside to play group games with whoever wanted to play. We left it open to the others to continue to ride their bikes or play ball. At the beginning of the experiment, we went out for playtime quite often, both morning and afternoon. Then gradually, nourished by the activities of the class, the children expressed less and less need to go out. We then only went out in the afternoon—and even then some of the children complained royally, because they hadn't had time to finish their activity. These outdoor playtimes were never routine; they depended on the children and the weather. Clearly we did more outside when there was a bit of sunshine. In the Paris area, these sunny times are fairly rare, and therefore the children needed them, and we did too.

The day usually ended with another group time, during which we sang and did relaxation and meditation exercises that helped the children learn how to be present and to listen. Recent neuroscience research indicates clearly that these kinds of practices are quite helpful for developing calmness, confidence, serenity, empathy, and as a result, also altruism and compassion. So we did not deprive ourselves of that.

We have already mentioned, and I would like to recall again, that language played a very important part in the life of the class. We provided the children with a rich and continuous flow of language throughout the day, and we were very demanding with regard to vocabulary and oral expression. We did not tolerate any slang or shortened words in the class. When slang words did come out, we proposed more precise alternatives, and we asked the children to repeat them. I was really very strict on this point and I did not miss a chance to ask the children to elaborate their remarks further, explaining to them the importance of using words that clearly expressed their thought. We stopped all other activity for this if necessary. It was a matter of the highest priority for me, and the

children related to it that way. For example, when it was group time and a child was unable to express himself, the children knew I would take several minutes if necessary to overcome this difficulty, but that come what may, the child was going to come through his linguistic adventure victorious. I would provide him with the words he lacked before he became discouraged, and I would give him space to take his thought all the way to its conclusion. During this time, the other children were usually very calm and patient. They knew that I would take this kind of time for them too, and when it was not their turn they respected the time being taken for their classmate. We will see in the third part of this book what factors allowed the children to develop their amazing capacity for self-control.

During these group times, we also read lots of stories. These readings were a sort of gift, offered just as they were. I didn't stop on each page to make sure everyone was understanding. I was simply *offering* them a moment of distraction, of being steeped in language and calm. I made sure to provide a daily ration of new words that was not too big, and I tried to reuse those words in the following days. When I saw that a reading contained too much new vocabulary, I was careful to spontaneously replace certain words with others. The children did not notice this at the time. However, some of the older children, when they reread on their own tales that I had previously read to them aloud, would say to me, pointing with a finger, "But Céline, you didn't say that word before. What does 'granted' mean?"

The week would continue in the same way. It might, however, be broken up by extracurricular excursions, or presentations by outside teachers on dance, music, or theater. We didn't do traditional "motor skills." I was not comfortable with the idea of making the children put up with climbing one by one onto a beam or jumping into little hoops one after the other. And in the end, in traditional physical education, the time for individual activity is often very brief. These very regimented activities, much too "instructional," made me very uncomfortable. Children naturally exercise their physical abilities by climbing trees or hopping around in circles that they draw on the ground. In my view, they don't need obstacle courses; what they need is nature and games that are a little riskier than the ones currently played in schoolyards.[4] There are many specialists who express this view these days. Sessions meant to drill motor skills are far less beneficial to children than being free to move about in a living environment that has not been smoothed out for them by a culture that sterilizes everything. They should be able to run, climb, and fall down on a lawn without hurting themselves, without an adult telling them, "Good, now it's time to exercise your

balance; walk on this beam, and then when you get to the end, jump down into that hoop."

I would like to see us have longer recess periods for children who want them, with stilts, scooters, bikes, and so on. Those who didn't feel ready to use a scooter could skip it, and when they were ready, we could help them. We wouldn't force anybody. Did we make our ten-month-old babies do motor-skill exercises to prepare them to walk? No. We simply allowed them to be free to act, and we helped and encouraged them when they showed they were ready to take their first steps.

No doubt in a traditional class where activities that don't suit the children are imposed on them, time for motor skills becomes essential. These are times when the children can let off steam and are at least free to move around. New teachers know to what extent these times require an iron fist to contain the energy that is then set free. But in the framework of a class operating on the basis of autonomy, children no longer feel the need to suppress their energy in the class and then discharge it in recess or in motor-skills development. As a result, we also have fewer disputes and injuries occurring during recess.

STRONG SOCIAL BONDING

A journalist asked me one day if all this individual guidance did not hinder collective interaction. Since then I have often been asked this question, and it always takes me by surprise. Why aren't we asked the opposite question? Doesn't collective teaching, in which pupils are all required to do the same thing at the same time, hinder empathic social bonding by fostering comparison and competition? Just because the children are forced to do the same things at the same time doesn't necessarily mean that they are really together. No doubt they have collective interactions, but are they really connected? I don't think so. Since their individuality is not respected by this approach, the children tend to try to build it up by differentiating themselves from their classmates. They compare, they judge. By contrast, when individual bonding with the world is promoted, children feel they are being related to for what they are. They flourish, each one with his or her own individuality, and they naturally perceive that everyone evolves at his or her own pace. The question doesn't even arise of who is getting ahead and who is falling behind. Each child is who he or she is, and each one is as advanced or less advanced as he or she happens to be. This kind of diversity is fulfilling and nourishing for everybody. A child whose individuality

is respected in this way later opens up generously to others and accepts them fully, because the need to differentiate oneself in order to exist is not present. The children spend all day living with each other. Their interpersonal relationships are extremely robust and colorful, since each one has the chance to fully develop his or her own inner qualities.

When the time came for them to move on to primary school, the ten children in the class who had just spent their three years of preschool together had to be separated into different classes. Their parents were crushed at the idea of this impending separation. They had been so positively surprised by the development of their children's moral and social qualities and by the strength of their bonds with each other that they did not want to see all that disappear in a different system. I remember a meeting with a school-district supervisor at the end of the school year to prepare parents for their children's transition to "big school." For our unique class, the supervisor had made a special trip. He thought he needed to reassure the parents about their children's future progress, especially in reading. The supervisor feared only one thing: that all the parents would ask that their children be allowed to skip a grade. He started off the meeting by launching into a long discourse giving a number of arguments against the request he anticipated hearing. He went on at great length and detail assuring the parents they had no need to worry—the teachers would adapt the level of their teaching, the children would not be bored, and everything was going to be fine. One dad interrupted, declaring in no uncertain terms that he couldn't care less about all that and that the parents' request was for something quite different. They wanted their children to remain together in the same class and be able to continue with the amazing altruistic dynamic that had developed among them. This request was denied. The parents were infuriated.

The following year when their children were in primary school, according to what their parents told me, the children from our class continued to congregate during recess. In the middle of the year, one little girl from the group broke her arm. Her former classmates were the ones who came running to help bring her backpack. A few of them had the idea of going to help her with homework while she was out of school, even though they were no longer in the same class. Their bond had remained strong and their desire to help one had another remained undiminished.

So in response to the question, "Doesn't individual guidance hinder collective interaction?" I answer without the slightest shadow of a doubt—no. Only the bonding with the environment is individual. Daily life is eminently collective.

And moreover, individual guidance of children makes real human interaction possible; collective teaching, on the other hand, hinders it.

THE LIBERATED ADULT

This approach based on autonomy and individualization liberates not only the child but also the adult teacher, who has a natural tendency, as we saw above, to establish an individual, authentic, and warm rapport with the children. In the context of the traditional approach, the adult has to "hold" the class, sometimes in a coercive manner; that is, she has to keep together an entire group of children, which, in addition to being exhausting, does not at all correspond to her spontaneous inclinations—or to those of the children. This vertical and controlling style of working isn't good for anybody. If we are willing to change our approach and cooperate with the laws of nature by providing a situation based on autonomy and a mix of ages, the constraint felt by everybody slowly melts away as the children become progressively autonomous. I receive a tremendous number of emails from preschool teachers who tell this same story with a great deal of precision and feeling:

> Since September, no more guided workshops, no more rotating work groups, no more pre-programmed classes—and here's the report. At the back-to-school parent-teacher's meeting I explained our approach with the help of your scientific documents,[5] and for the first time in my career I was applauded by the parents at the end of the meeting! That was inspiring and encouraging! My fears and hesitations were immediately blown away. It's now February: four out of ten pupils in the intermediate section [four-year-olds] have learned to read, and I think two or maybe even three more are sure to have learned to read by the end of the year. Four out of ten of them understand large numbers and will certainly be able to do addition with large numbers by the end of the year. One pupil who was considered lacking in motivation last year, who the principal was worried about being depressed and apathetic, is now the most inquisitive pupil in the class. She is interested in everything: math, reading, art, and so on. She has even gotten ahead of the two pupils we considered the best ones last year. The parents' feedback is better than I could have hoped. They are happy with the

requirements of autonomy, respect for all, and inquisitiveness in their children. This has also changed my personal and professional life. I have been freed from the tension of constantly setting up workshops. I don't have to tell myself to hurry up all day long. Instead I say, "Don't worry, you can continue this later, you can start over with this tomorrow." I don't freak out anymore if a field trip, an outside visitor, or something else unexpected comes up and throws my workshop rotation off—I can relax, what a relief! A parent wants to come in and read a story in a foreign language? No problem, whenever you like. A child wants to make a presentation, a discussion is supposed to take place? Today is fine, no problem. And so on. The pride in the children's eyes has become the sap that nourishes me professionally, and I am well fed!

At the same time, at home I get much more out of being with my own children. I allow myself to play with them, enjoy them, take time to be with them, and too bad if I don't get my class plan written up until tomorrow—my relaxed brain will be there to help me do proper follow-up in the class tomorrow! My thanks goes to my classroom assistant, who followed along blindly with me and shored up my morale when I was having doubts. Before, she had wanted to change to a different school, but now she has ended up wanting to stay for another year so she can continue working with me in this new way. Thanks to my husband who thinks I'm terrific for taking this kind of approach. The pride in his eyes does me good whenever I'm having doubts. This is the first year he's stopped reproaching me for working for the school too much (even though I keep tinkering around getting together the teaching materials!).

AURELIE GOURMELON, VANVES, HAUTS-DE-SEINE

Madame Alvarez,

I am taking the liberty of stealing a few moments of your time, which I know is precious. Forgive me. But since you have blithely and deliberately caused an upheaval in my professional life, I am allowing myself to think that some feedback concerning your powerful influence might be of interest to you. Quick summary. I am thirty-six. After lengthy studies in philosophy, I spent ten years as a substitute schoolteacher. At the beginning of the 2015–16

school year, I became the proud heir to an intermediate-year preschool class in a school in Le Havre that is part of the network of priority education for the underprivileged.[6] My ten years as a substitute left me feeling rather resigned about the effects of social determinism and the ability of schools to overcome them. I have known many conscientious, compassionate, and hardworking teachers, but there was always this 30 to 40 percent of pupils who couldn't be reached. And then, two weeks after the beginning of the school year, I discovered your work, and BAM! (I still feel the shock today!) Unbelievable! The skeptic in me first thought it was a scam. This couldn't really be done. No, you mean it's real? Wow! A debate then ensued between my honesty and my intelligence, which five minutes later gave birth to the following conclusion: it would be criminal not to try to reproduce your work. And not tomorrow, but right now.

I am writing you today to express my immense gratitude to you —for all those moments of grace that I see in my class every day (and of which, sadly, I am the only witness, since I don't even have a class assistant to share them with), for the unexpected happiness that I experience every day (because it keeps multiplying by ten), for the joy on the faces of my pupils every morning when they enter the classroom.

I am rediscovering my work and am bathing, since I encountered yours, in an intellectual euphoria as powerful as a hallucinogen. Oh yes, of course, some days are spent mopping the floor, changing wet diapers, or picking up broken glass, and I have to confess I've cursed you. But that was when I didn't know what joy was waiting for me. Certainly, everything is still far from perfect (the class started with no budget), but I don't regret for a single second having put my head down and pushed forward in your tracks. For an upheaval such as this, a thank-you seems to come up a bit short. But a thousand words wouldn't be enough either. If you still have any doubt about it, your work is finding genuine echoes here and there, and thanks to you, we feel a fresh wind blowing full of promise for our preschools and which is sure to become a gale.

JULIEN MERTENS, LE HAVRE, SEINE-MARITIME

Dear Céline,

I had a very difficult year both in school (a class overloaded with thirty-one pupils in the lower and intermediate preschool levels [three- and four-year-olds], with one very problematic child bordering on psychopathic) as well as from a personal point of view because of health concerns. I had lost faith…. And then by chance, I learned all about your experiment at Gennevilliers—what a lot of happy news! As a result, I immediately overhauled my whole organization, starting in April 2016, after the vacation, because I couldn't abide waiting for the start of next school year in September to get going on this.

What a change! I pushed hard because I thought to myself that I just wasn't willing to keep wrecking the potential of these little children for another ten weeks…. They were extremely surprised by all the changes but also excited. Even the intermediates and the very difficult little boy could see the advantages of this new approach.

I admit that I'm still groping, but the atmosphere of this class of thirty-one has turned in the direction of calm and peace…. (what inner peace), a real breath of fresh air.

HÉLÈNE PEREK, DELME, MOSELLE

THE ADULT'S APPROACH

Within such an environment, the role of the adult is transformed. Her principal role is no longer to "hold" a group of children, but to create favorable conditions for learning and development, both individual and collective. She prepares and selects activities that seem to her to be nourishing and relevant. She makes sure that the children's environment is orderly and clean. She individualizes the scaffolding she provides so that she can present each child with an activity at the right level of difficulty, which has to be stimulating enough for the child but never overwhelming.

Current cognitive-science research tells us that children learn when they are presented with material that is sufficiently difficult to be motivating, but not so difficult as to be discouraging.[7] And let it be said in passing that most children naturally do exactly the appropriate thing: they choose activities that are close to

their “zone of proximal development” and very rarely go beyond it.

Individualization like this also allows the adult to attune herself to the areas of interest, the personality, and the doubts and difficulties of each child. She can follow the individual progress of the children by using follow-up charts or sheets so she can optimize the guidance she gives.[8] The moment of providing this kind of individual support is a special one in which the emotional dimension acts as a catalyst. A child who feels respected, loved, and personally considered develops confidence and self-esteem. The child then takes pleasure in doing things by himself and taking chances. First he does this under the eyes of the adult, who offers him her complete trust, and then little by little, he sets off on his own with more independence, checking back with the adult less and less.[9]

The adult becomes a facilitator, a benevolent guide, who takes the time to come down to the child’s level in order to speak to him. As Pythagoras wrote, “A man is never as big as when he is on his knees to help a child.” Nevertheless, the teacher does not hesitate to provide a strict framework for the children, one that will give them a sense of security and orientation. She will also very clearly set the rules of collective life and will teach the children to immediately stop any behavior that is not constructive. A study conducted with children of two years of age shows that the combination of compassionate support and firmness yields the best educational results. It gives children clear reference points and invites them to affirm their own autonomy. Children then manifest better personal equilibrium, good relations with those around them, and better scholastic results.[10]

The adult protects the concentration of each child, especially when the child is fully engaged in an activity. As long as a child is manifesting attentive, continuous, and caring interest in the task he is performing, something is developing in him and is manifesting in millions of synaptic connections. The adult sees to it that this inner development is not interrupted. She protects this creative brain activity, which the Hungarian psychologist Mihaly Csikszentmihalyi has called an “optimal experience state of flow.”[11] This state generates intense concentration, and most of the time, profound satisfaction.

In the midst of this compassionate scaffolding, the adult has to watch out for his or her own projections, sometimes unconscious, regarding the children—they can become self-fulfilling prophecies. A well-known study conducted by Rosenthal and Jacobson[12] shows this. At the end of the 1960s, these two researchers selected an elementary school from a socioeconomically

disadvantaged area. They had all the children take IQ tests at the beginning of the school year. They intentionally falsified the results and randomly designated 20 percent of the children as having scores greatly superior to the norm. Then they made sure that the teachers were aware of these scores but did not know they were false. At the end of the school year, the children were again given the same tests in order to measure their progress. The teachers, believing that the children from this 20 percent group had above-average abilities, had changed their attitude toward them, and these children showed significantly better progress on these final tests than their classmates. It is plain from this that our projections are creative. They have a considerable impact on our reality. They can be positive—and we then speak of the "Pygmalion effect." Or they can be negative—and we then speak of the "Golem effect." It is thus essential, to the extent possible, to maintain a solid and serene faith in every child.

It is important, if possible, for teachers to be able to follow the children in their class for several years in a row. In order to thrive, every child has a need for strong and supportive social bonds, as much with the teacher as with his or her classmates. Being able to benefit from the same class group several years in a row (even if there are minimal changes from one year to the next) permits children to create lasting bonds and to further develop their social and cognitive abilities.

FIRST ACTS OF AUTONOMY

In this environment in which children are left free to act, they have to learn to develop their independence. In guiding them through the process of this development, the adult must take care to clearly demonstrate the children's first autonomous actions for them. In our preschool class at Gennevilliers, we gave the children short and repeated demonstrations, which permitted their newly formed neural pathways to become firmly established. These demonstrations were always individual, clear, precise, logical, and indeed, silent so as not to interfere with the transmission of these first steps.

We showed the children how to put on their slippers by themselves in the morning, how to put their shoes away in the right place, how to take the materials for an activity off the shelf without spilling them and then put them away in their place, how to unroll a mat, how to walk around the classroom without disturbing the other children, how to put their chair back in place after getting up, how to speak softly, how to open a door and then close it without

slamming it after coming back from the bathroom, how to blow their noses, how to touch an adult delicately on the shoulder when the adult is busy and the child wants to speak to her, and finally, how to put their shoes on by themselves and put their slippers away in the right place at the end of the day. We really took the time to show these actions to the youngest pupils from the time they first arrived in class.[13]

We did not hesitate to do these little demonstrations as many times as necessary, or to redirect the children's errant actions with discreet, nonintrusive touches before they reached the point of discouragement. Leaving a child to get through an action like this on his own when he has reached an impasse under the pretext of not disturbing him is really a big mistake. It puts the child in great difficulty and creates a strong sense of insecurity. The child becomes discouraged and will start to push away the materials he is using.

Here's what Maria Montessori wrote:[14]

> When a child is absorbed in his "big task," the teacher should respect his concentration and not disturb him either with praise or criticism. Many teachers have understood this principle in a very superficial way. After having distributed the material, they withdraw and remain silent no matter what happens. Major disorder in their classrooms usually follows…. Once I saw a whole classroom full of disorderly children who were using all the materials wrongly. The teacher was drifting around the classroom very quietly, as silent as a sphinx. I asked her if it would not be better for the children to go run around in the garden. She then moved from one child to the next, whispering a few words in the ear of each one. "What are you doing?" I asked her. "I'm speaking softly in order not to disturb them." This teacher was making a grave error; she was afraid of disturbing their disorder instead of trying to re-establish order, which is the only thing that promotes the individual activity of the child.

A child will not reproduce our actions correctly after the first demonstration. It takes time, frequent repetition, and practice before their newly created neural connections gain strength and firmly establish these movements as automatic. Dr. Catherine Gueguen tells us, "When lived experiences are repeated, the brain connections and circuits take five or six months to become consolidated."[15] So

the keywords here are patience and letting go. If children do not immediately reproduce what you show them, just breathe out—this is completely normal. The skills we want to transmit to them—such as gently pushing their chair back or waiting their turn to talk—will not be acquired after one time, or even after two or three. Repeated experiences and observations are going to be needed. You can safely assume that the child will need these little demonstrations to be repeated a number of times. And what counts here is not the length of the presentations, but the *frequency* of them. Staying with a child and showing him the same thing for two hours will only exhaust him and will not bring about retention. On the other hand, giving him frequent demonstrations, briefly and with warmth, is what brings about retention of these actions, and the child will then be able to train in reproducing them alone, without the aid of an adult. Thus in the class at Gennevilliers, we repeated these presentations often, very often, for the small children who asked for them. For some, a single presentation was enough; for others, no.

The more advanced children who had mastered these actions took a great deal of pleasure in demonstrating them and demonstrating them again many times to the smaller children. The resulting scenes were particularly touching. I clearly recall how earnest most of the older children were when they were doing demonstrations for the younger ones. I remember their incredible patience with their little disciples who just couldn’t manage to perform a very simple action. And I also recall having seen little ones pretending not to be able to accomplish the demonstrated action just so they could keep on receiving the kindly attention of older children, who almost never seemed to realize that they were being duped. This mutual support among children of different ages was highly beneficial for learning. The children could become autonomous quicker by soliciting the aid of the twenty-five other little teachers around them who were always ready to show them the appropriate actions. An adult alone never could have managed to do so many repeated demonstrations for more than twenty-five children.

When the little ones asked for our help, say, in hanging up an apron that was hard to hang or a mat that was difficult to roll, we urged them to politely ask their more experienced classmates for help. We then sometimes had to watch as they timidly approached a bigger child and mumbled some barely audible words. In order to prevent that, we would accompany them the first few times and help them formulate their request. We made sure that the request was made politely, elegantly, and warmly: “Suleiman, could you please help me roll up my mat? I

can’t do it.” The first few times the little ones dragged their feet with embarrassment and just pointed with their finger to the object that was causing their problem. The bigger children smiled, knowing well that we were going to require a clear and explicit formulation—if, of course, the little one was capable of it. We wouldn’t insist on this if the child could not or did not want to reformulate. Time, trust, and kindness would eventually help the child to succeed.

A WELL-ORDERED SPACE

In facilitating their journey toward autonomy, it is important to make sure they can orient and locate themselves in space. Thus the adult also has the task of providing the children with an orderly environment in which space is clearly and logically organized. At Gennevilliers we thought it was a good idea to separate the different areas—for language, mathematics, geography, sensory refinement, plastic arts, and practical activities. This organization seemed to suit the children and to facilitate their understanding of their environment. Within each area, the materials for the activities were placed on low shelves in a very clearly defined space. The activities were arranged according to increasing difficulty. The beginning activities were to the left, and the more a child moved to the right, the more complex the activities she would find. Thus the level of difficulty was clearly indicated by the place of an activity on the shelf. So the children could locate themselves both in the general space of the classroom as well as within a given area. A quick glance was all that was needed for them to establish the relative difficulty of the various activities.

The next thing was to see that there was nothing unnecessary within the activities themselves. All superfluous pieces were removed. This provided clarity that allowed the children quickly to understand what task they were supposed to perform, to store the material properly once they were finished with the activity, and thus to be more autonomous. We observed that this kind of orderly and clear organization of the environment correlated directly not only with more autonomy but also with more careful and orderly behavior on the part of the children. If the children have a clean, logically arranged, and beautiful environment, they take caring for it to heart.

Order is also conducive to the development of logical thinking, memory, planning, and cognitive flexibility (which are basic skills we will speak of at greater length in the third part of this book). The children must *memorize* the

relationship between the objects and their placement, and between the objects and the actions to be accomplished with them. They *plan* their actions so as not to disturb the order, and in case disorder arises, they *reorganize* their actions in such a way as to get everything back in order.

Teachers, please don't hesitate to change the arrangement of the classroom several times, even in the course of one semester—until you finally arrive at the most logical and orderly arrangement. The first year at Gennevilliers, we moved the furniture more than ten times after the school day was over, until we finally found the organization of the space that seemed most suitable to us.[16] The rearrangements we did and the resultant behavior of the pupils the following day provided us with precious information about the suitability of particular arrangements. And rearranging yet again was never out of the question.

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We possess extremely sophisticated innate pre-wiring that provides us with a powerful learning mechanism. The best artificial intelligence engineers are still trying to imitate it. But as sophisticated as we may be from a biological point of view, the development of our intelligence is still primarily conditioned by the environment in which we are developing. If we are deprived of the world at the time when we need to be nourishing ourselves from it, our innate predispositions run into an environmental wall. Despite being programmed to learn, we end up with major cognitive and behavioral deficits.

Let's stop getting hung up on the results our children are producing. Instead let's focus on evaluating the environments in which they are developing. Is this framework sufficiently nourishing for a human mind in its peak moment of development? Does it arouse enthusiasm, energy, generosity? Does it provide appropriate scaffolding that promotes human interaction, a sense of meaningfulness, rest, kindness? Does it provide access to human culture in a concrete, comprehensive, and attractive way? Is it a place where clear, precise, and refined language is heard from morning till end of day? Is this environment to the young human being what royal jelly is to the bee larva? It is essential to pose these questions. The extraordinary plasticity of the young human brain represents great opportunity and great vulnerability at one and the same time. The child's intelligence is formed as it connects with the world. Every experience counts, positive or negative. That being the case, a social imperative emerges: we adults have the responsibility to provide conditions for the newborn

child that offer the best and avoid the worst.

In the meantime, our current educational programs are clumsily attempting to fill children up with knowledge, without really considering either the tremendous importance of the environment or the natural laws that govern the formation of their intelligence. All the same, these laws reveal to us one fundamental thing: we can't really "teach" children. Children alone can create and form their intelligence through their own experiences. We can only assist them in their work of creation. The terms "active learning" or "active-learning pedagogy" could thus not be more redundant. There is no pedagogy worthy of the name that is not active. Human beings learn through their own engaged and intrinsically motivated activity. It is on this point that our schools have been off the mark. Just as the contemporaries of Galileo, not without pain, had to revise their conception of astronomy and finally accept the upsetting truth of the heliocentric system, today we have to revise the totality of our educational models on the basis of the truths that have come to light about children. And this is urgent. Because at the moment, in these museums of an outlook inherited from another era—from which era we're not sure—generations of extremely talented children, starved for experience and knowledge, are wilting from boredom in classrooms that are too small, while looking at the real world out the window and dreaming of the complex, vibrant, and dynamic explorations in which they could be engaged.

PART TWO

HOW TO TEACH

Because of the powerful plasticity of their intelligence, young children can acquire a large amount of information through the channel of their senses. Thus it is very helpful to present them with activities that allow them to refine their capacity for sensory perception—so that they can *see better, smell better, hear better, taste better, and perceive better by means of touch,* but also so that they can *name* what they perceive: the colors and the subtle differences between them; different dimensions (thick/thin, long/short, little/big); textures (rough/smooth, silky, soft); sounds (low/high, musical notes); smells; various tastes.

To do this in our class, we used sensory material, some of which was devised by the French doctor Jean Itard. This material was later adopted and developed further by his disciple Édouard Séguin, and then expanded upon by Dr. Maria Montessori. “The red rods were invented more than a hundred and fifty years ago,” Dr. Montessori tells us in a lecture in London from 1946,[1] “a hundred years before I began my work.” She continues, “The pink tower was also used as a cognitive test forty years before I began my experiments…. I did not invent these exercises myself; I took those that existed already and tested them on young children. I discovered that they utilized the material with great attention and for long periods of time.”[2]

Because of its great simplicity and because of their attractive colors and dimensions, this sensory material holds the attention of children and engages them in a highly constructive activity. Nevertheless, it is highly likely that other activities have similar qualities. So it is up to each teacher to select the materials that seem to bring together the appropriate qualities, arouse children’s interest, and facilitate their comprehension of the world. In case you are attracted to using, among others, the teaching materials presented briefly here,[3] it is important to make use of this inherited material in the same way as Maria Montessori did, not as a final goal in itself, but as a very interesting point of

departure that we should feel absolutely free to adapt to our times and the child we are working with. The material is only a means. What really counts is the child, her personality, her rhythms, her needs.

During this period when the brain is highly impressionable, it also seems important to provide children with the opportunity to *refine their cultural knowledge* in areas such as geography, music, geometry, mathematics, reading, and writing. The children already have inklings about these things, which they have developed by being with us. In the class, we presented activities related to reading and writing, mathematics, music, and geography. I also made the decision to make use of the material and the activities developed over several decades by Jean Itard, Édouard Séguin, and Maria Montessori. These activities have the qualities necessary to effectively hold and focus children's attention and enable them to make clear, concrete progress. At the same time these activities are ambitious and stimulating.

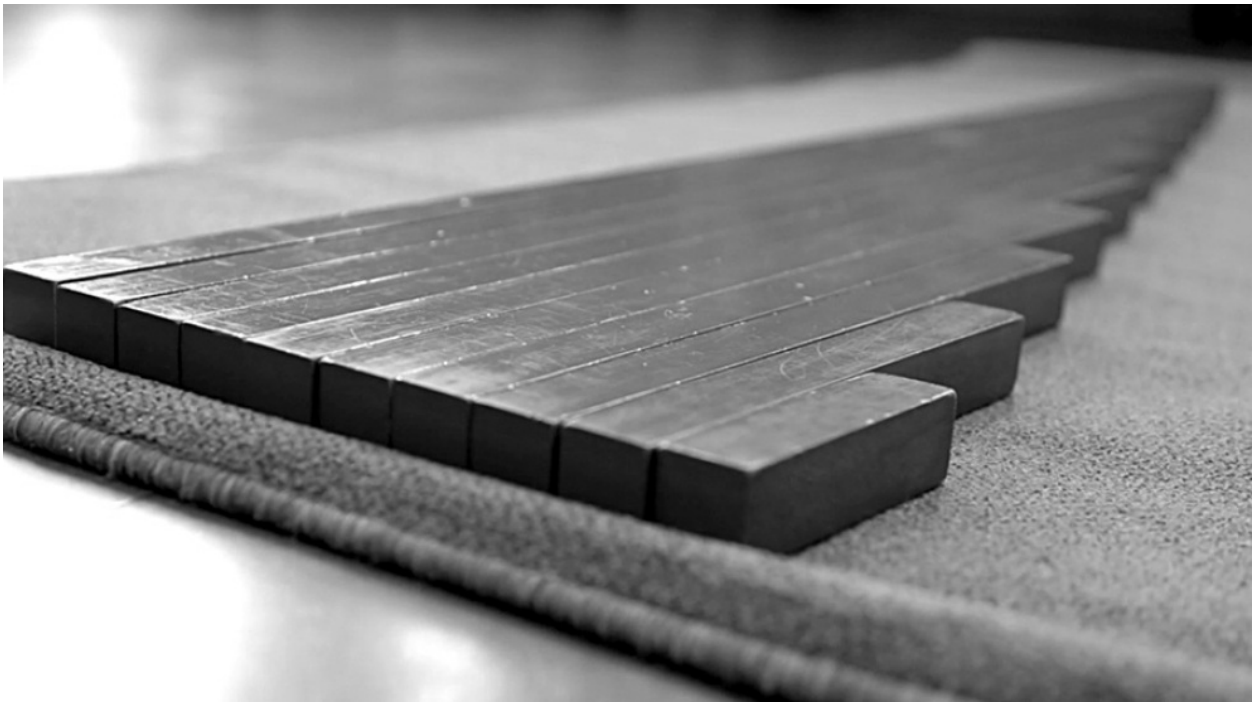
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Refining Sensory Perceptions

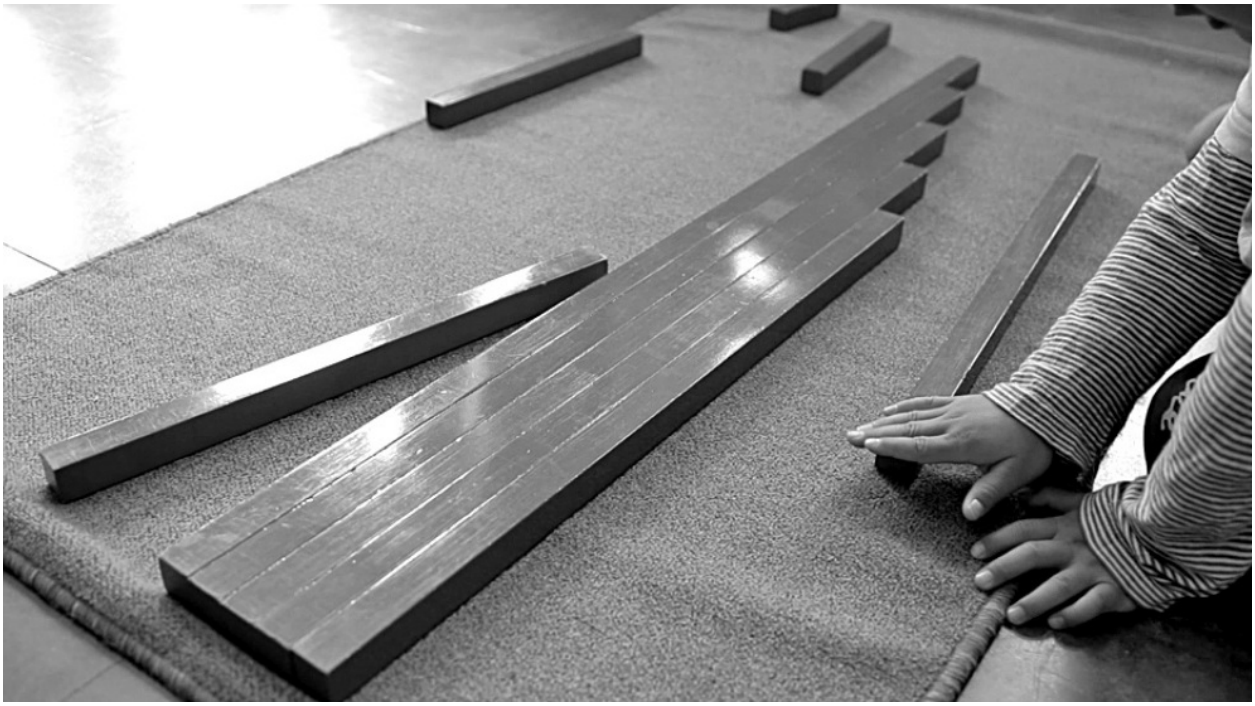
The sensory materials I chose to use have the immense advantage that each activity isolates a single quality to be explored.

Take, for example, the material that enables children to study and discriminate differences in length—the red rods. These are wooden rods of different lengths. The shortest is ten centimeters in length, and the longest is a meter long. All the rods are painted the same color—red—and are not distinct from each other in surface texture. The only parameter that varies is the length of the rods. Thus the attention of the child is attracted and focused on differences in length and is not distracted by any other sensory variations.

Similarly, the material designed for teaching colors draws the attention of the child solely to the variation in colors. The color tablets present no differences in form or texture; only the color of the tablets varies. The eight bells of the C scale —each of which sounds one of the notes *do, re, mi, fa, sol, la, ti, do*—are conceived according to the same principle: all the bells are similar in appearance, and only the sound produced by each one varies.



The red rods focus the child’s attention on differences in length.



A child of three reconstructs the sequence of the rods from the longest to the shortest. She is exercising her ability to differentiate dimensions without distraction or dual-tasking.

Thus one single quality at a time is highlighted in most of the activities of

sensory refinement. This cognitive clarity is essential, because as we know today, the brain cannot deal with two pieces of information at the same time. If several items of information reach it at the same time, the brain considers them one after the other, and thus the treatment of the data is slowed down—even distorted. The cognitive clarity of these materials, which excludes distractions and dual tasks, is one of the conditions that enables an optimal learning experience.[1] Thus this principle is an essential guide to our choice of materials and activities.

PAIRING AND GRADING

In order to refine their perceptive abilities—that is, so that that they can see better, smell better, hear better, and touch better—children are invited to exercise their senses in two ways:

- They can do *gradations*, as was done with the red rods. With the material for work with colors, children choose one color (blue, for example) and classify its different shades from dark to bright. These gradations enable children to achieve a great deal of precision and subtlety in their visual sense and to see the external world better.
- When the material permits, the child is first invited to perform *pairing* before grading. In pairing, the child regroups elements having the same quality two by two. This exercise is an initial way for the child to hone and refine her perceptive abilities before going on to practice grading, which requires a greater capacity for discrimination. Pairing can be done, for example, with color tablets. The child is encouraged to match the tablets of the three primary colors (blue, red, yellow) two by two, then those of the other colors (orange, green, violet, brown, gray, black, white, pink), and then finally the tablets with sixty-three shades derived from nine different colors. Thus the child has 126 tablets and must make matching pairs of sixty-three color shades.[2]



A child of three does pairing with the second color box.

NAMING PERCEPTIONS WITH THE THREE-PERIOD LESSON

When activities entailed new vocabulary for the children, as was the case with colors, we presented this vocabulary in a rather formal manner, making use of the “three-period lesson” of Édouard Séguin. All teachers should be familiar with these three periods, because they enable a child to memorize two or three new words in an exceptionally effective manner. Let’s take the example of the colors:

1. The first period, or phase, consists in *naming*. The teacher names the colors as she points to them with her finger and has the child repeat after her. We say “red,” pointing to that color, and the child repeats “red.” Then we name “blue,” pointing our finger at it, and we wait for the child to repeat “blue.” We carry on in the same way with “yellow.” We go through the process several times with the three colors, keeping it short in order not to tire the child.

2. The second period consists in *showing*. We ask the child, “Show me the yellow.” He then points his finger at the yellow. “Yes, that’s yellow,” we say, confirming the name of the color. Then we ask him to show us the

other colors as we name them one after the other, always in a brief and fun way. At this stage, the child already begins to associate a name with an object or a concept, without yet being able to name it himself. This second stage needs to be longer than the others in order to give the children a chance to memorize the vocabulary well.

3. Finally, we have the third period, which consists of *identifying.* Pointing to the red tablet, we ask the child, “What is that?” If the previous two periods have been exciting enough, he will answer energetically (and sometimes quite loud), “It’s red!” We continue with the two other colors, and we go on with this third period until the new vocabulary seems to have been learned—making sure to keep changing the placement of the tablets on the table (which the children find quite entertaining).

As a continuation of the three periods, we played a little game the children loved. We asked one of them to close her eyes, and we hid one of the three tablets behind our back. We then invited the child to open her eyes, and we asked, “What am I hiding?” After a moment of concentration, sometimes an intense one, she replied, her face lit up with mischief, “Red! You’re hiding the red one!” Later, we presented three other colors to the child, asking her first to name the ones she knew. Sometimes, she recalled only two of the three from the previous day’s three-period lesson. We then had to present the color she had forgotten again, along with two new ones.

The children spontaneously picked up on these little hiding games and played them with their classmates. This very often had the result that they learned the colors from each other without our having to subject them to learning them from us in a formal way. I recall seeing a child playing this game who did not know the names of the colors. She closed her eyes, and one of her classmates picked up one of the color tablets from the table and hid it behind his back. The first child, reopening her eyes, knew which color was missing and began trying to name it; but she couldn’t. Frustrated, she asked her classmate, “What’s the name of that color you’ve got behind your back?” As soon as she got the answer from her classmate, she took possession of the word, and said, “Green! You took the green one!”

Occasionally I would bring the primary colors along to our group circle[3] and present the tablets to the children one by one and ask them to name them. This exchange was always kept short, but I made a point of doing it regularly, and I

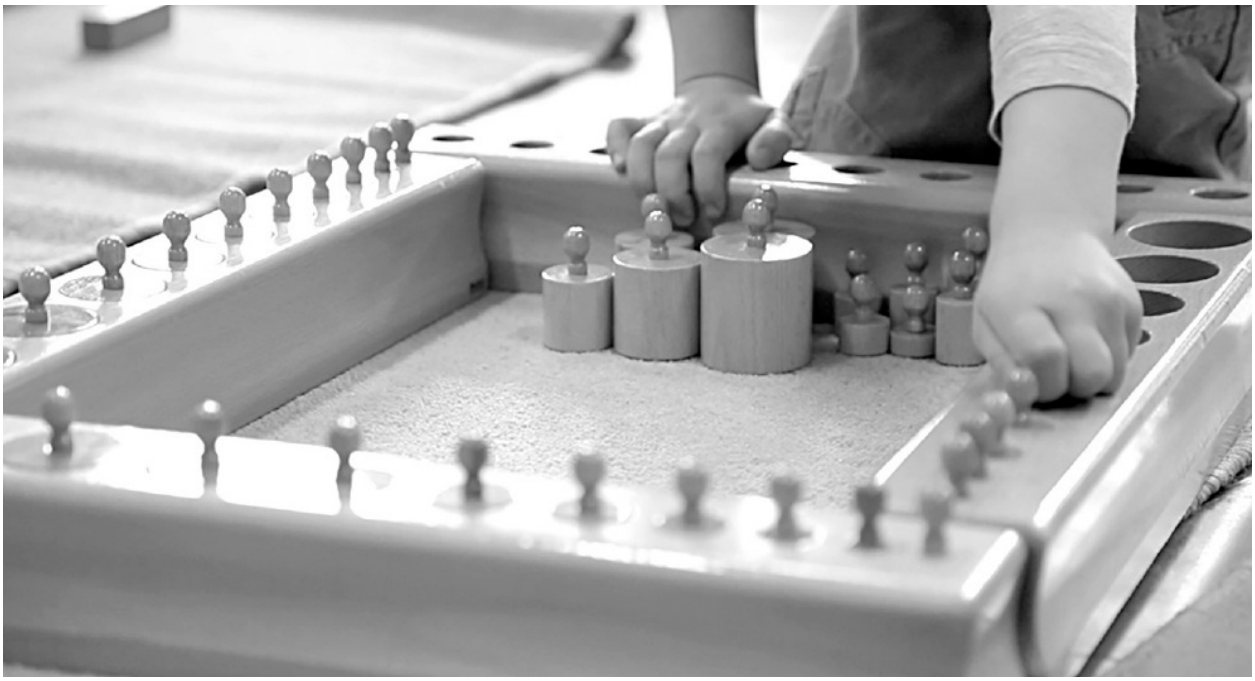
would clearly say, “Children, I really want you to know the names of all the colors—it’s important.” They took that very seriously. My emphasizing the importance of something in that way helped them to learn faster. In particular, the tone of voice I used, encouraging but very serious, was an *ostensible social cue* that focused the attention of the children on particular material and alerted them to its importance. This in turn made it possible for them to remember it. We saw in the first part of this book that without these kinds of clear social cues (voice, gaze, pointing), children can totally miss obvious elements in their environment that it is important for them to learn about.[4] By contrast, with this kind of explicit emphasis, which I took care to use with the children, they were able to retain important things very effectively. Of course I did not give these kinds of emphatic signals at every group session so as not to risk diluting the impact of my directions and losing the children’s attention. I therefore chose the content that was really important to highlight for this group of children—and sometimes waited several weeks for that content to be well assimilated before directing their attention to new material.

SEEING BETTER

We provided the children with various activities to help them perceive the world with greater refinement through their visual sense. The color material as well as the red rods were part of this category. But for the refinement of the visual sense, the first activity we presented to the children (age two and a half to three) was the *cylinder blocks,* because they provided automatic error control, which helped the children develop stronger attention as well as a more precise visual sense. Thus we used those before other activities like the red rods, which did not provide such clear error control.

Four blocks of cylinders were made available, each with ten cylinders whose heights and diameters were graduated in constant fashion from one to the next. The task for the child, once she has taken the cylinders out of their holes, is to get the right cylinders fitted back into the right holes. This activity enables young children to develop their perception of dimensions—height and breadth—in a very precise way and thus to *see* the world around them better. Their eye becomes more refined. We presented only one block of cylinders to the children, gently taking the cylinders out of the block in front of them. We then mixed them up on the table and asked the children to replace them. With time, when they had succeeded with just one block, we invited them to work with two

blocks of cylinders at the same time. They then had to match twenty cylinders with twenty different holes. This is a very difficult activity for a child of three. Later, they would work with three blocks of cylinders at the same time and would have to perform the activity with thirty cylinders and thirty holes. Finally, around the age of four, we had them spontaneously perform this activity with four blocks of cylinders. They then had to work with forty different cylinders and holes.



A child of four uses four sets of cylindrical blocks.

Some four-year-olds get easily discouraged by the sheer magnitude of this task, but with a little bit of help and encouragement, they gain confidence, and in the end they are full of pride as they put the last cylinder in place. This activity is quite subtle, because the variations between some of the cylinders are quite small. I regularly found myself mistakenly trying to put the wrong cylinder in the wrong hole when I was putting this material away. I had to concentrate a bit; this job with the cylinders could not be done automatically. Thus the difficulty of it was a challenge even for children of five.

However, I remember one little boy of three who right from the beginning set himself the very ambitious goal of performing this activity with three or four blocks of cylinders, even before he was able to do it with just one. He would set out two or three blocks on his mat at the same time. I often told him, “You know,

I think you would be better off beginning with just one block, and when you can do it with that one, you can take a second." Then, with the little boy helplessly looking on, I would put two or three blocks back on the shelf and leave him just one. Hardly would I turn my back before he would go back and retrieve the blocks I had just put away. Anna, who had observed this choreography being repeated a number of times over a couple of days, suggested that I not intervene. I was really convinced that the challenge the little boy had set himself was much too ambitious and that to leave him with that level of difficulty wouldn't help him. I was completely wrong. Not wanting to get into a quarrel with the child and encouraged by Anna, I decided to let him be, just asking him to make sure that all the cylinders stayed on his mat. So the little boy went on with his work—continually the same thing—every morning for the next three weeks. And indeed, he was getting better at it. Then one morning, I saw him take all four blocks, take all forty cylinders out of holes, mix them up, and then, one after the other, confidently and with little hesitation, put them all back in place. I had never seen a child that young accomplish this feat! I say again, it is a difficult and very subtle exercise.

This story reminds me of two things: First, we must take care to remain very humble and to respect the goals that children set for themselves—even if they seem totally exaggerated to us. When a child insists that much, it is important to allow him to pursue his ambition to the end. The second thing is that the activities we habitually propose to the young children in preschool—inviting them to put together a few pieces of a puzzle or put a few rings over a peg—dramatically underestimate their intelligence.

As I said earlier, this particular exercise for the eye possesses the great advantage of automatic error control. If the child picks a hole that is too wide for the diameter of the cylinder, he will see that it does not fit well and will try another hole. If he doesn't notice this mistake right away, he will notice at the end when all he has left in his hands is a cylinder that is too wide for the remaining hole. This will certainly make him frown, but with a little perseverance, he will find the solution by himself. Thanks to this built-in error control, the child can readjust his erroneous predictions and repeat his activity until he masters it perfectly, without the help of an adult.

Later on, when the child has refined his visual discrimination skills, he will be able to use the sets of cylinders without the blocks they fit into. At that point the child will be able to perceive his mistakes by himself, through his own observation. Children love this activity.

The three following materials—the pink tower, the brown stairs, and the red rods—invite children to perform a gradation that is rather subtle for their young eye, and more and more complicated. Error control, with these activities, is visual. Children, through practice, will progressively perceive their own mistakes. That is one main reason that these three materials are large in size—that way, the differences between elements are easier to see.



Anna shows a child how to perform the gradation of one of four series of cylinders. The child can do it this way, horizontally, or vertically, in the form of a tower.

The pink tower is simple to work with, since all sides of the cubes vary in size. Thus, though the size differences between the cubes are minimal, they are easy to make out.

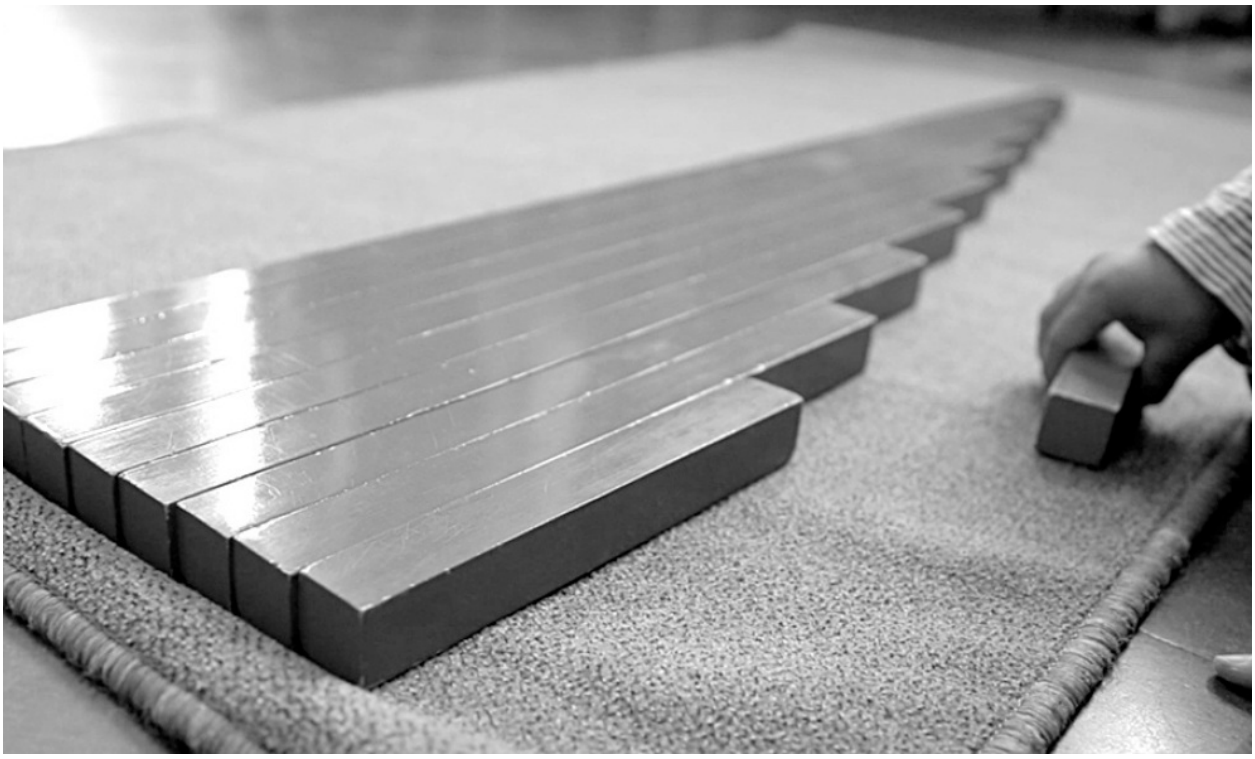


A child of three grades the cubes in the pink tower.

The brown staircase is a little more difficult to work with because one side of all the blocks that make up the staircase is the same, the length. The children have more difficulty discerning the differences between the blocks, since they vary only in the two dimensions of height and width.



The gradation of the ten prisms forms the brown staircase.



A child performs the gradation of the ten rods.

Finally, the gradation of the red rods represents a high level of difficulty for the children, because two sides of the blocks do not vary (width and thickness). Only their lengths vary. As surprising as that might seem, children really have a lot of trouble performing this third activity, where there is only one dimension that varies.

In speaking to the children about these teaching materials, we always made sure to use precise nouns and adjectives: *block, cube, rod, long, short, wide, narrow, high, low,* and so on. This, as I mentioned several times in the first part of the book, is a general rule that we applied to all the activities and discussions we participated in with the children. Objects and different concepts were named as precisely and properly as possible. The children loved this. The “erudite” vocabulary seemed to satisfy their profound desire to communicate and to name the world with precision.

HEARING BETTER

We also worked with the children on refining their auditory perceptions. We did this initially with the help of sound boxes that provided two identical series of

different sounds (inside the boxes were very fine sand, little pebbles, or different kinds of seeds). The children had to discover the similar “hidden” sounds in each of the two series and pair them. After that they could use just one series of boxes (the red or the blue) and grade them from the loudest to the softest sound or in the opposite order.



A child of three pairs sound boxes by ear.

The children could then hone their auditory perceptions with two series of bells, each one sounding the C scale (*do, re, mi, fa, sol, la, ti, do*). The children mixed up all the bells of the two series (so they had two C scales, with two each of the eight notes of the scale). Then they found the bells that matched and put them together (the *re*s together, the *mi*s together, etc.). At the same time—and the children loved this—they could mix the eight bells of one series on a mat and put them in the right order to perform the famous *do*, re, mi, fa, sol, la, ti, do. Thus they had accomplished a gradation of sound from the lowest pitch to the highest.

BETTER PERCEPTION THROUGH TOUCH

The children also exercised their tactile perceptions. With the help of samples of fabric gathered in a box, children who had been asked to blindfold themselves had to discover the similar pairs of cloth by means of touch among all the

swatches of cloth spread over a mat. The children loved this activity, which they often did in pairs. One child would spread out the bits of cloth while his classmate, blindfolded, then tried to match the similar ones. Of course we gave them the names of each pair of fabrics: silk, cotton, linen, tulle, Lycra, baize, and so on. The same activity could be done with tablets made of different materials. With a blindfold over their eyes, the children were asked to pair identical tablets by touch (which had been previously mixed up by a classmate). The name of each material was also given: metal, cork, glass, clay, felt, wood.



A child of four pairs bells by ear. He puts together the two ***do***s, the two ***re***s, the two ***mi***s, and so on, not necessarily starting with the ***do***s. The important thing at this stage is for them to hear and recognize the same pitches.

IMPROVING SMELLING AND TASTING

We also gave the children the opportunity to hone their perception of taste and smell, but in a very vivid manner, by regularly having the children test tastes and odors during our group time. For example, I brought some lavender and had the children smell it. I took care to name it and asked the children if they had ever smelled an odor like it. Then we left the lavender in the classroom, near other scent-bearing items we had brought in previously. The children could smell them at any time during the day. A little entertaining game we could play as a group consisted in asking a child to close her eyes, then having her smell some of the odor-bearing items kept in the class. We then invited her to name them if she

recognized them.

CHILDREN REFINE THEIR SENSES BY EXERCISING THEM

Most three-year-old children will not immediately be able to perform a correct gradation of cubes, blocks, or rods, nor will they be able to pair sounds, textures, or identical colors. They will refine their perceptive skills progressively by exercising them and observing their classmates doing so. Thus we will initially see glaring errors on the part of the children, and that is completely normal. Some children might be able to notice that they are making a mistake if we point their error in perception out to them, but with others, no matter how much we point it out to them, they will not be able to see it and will look back at us uncomprehendingly, but completely satisfied with themselves. Their capacity for discrimination has not yet developed. Only through regular exercise will they be able to see what they couldn't see before. The glaring error that they did not perceive a few days earlier will then immediately bother them.

These activities seek to exercise children's discrimination. The goal is not to get them to succeed immediately in pairing or grading; on the contrary, the idea is to propose an activity to them that is hard enough so that they can train their discrimination skills. When a child immediately succeeds in performing one of these activities without making any mistakes, the difficulty level is no longer high enough. She will not be able to further refine her sensory skills. In this case, another activity with a higher difficulty level should be proposed to her.

Most of the sensory exercises we have referred to—the pink tower, the brown stair, red rods, color boxes, fabrics, and so on—are more difficult than the cylinder blocks, because they do not provide automatic error control. With them, it is the child, by means of his trained eye, ear, or touch, who will progressively become aware of his errors.

REFINING PERCEPTION AND REDISCOVERING THE WORLD

By suggesting that children refine and name their sensory perceptions, these materials enable children to see the world better. I remember a little Berber boy who did not speak French when he started the class. I used the color material to make it possible for him quickly to learn the names of the primary colors—red,

yellow, blue. He then became very enthusiastic about the subject. He kept asking me, “What color is that?” pointing to my blouse, even though I was talking to him about something else. It was equally common for him to stop dead in the middle of a conversation and cry out when noticing an object: “That’s red! Céline, that’s red!” He learned the colors in no time at all. The older children helped him a lot by being willing to show them to him—his demands were very insistent and persuasive—and to repeat the names of them numerous times. This child was speaking French before we knew it.

By using these means to refine the senses, which are the intermediaries between children and the world, we make it possible for them also to refine their intelligence and their understanding of the world.

The material presented here can definitely be replaced by other kinds of materials or activities that also offer children the opportunity to hone and clarify their sensory perceptions and to name them. Therefore, I invite you to explore existing possibilities and not confine yourself to these specific materials. The important thing is to select materials that seem to you to be applicable, clear, and likely to hold the children’s attention. You should trust yourself completely and choose your materials freely, always being guided in your choices by the concentration and interest a given activity arouses in the children.

THESE ACTIVITIES ARE ONLY COMPLEMENTARY

These materials and activities are only a complement to the richness and variety of real life. Walking in the sand, walking on a rug, touching a piece of wood, painting, modeling with clay, playing in the water, gathering small pieces of wood to help build a fire (and thus comparing the lengths of the pieces and only taking the thinnest and smallest, for example), making a fruit salad and naming all the beautiful colors, listening to the birds singing in the forest and trying to recognize them, gathering dead leaves in the fall and examining them, smelling the coriander or roses in the garden, being alive, alive, alive and fully present to this world. All these very simple and natural sensory experiences are what nourish the plastic intelligence of the child in the peak stage of development, and that is what is irreplaceable. The teaching material does not provide *content* for children; it provides *order* for the content. It allows them to organize and name certain impressions that the world has already brought them. Thus the essential aspect of children’s sensory refinement takes place outside of school activities. The work of teaching here is to promote life, and to propose, by way of a

complement, activities that make it possible for children to order and assimilate the sensory information they receive from them.

5

Offering Culture Step-by-Step in a Clear, Sensory Way

The material I will now briefly present, which is also derived from the work of Itard, Séguin, and Montessori, brings to light, in a concrete and evident way, abstract conceptual content that is often difficult to transmit to children: geometry, geography, music, mathematics, and the alphabetic code. In this chapter we will deal with the first three areas mentioned; and in order to give more space to developing the last two—mathematics and language—I will devote chapters 6 (mathematics) and 7 (language) to them.

The cultural material presented here once again possesses the immense advantage of respecting the way the human brain works by never proposing dual-tasking. Thus the brain, which is incapable of doing two things at the same time, never has two goals to achieve or two elements to remember at the same time. The material for sensory refinement that I have just briefly presented to you in each case isolates a single *quality* to explore and thus only proposes a single element of *knowledge* to be assimilated. Once that knowledge has been acquired, another element of knowledge is added with the next material presented.

GEOGRAPHY

We introduced the children to the major geographic reference points: planet, land, water, continents, oceans, countries. We showed these different concepts

initially using two globes.



On the left is the first globe we presented to the children; on the right, the second.

We began with the first globe. After having told a child of three that the globe represented our planet, we drew her attention to two principal elements: “On the planet there are two things: there is water and there is land.” We helped her get a grip on this new vocabulary (land and water) using the three-period lesson of Séguin. We then let the child explore the globe, the shapes of the land parts painted beige, the shapes of the oceans blue; we had her turn the globe and continue doing it as long as she wanted. One day, a young child said to me after having looked at the globe for a long time by herself, “But, Céline, there’s really a lot of water on the planet!” I answered, “Yes, that’s why we call it the blue planet.” And she began to reflect deeply. Her neural connections must have been ticking along at a great rate. This material is so perfectly clear—you just have to present it to a child to enable her to get started on a fruitful exploration.

The following day or the day after, we went back to this first globe to make sure that the child remembered properly what had been presented to her. To find out if she could without difficulty identify the parts of the globe representing water and land, we showed her the other globe on which the continents were represented in different colors. “You see, there’s still water and there’s still land.

But look, we humans have separated the land up into different continents: one continent … another continent," I said, pointing to them. "Another continent, and still another continent. Can you say that? Continent?" "Continent," the child replied, totally absorbed. "We humans have also separated the water up into different oceans: an ocean, an ocean, an ocean . .," I said, pointing to the different oceans with my finger. "Can you say that? Ocean?" "Ocean!" the child replied happily. Then we did a three-period lesson to firmly set this new vocabulary. Then the child had the opportunity to explore and contemplate the different continents and their separation for as long as she wanted.

Later in the week we returned to this second globe and checked to see if the child still had her new vocabulary memorized. I pointed to a continent and asked, "What is that?" "A continent," the child loudly declared. I then set the globe down on a mat and I added to it a puzzle representing the planet, but this time in a flat form. This is what is called a planisphere puzzle, a flat sphere. I explained that simply: "Look. It's a planisphere. It's the planet, but it's been flattened out so you can see all the continents at the same time. You recognize them? Can you show me a continent on the planisphere? An ocean?" And the child pointed to them and named them in turn. At this stage, she had already perceived these very abstract concepts sensorially. She knew that a planisphere is a flat representation of the planet, and that this is composed of pieces of land separated into continents and of a lot of water that are called oceans. She was then invited to do the continents puzzle.



A few three-year-olds watch a classmate do the continents puzzle.

The first year, all this vocabulary—continents, oceans, planet, globe, planisphere—was new for the whole class, so it was necessary to introduce it by repeating it often and regularly inviting the children to repeat it. However, by the following year, the older children had assimilated it and used it often. Because of this, it was easily learned by the newly arriving younger children. I even had the experience of presenting the first globe to a younger child, who, almost offended, said to me, “Why are you showing me that, Céline? Jumana already showed it to me. Look, that’s land, that’s water.” I nevertheless took the time to make sure the child had understood what the representation was all about. “But you know what that is?” I asked her, pointing at the planet. “Sure I do! That’s the planet. That’s where we live! And I live there!” she said, pointing to an island in the Pacific. “Not exactly,” I replied, smiling and looking at Anna—who was laughing—out of the corner of my eye. “If you like, I can show you what piece of land you live on.” I then drew her attention to the second globe. I presented the idea of continent to her in the same way I explained above. And when she had repeated and retained the word “continent,” I took care to explain to her that we lived on the continent represented in red. Her eyes glowed with happiness.



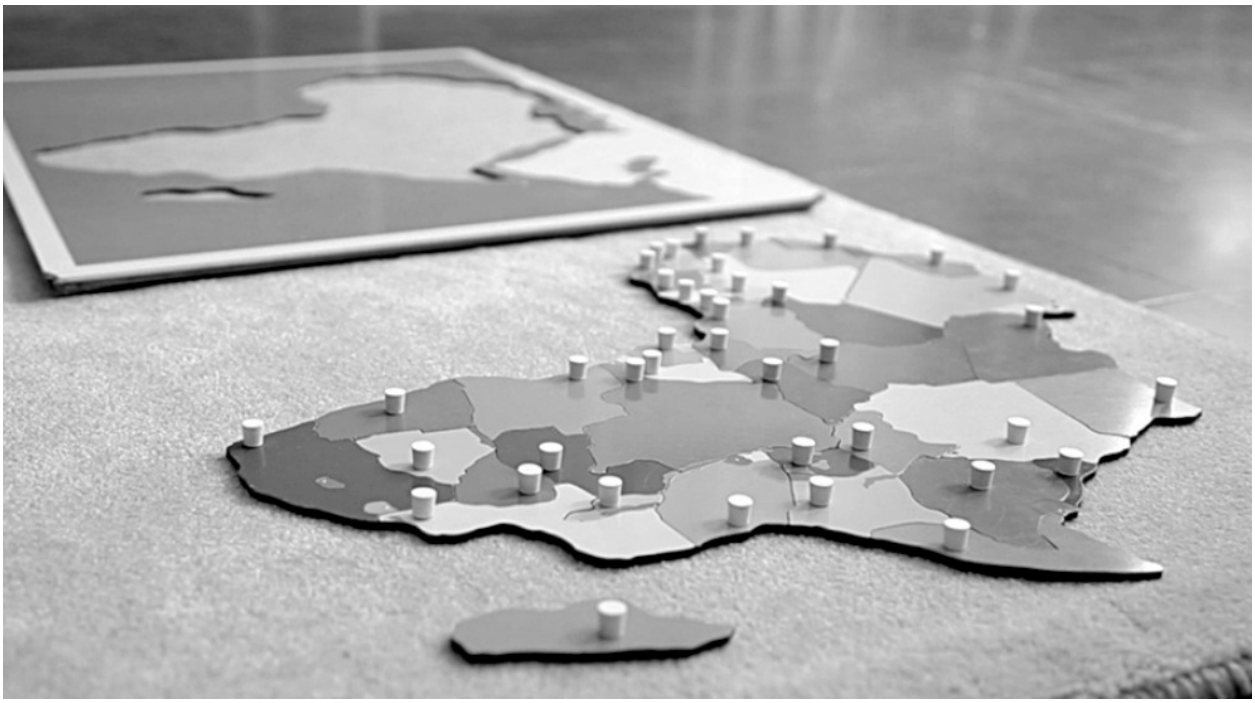
To satisfy the children's urgent desire to know more about the animals, we regularly changed them: lion, African elephant, Asian elephant, koala, and so on.

The children could then associate animals with the continents that were representative of each of them. We presented animals to them in small groups; we talked about their characteristics and associated them with their continent. From the point of view of richness of vocabulary, this little game was far from useless. Very few children in the class at the age of three knew the names of all the animals. Panda, giraffe, squirrel, polar bear, kangaroo, and parakeet were all completely new words.

When a child had done enough work with the continents in the planisphere puzzle, generally after one or two weeks, we would give him the *names* of the continents: Europe, Africa, North America, South America, Asia, Antarctica, and Australia. Here we again used the three-period lesson of Séguin. The names of the continents were presented three at a time, and it took several days for the children to memorize them all.

After a few three-period lessons spread out over several days, when the names had been well memorized, we presented the puzzles of the various continents. Each continent had its own puzzle. The countries in each continent were pieces that could be taken out and replaced. We explained to the children that the

continents are divided into smaller pieces of land called “countries.” Little by little, we gave the children the names of the countries—always with a three-period lesson—beginning with the ones they were already familiar with: France, Morocco, Algeria, Senegal, China, Spain, and so on.



The children could do the puzzle of the different countries in a continent either inside or outside the supporting frame. They could use a photo of the completed puzzle to help with the placement of the countries.

At this stage, the children were about four years old and already knew how to read a few words, so they could read the names of the countries on the control map and learn them by themselves. Thus by the time they were five, they already had a clear mental image of what the planet might be like, with its continents, oceans, and countries. I remember a mother during the first year who came to see me after class. “My son talks to me about Togo, Benin, and he says these are countries in Africa; and he talks to me about South America and North America, and he says there are parakeets in South America and lots of bears in North America. He tells me that he learned all that here, but I don’t believe him. But since he insists and I can’t figure out where he could have learned those things, I came to ask you.” I took the time to show this mother the whole process I have just explained to you. She was very moved to learn that her son hadn’t invented anything and already knew all that. She told me, “That’s incredible! He’s only

four years old.”

What is incredible from my point of view is that all children four years of age do not have the chance to be exposed to such clear and simple geographical representations. When we visit a new place—a house, for example—someone will give us a tour of the premises so we will know our way around while we are there. Why not provide young children—who passionately ask for it—a clear representation of the planet on which they live and breathe?

In our classroom, anytime was a good time to head over to the geography area and get out one of the continent puzzles or the planisphere. Every time they came back to school after a vacation, the children wanted to see the continent and country they had traveled to. “Oh, Portugal, that’s in Europe. I went to Europe!” one of them said. “But you are already in Europe, look. France and Portugal are on the same continent.” “Oh,” the first one disappointedly replied. Another one was surprised that he had changed continents by going to Algeria. He didn’t realize he had crossed the sea in the airplane. But everybody was fascinated by young Lucas, whose mother was Japanese and who had spent the summer in Japan. He was the only one to have gone that far.

We see here once again that the cultural material only supports and complements the real, living experience of the children. It is at those times when it comes as a complement to their actual experiences that it really takes on its full significance. Used in a purely didactic manner, without any relationship to a living context, as esthetically pleasing as they might be, the materials are only faintly interesting to these young children.

GEOMETRY

All around us, everything is geometrical, including buildings and most objects. Connecting with, exploring, and naming all the forms children perceive is a fresh occasion for them to observe the world more precisely. In showing them the most common plane and solid geometrical forms, we once again proceeded in a simple and concrete manner.

With the help of the blue geometric solids, the children could manipulate and explore with their senses the cube, the ovoid, the ellipsoid, the block, the square pyramid, the triangular pyramid, and the cylinder. They very quickly learned these names over several three-period lessons, and they were particularly fond of the most complicated words, like ellipsoid, ovoid, square pyramid, and triangular

pyramid. Saying these words made their eyes shine triumphantly.

Once these names had been learned, the children enjoyed playing in pairs plunging their hands into the bags containing the miniature solids. Each child would hang a bag around his neck, and with his hands deep in this treasure trove, they waited for a third classmate to proclaim, for example, “The first one to find a block wins!” They then dug around in their bags as fast as they could until one of them came up with the block and brandished it victoriously.



The geometric solids.

At the same time, with the help of the geometry cabinet with its various drawers, the little ones, starting at age three, could manipulate all kinds of plane figures. One drawer offered different sizes of disks and rectangles; another drawer, various types of triangles; another offered quadrilaterals (trapezoids, parallelograms, rhombuses); another, polygons (pentagons, hexagons, heptagons, octogons, enneagons, decagons); and finally a last drawer presented all kinds of simple and regular forms well known in geometry. The children could take the drawer they wanted, take the forms and their supporting frames out onto a mat, and take the forms out of the frame and put them back. Little by little, we also gave them the names of these forms, using a number of Séguin three-period lessons.

Once again, what is of value in these activities is that the children understand that the classroom material enables them to achieve a more precise, more refined, and more expert rereading of the external world. This realization often happens suddenly, as if a little light had gone on over their heads. They realize that the windows are rectangular, that chicken eggs have an ovoid form, or that the legs of chairs—this was the 1960s style of chairs—formed a trapezoid. We obviously helped them to realize these little details by drawing their attention to them. However, to their even greater joy, a few of the children made this discovery by themselves.



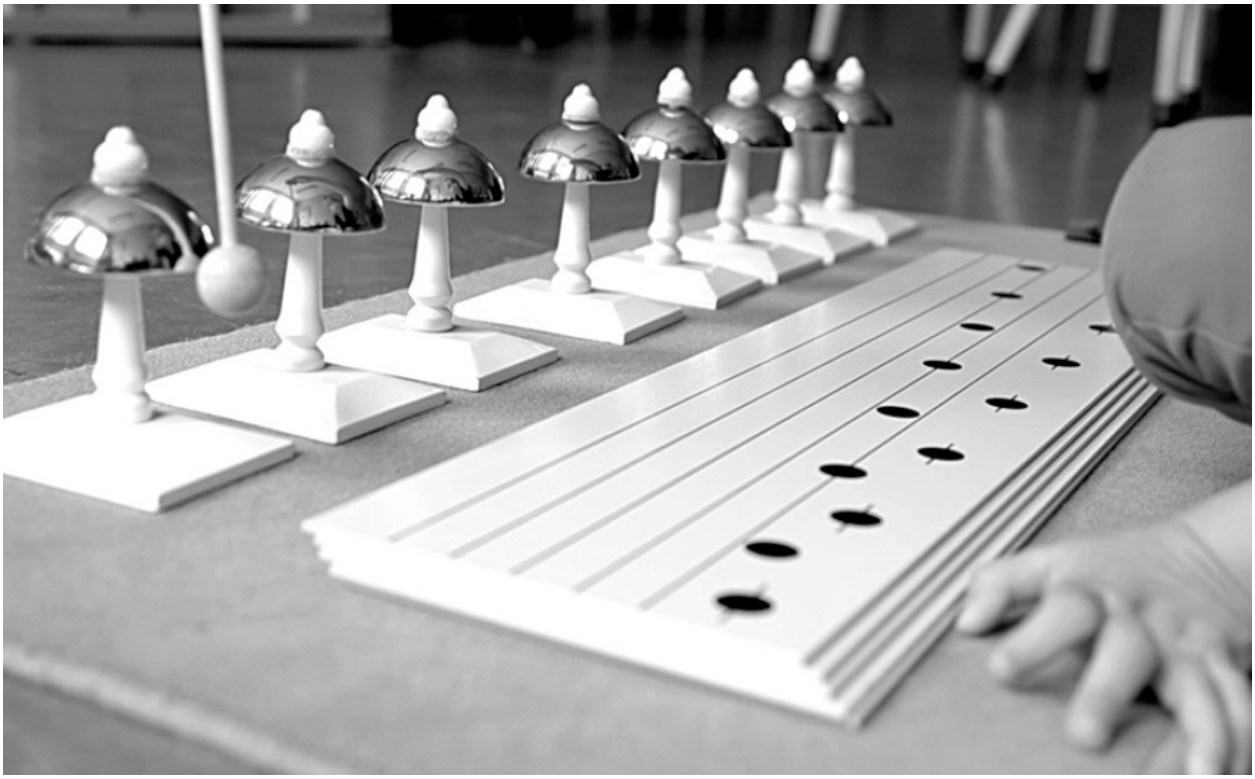
The geometry cabinet.



The polygon drawer of the geometry cabinet.

MUSIC

Once the children had become familiar with the notes of the C scale (*do, re, mi, fa, sol, la, ti, do*) and were quickly able to put the sequence back in the right order—through the intermediary of tuned bells—we showed them how to code a sequence of sounds on a small musical score. They were then able to decode it and to play a prepared series of notes. In this case, the children put in front of them a single series of bells and rang them in the order indicated by the score. They often replayed the melody several times in order to automate their decoding. They also composed short melodies for a classmate with the eight notes they had available. The classmate was then invited to play them once or several times in a row. The children had blank scores available for this activity on which they arranged wood tokens to indicate the placement of notes.



A child of five decodes and plays a short melody.

The ideal would be to be able to provide for the children a room dedicated to the practice of music so as not to disturb the group. In this room, there could be all kinds of little instruments. The presence of an adult or an experienced child to provide occasional guidance to the little musicians-to-be in their musical explorations would, in my opinion, be an excellent further feature.

Here we have briefly dealt with geography, geometry, and music, but there is no reason why we could not also introduce botany, biology, or any other cultural field that might interest children in the same sensory and gradual way.

6

Mathematics

Did you know that newborns no more than a few hours old already have an approximate sense of number?[1] That seems hard to believe, and yet there is evidence for it. Researchers had nursing babies listen to series of identical sounds—either four or twelve of them.[2] They were then placed in front of images containing either four or twelve dots. To the great surprise of the scientists, the babies looked for a much longer time at the images containing the same number of dots as the number of sounds in the series they heard! This experiment indicated that newborns are not only capable of perceiving quantities, but they can do it both by ear and by sight! And counter to all expectations, they were even capable of associating these two types of perception. They associated the number of sounds perceived by ear with the quantity of dots they perceived by sight. Of course at this stage the babies would not be capable of making a distinction between four and five dots or between ten and twelve dots. Their discriminative capacity is not yet refined to that point. Nevertheless, it is exactly this kind of experiment that causes specialists in numerical cognition to say that newborns have a profound mathematical sense from a very early age. Thanks to this innate sense, at four months, when they cannot yet either walk or talk, babies are capable of perceiving a gross error in addition or subtraction.[3] Scientists placed an object in an opaque box under the attentive gaze of babies. Then they added another object. If when the box was opened there was only one object inside—or three!—the newborns appeared astonished. Thus they intuitively know that one plus one equals neither one nor three but exactly two. Their surprise was the same if two objects were placed in

the box and then one removed, but when the lid was taken off the box, there were still two objects inside. Babies thus seem also to know intuitively that the product of two minus one equals one.

This approximate sense of quantities was also tested on children in the older section of preschool (five-year-olds). These children were shown to be capable of telling if the result of an addition or a subtraction—much more difficult for them—was correct or not, just on the basis of their innate sense of number. The experimenter asked: “Sarah has 21 pieces of candy. We give her 30 more pieces. John has 34 pieces of candy. Which one of them has more?” Even though they had not learned to add such big numbers, most of the time the children were able to answer that question correctly.[4]

From where does this innate sense of number come? From the time of birth, we possess specific neural circuits that are activated the moment we perceive quantity. These circuits endow human beings, much earlier than we would have imagined—that is, from birth—with very sophisticated intuitive abilities, *which preexist any instruction.* It is not necessary for schools to *create* mathematical skills out of nothing. Children already possess an innate sense of number. It is essential to appreciate the significance of this information. The child starting preschool at the age of three is not only born with intuitive mathematical knowledge, but she has already had three years to refine it. The last experiment cited above with the older preschool students shows that we underestimate their abilities. Instead of guiding these children in the realm of mathematics as though they knew nothing—which in the end risks boring them and causing them to lose their interest in numbers—research in numerical cognition invites us in teaching mathematics to rely on their rough innate capacity and to refine it.

Research indicates that counting or *enumerating*[5] quantities and associating them with a symbol (a number) is the way humans refine their capacity for numerical discrimination. To the extent that a child becomes capable of doing that, he becomes capable of differentiating between close quantities such as 5 and 7. Research also makes it clear that this discrimination can be developed further by *manipulating* quantities—by adding and subtracting them, as well as by *locating the numbers* linearly on a number frieze. Understanding the linear progression of quantities permits a child to grasp that the following number is always bigger than the preceding one, and that they are separated by a single unit.

This is exactly the way we proceeded at Gennevilliers. We knew that the

children possessed amazing intuitive knowledge, and we helped them to hone this by means of counting, associating quantities with exact symbols (numbers), and manipulating increasingly larger quantities and the placement of numbers on the number frieze. And to satisfy the extraordinary plastic intelligence of the children, we very quickly presented very large numbers to them. They could count beyond 100, even to 1,000, and had the opportunity to manipulate several thousand units. It seemed that this rapid access to large numbers satisfied, clarified, and galvanized the intuitive mathematical intelligence of the children.

Proceeding in this manner, the children in the class were able to develop major mathematical skills joyfully and with ease. Here's an extract from the test results from the second year of our experiment:[6]

> *Complete and unified representation of the numerical code:*
>
> In view of the results, it is possible to state that all the children possessed a firm idea of the numerical code. Only two children did not obtain the maximum scores on the two tests. The oral numerical-decision test was successfully passed by all the children of the advanced section [five-year-olds] and by one child in the intermediate section [four-year-olds]. This test is standardized for children in the second year of elementary school [eight-year-olds]. Children who get a score of 12 out of 12 on this test not only have top results for their age group, but results equal to children in the second year of elementary school.
>
> *Comparison of numbers:*
>
> Once again we can only say that all the children passed these two tests with flying colors, which suggests an astonishing mastery of numerical quantities for children of their age.
>
> *Conclusion regarding the mathematical tests:*
>
> Some of the children obtained results that were beyond the highest level for their age group. This phenomenon was more or less pervasive for the numerical-decision test and the comparison of numbers test. When children get the top scores for their age group, it is common for them to attain the standard level for the end of preparatory school [CP; six-year-olds]. Three children in the advanced section of preschool were even sometimes at the level of

> the best students of the second year of elementary school [eight-year-olds].

Without getting into detail on the teaching process or presenting all of the material used in the class, here are the main stages that allowed us to refine the innate sense of number of our students.[7]

We continued to use the teaching material devised by Drs. Séguin and Montessori. This material possesses a tremendous ability to refine the innate intuition of many students through *enumeration*, *association of numbers with symbols*, *and the manipulation of real quantities*, and it does so with great precision, clarity, and rigor. Each set of materials isolates one area of difficulty, proposes a single clear objective, and is devoid of distracting decorations. The attention of children is totally focused on the skill to be acquired, and this allows them to reach the proposed goal quickly.

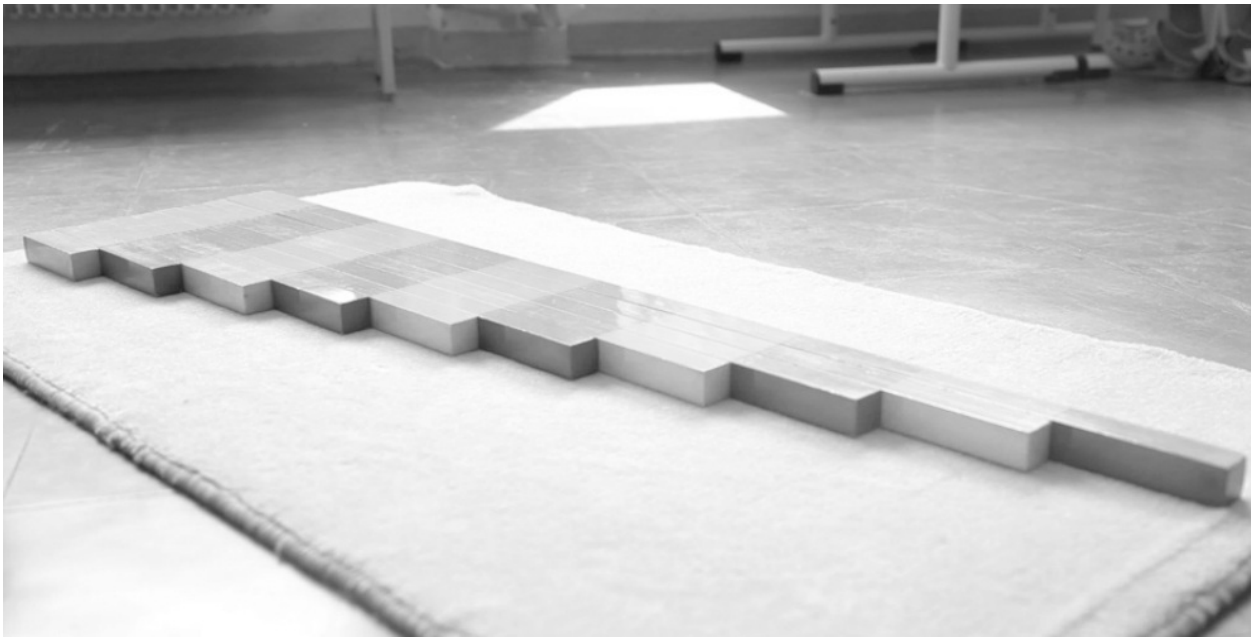
I am not aware of any other teaching material that offers such precision in its mathematical progression, such genius in the way it makes quantities concrete, and that possesses such simplicity and effectiveness. That is why I cannot but invite preschool and elementary school teachers to look into it. It is so rigorously concrete and progressive that it enlightens even the adult who learns how to manipulate it and may even, in the case of the adult who does not have a good relationship with mathematics, reconcile him or her with this field.

As a complement to this material, the children had at their disposal a long numerical chart, or frieze, that went all the way up to 200. This allowed them at once to satisfy their immense desire to count ever higher, to become familiar with the names of the numbers and their graphic representation, while at the same time offering the opportunity to assimilate the concept of linearity in a sensory and indirect manner. And as we pointed out earlier, it is thanks to this linearity that children can understand that each number is followed by another number containing one further unit. In this way they considerably refine their innate ability to discriminate quantities.

COUNTING QUANTITIES FROM ONE TO TEN

The activity with number rods was the first one we presented. In this activity, children of three could progressively count the quantities from one to ten using ten rods of different lengths, each alternatively painted red and blue to represent

units. The children had already become familiar with these differences in length through working with the red rods.



As with the red rods, the shortest rod, representing the quantity “one,” is 10 centimeters long, and the longest rod, representing the quantity “ten,” is 1 meter long. The length of the rods increases incrementally by 10 centimeters.

With this material, each quantity, from one, two, three, four, five, six, seven, eight, nine, ten—with the units of each represented on a single bar—forms a single whole. Presenting the numbers to children in this way is important: when a child holds in his hands the rod that represents the quantity “nine,” he holds an object composed of nine united units. Thus the number rods convey a very clear idea of number to him. “Three is three units together”; “four is four units together.” We invited the children to count each one of the rods progressively from one to ten. Being able to count all the rods correctly could sometimes take several weeks—however long it took for the children not to skip any units, while at the same time coordinating the movement of a finger from one to the next along with the oral sequence of numbers they were automatically reciting, which is called a *counting song*.



Anna helps a little girl of four to count the quantity “four” from left to right, in the same direction as in writing.

Using material of this kind, the comprehension of number is simple and effective. Not only does the child perceive the number as a whole, but she can easily compare the differences in size from one to another in a concrete way. The quantity “ten” is represented by a rod a meter long, while the quantity “one” is represented by a short rod only ten centimeters long, composed of only one unit. The child jumps for joy at seeing the gigantic difference that she perceives visually, without even needing any explanation. By repeatedly performing that gradation of these rods while counting them, children of three quickly become able to perceive at a glance the difference between the quantity “five” and the quantity “seven,” which is something they would have been incapable of a few weeks earlier. Through the use of this very clear and concrete material, the innate abilities of children are refined—much faster than what we usually expect to see—and this gives them a very definite sense of joy and happiness.

ASSOCIATING SYMBOLS WITH QUANTITIES FROM ONE TO TEN

Once counting had been learned, we next invited the children to associate the graphic symbols (the numbers 1, 2, 3, 4, 5, 6, 7, 8, 9, 10) with the corresponding

quantities by placing little wooden plaques on the rods.



A child of three and a half associates numbers with the corresponding quantities.

To help the children achieve this association between symbol and quantity we presented the numbers from 1 to 10 with the help of figures cut from sandpaper. Using this material, the children named the numbers while tracing them. This multisensory approach facilitates learning. The fact is that the brain learns better through a simultaneous convergence of the same information through the intermediary of different senses—sight, touch, hearing.[8] Studies indicate that this type of approach is highly beneficial for all children, and that it particularly helps those with specific learning problems.[9] In this way the children memorize the numbers in their aspects at once—the number is at one and the same time a symbol, the precise outline of a shape (the finger goes this way and not that way), and a name. And in our class, the children who could no longer remember the name of a number only had to trace it for the name suddenly to pop back into their mind. Whenever a child could not remember the name of a number, we would say, “Try tracing it and maybe the name will come back to you”; and the vast majority of the time, the name did come back to them—sometimes as a loud, joyful exclamation.



A child of three names the numbers while tracing them.

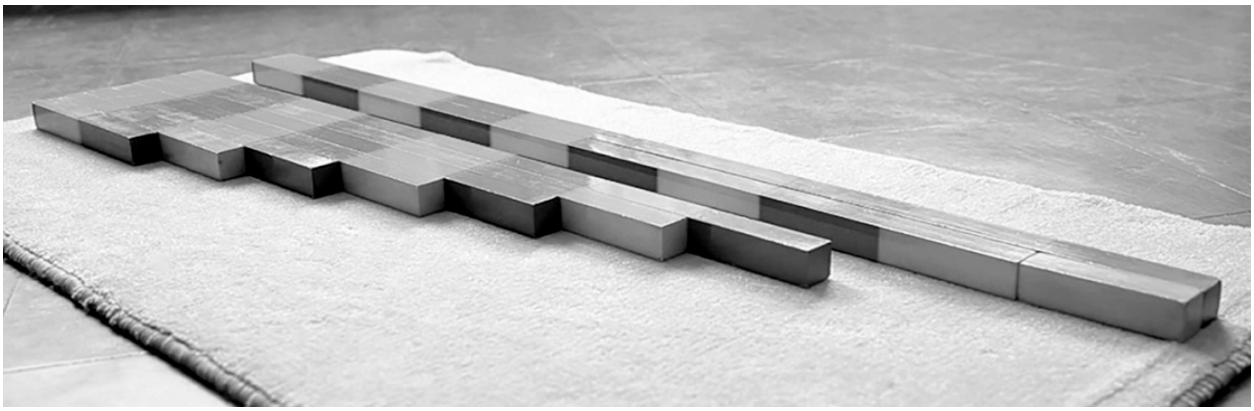
Thus the number rods make it possible for children not only to refine their perception of quantities but also to associate a graphic sign with them. This sign —the number—is fundamental: it codes the quantity in an abstract manner, thus allowing us to manipulate it easily in addition, subtraction, division, or multiplication. This abstraction gives our mathematical abilities wings.

In the same way that in order to read and write, children must understand that a sound is encoded by a graphic symbol (a letter), children must understand that *a number is a whole composed of a grouping of units, and this "whole" is encoded by a symbol* (the number). The number encodes quantities, and the letter encodes sounds. It is this understanding that opens the door to doing mathematics in a simple and liberated manner. No explanations are needed to convey this key understanding to children. It is enough for them to see things as they are. All that needs to be done is present mathematics to them in a simple, clean, and intelligent way. The rest, "getting it," takes place automatically in their little brains—even though for some, timely and appropriate scaffolding is necessary.

Thus, for example, it was enough for us to arrange the rods in a certain way for the children to understand spontaneously that 9 plus 1 equals 10; 7 plus 3 equals 10; and 6 plus 4 equals 10.

FORMING A QUANTITY FROM ONE TO TEN UNITS

Once the children began to be able to count up to ten and associate the symbols with the quantities, the next step was to introduce the material called the *spindle box*. This time the children formed the quantity before associating it with the symbols.



The quantity “one” was placed next to the quantity “nine,” which allows the child to see that this combination is equivalent to the quantity “ten.” Next, placing the quantity “two” next to the quantity “eight” allows the child to see that this combination (although it is different from the preceding one) also equals the quantity “ten.” The same goes for “seven” and “three,” and then for “six” and “four.”

Here the level of difficulty increases, and the child becomes more active: it’s up to the child to form the quantity “one,” the quantity “two,” the quantity “three,” the quantity “four,” the quantity “five,” the quantity “six,” the quantity “seven,” the quantity “eight,” and the quantity “nine,” by assembling by himself the right number of sticks (spindles) and placing them in the corresponding spaces with the symbols 1, 2, 3, 4, 5, 6, 7, 8, 9—and 0—positioned above them. Forming a quantity is not an easy task for children who have just turned four—some of them still in the lower section of preschool. Counting separate units is much harder than counting units joined together, which don’t move around and form a single whole. Here the child must memorize the number of units he is holding in his hand and count additional units one by one until he has reached the desired quantity—all while holding all this information in his memory while

the units (here in the form of little sticks) are rolling around on the table! We always invited the children to recount the quantities they formed by checking their count—units regularly got skipped along the way. During the time it took to pick up another stick, the child could forget that this was the fifth stick and count "6," or else count "4" over again.



A child of four assembles quantities of sticks from one to ten and associates them with the corresponding numbers, taking care to fasten together the units making up the quantities.

We invited the children to fasten the units of a given quantity together with a rubber band. This detail is quite important for a sensory understanding of the concept of "quantity." It makes clear in a concrete way that it is the *whole bundle* of *x* number of units that forms the quantity.

COUNTING BEYOND TEN

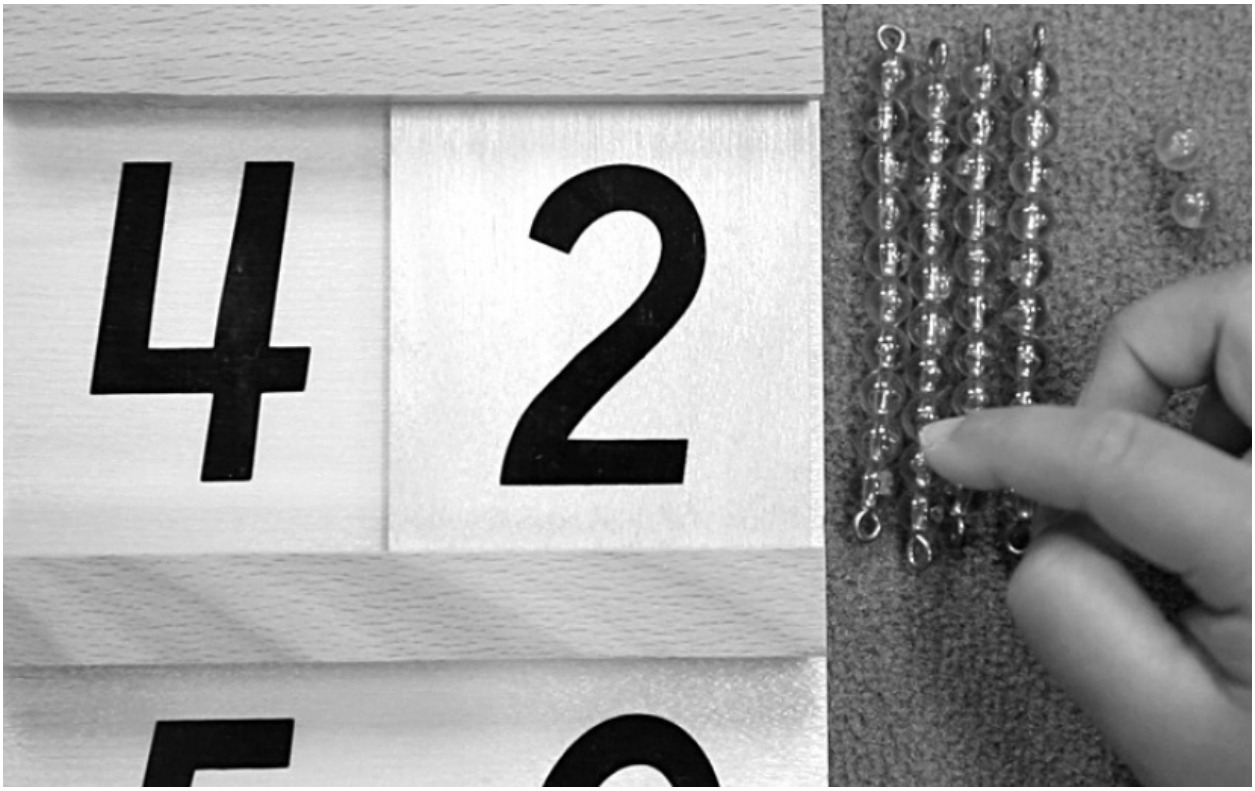
Once counting from one to ten had been firmly acquired, the children continued in the same manner to refine their perception of quantities, now with quantities over ten. The process was still one of counting, association with symbols, and

the manipulation of quantities.

To name and form the quantities from eleven to ninety-nine, the children had available to them two “Séguin boards” (designed for this purpose by Dr. Édouard Séguin).



The first Séguin board allows children to learn the names of the symbols 11, 12, 13, on up to 19 by means of three-period lessons. Once the names of the symbols have been learned, we invite the children to “build” the quantities and associate them with each of the symbols.



The second Séguin board allows children to learn the names of the tens up to “ninety” by means of three-period lessons. Once the names of the tens have been learned, we invite the children to “build” quantities such as “42.” As a result of activities we will describe presently, they knew that the “4” indicates four tens and not four units.

The children were also helped in learning the names of the symbols and the tens by a long number frieze that went up over 200. It went all the way around the classroom.



The children practiced counting every square in the number frieze spontaneously several times per day. The enthusiasm and achievement of a few of the children incited the others to keep going further. In that way, day by day they firmed up their comprehension of the counting song which they repeated every day, learning the names of the tens as they went along.

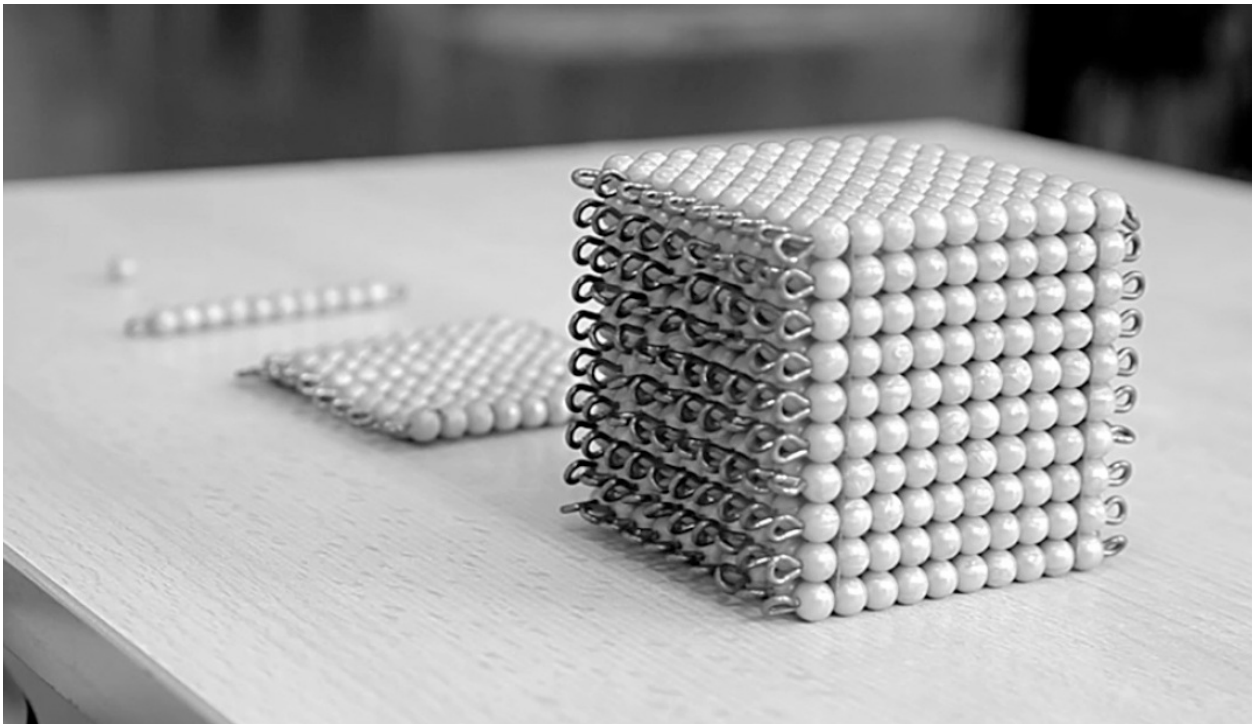
The children loved this number frieze because they could practice counting with the help of a classmate, and then when they felt ready, they very proudly insisted on showing us how far they could get on it without making a mistake. At those moments, we took the time to listen to them, and sometimes, when the child wanted to count from 1 to 150, this took a great deal of patience! We then placed the photo of that particular child under the number they had been able to reach without making a mistake and without skipping any squares.

This is typically the kind of activity that children adore and that parents can practice with them at home. The number frieze brings a number of benefits: knowledge of the counting song, association of the names of the numbers with the corresponding symbols, and refinement of their capacity to locate the numbers on a linear support. Research in numerical cognition shows clearly that using a frieze as a pedagogical support makes it possible to considerably

increase the mathematical skills of children.[10]

INTRODUCING THE DECIMAL SYSTEM

Very early on—as soon as they can count to ten—we gave the children an idea of what might be represented by the quantity “hundred” or the quantity “thousand.” We used material that presented the code of our decimal system: the unit, the ten, the hundred, and the thousand. We drew their attention to the fact that a ten is composed of ten units, a hundred is composed of ten tens (or a hundred units), a thousand is composed of ten hundreds (or one thousand units.) Thus by the age of four, the children had a concrete physical representation—which they could count—of these quantities. Having this representation directly satisfied their need to make their intuitions of these large quantities more definite, and it often produced major expressions of joy. Don’t children often ask us, “How much is a hundred? Is it big like a thousand?” I wish you could have seen the faces of some of the children when I told them, first presenting the hundred and then the thousand, “Look here, that is a hundred; and that—that is a thousand.” Not being able to count the thousand because all the units were not visible, they immediately got into counting the units of the hundred. We presented some supplementary activities to allow the children to memorize this new vocabulary.[11]



From left to right: the unit, the ten, the hundred, and the thousand.

Then, the following day, we would show the children the symbols corresponding to the different quantities: 1, 10, 100, 1,000. The great majority of the time, the children already knew the concepts of unity, ten, hundred, and thousand as well as the names of the associated symbols. This was because all day long they had been seeing their older classmates using them.



The symbols corresponding to quantities that had already been named.

We then showed them that if the symbol 1,000 represented a thousand, then the symbol 3,000 represented three thousands. And similarly, if the symbol 100 represented a hundred, then the symbol 600 represented six hundreds. The same thing for the tens: if the symbol 10 represented one ten, then the symbol 70 represented seven tens. After this explanation, which they didn't find very complicated, the children were rapidly able to associate *x* tens, *x* hundreds, or *x* thousands with the corresponding graphic symbols.



A child of four learns to associate quantities with symbols.

MANIPULATING LARGE QUANTITIES

Next the children had the opportunity, with this same material, to perform addition in a very concrete way. Two children would each take an individual tray and put some quantities in it. For example, one of the children would put a thousand, two hundreds, five tens, and four units in her tray and associate the right symbol—1,000, 200, 50, and 4—with each of the quantities. By correctly positioning the symbols, one on top of the other, the child could read 1,254. Let's suppose that her classmate chose the quantity 2,422 for his tray. Next the children put their quantities on a mat, taking care to place their symbols—1254 and 2422—on the top of the mat so they could remember the terms of the addition. A third classmate enumerated the *sum* of this addition beginning with the units. (We insisted that the children use the precise term *sum* to designate the result of the addition.) Then the third child enumerated the number of units, tens, hundreds, and thousands that had been assembled, and then went to get the right symbol for each of these quantities—3,000, 600, 70, and 6 equal 3,676. Little by little the children learned to formulate the result aloud, each in their turn: "1,254

plus 2,422 equals 3,676”—and they loved it!

Thanks to the counting on the number frieze the children did every day, they knew the names of the tens. They were thus rapidly able—of course with a little help—to read these large numbers. When the addition resulted in a number to carry, we told the children: “You have counted ten units. Look.” Then we put a ten off to the side. “Ten units make a ten. We have to exchange these ten units for a ten.” The child then put this new ten with the others and recounted the units. Then she continued with the tens. If she counted ten tens, we reminded her that ten tens make a hundred. We put the ten tens off to the side, and the child “saw” the hundred. The same thing with ten hundreds placed one on top of the other: the child “saw” a thousand.

Once they had understood the concept of addition, it was very easy for the children to do multiplication. All that was necessary was for three children to choose the same quantity, 1,254, for example. We would then have 1,254 + 1,254 + 1,254. We then explained to them that multiplication was a particular kind of addition. “It consists in putting together the same quantities. The children then placed their symbols at the top of the mat and we invited them to correctly formulate the *product* of the multiplication: “3 times 1,254 equals 3,672.”

The children could also do subtraction or division in just as simple and concrete a way. For subtraction, a child presented a quantity (for example, 4,843) and a classmate presented some symbols (for example, 378), indicating the quantity he wanted to “take away” from his classmate’s quantity. Together, they would read the *difference* resulting from the subtraction. For division, a child presented a large quantity, which he divided evenly between two classmates (or three). The children read the result of the division, being careful to indicate the remainder.



A child moves her finger to help her to “read” the product of the multiplication that two or three of her classmates have decided to do.

By refining their innate sense of numbers, the children in the class acquired solid mathematical skills. At five years of age, most of them were able to do addition, subtraction, multiplication, and division to several places—and understand what they were doing. They were totally able to explain the way they were going about these operations to their younger comrades. The majority, moreover, began to do large additions in their heads. When two children were having fun doing an addition together and describing it to a third classmate—for example, “4,000 + 3,200”—perhaps a child seated farther away coloring in a mandala might completely (and involuntarily) spoil the fun of his two classmates by saying loudly, “7,200!”

ENCOURAGING SPONTANEOUS ENTHUSIASM

Let us summarize the impact of this early mathematical sense on pedagogical method. Research[12] tells us that the way children can develop their innate sense of quantity and build solid mathematical foundations is by counting (at an increasingly higher level), by associating graphic symbols (containing more and

more digits), and by concretely manipulating quantities (ever larger ones). And that is all they need! When a child asks “How much is 30, Mama? Is 100 more than 30? And is it as much as a thousand?” she is trying to refine her innate sense of numbers; she is looking for definite reference points. Our job is to give them to her in a concrete way by showing what such quantities might correspond to, by asking her to manipulate them, to compare them, and why not put them on a wall chart? For a child, refining her intuitive comprehension of numbers is not more complicated than learning the implicit rules of syntax by listening to us speak every day. The child, possesses neural circuits that pre-equip her both for language and for numbers. And though we might avoid using the subjunctive because it might seem too complex for our children, we should not hide whole areas of mathematical culture that they are passionately interested in just because they seem *to us* difficult to explain and understand.

However, I would like to make clear that the innate sense of quantities that children possess, as well as the quite amazing results achieved in mathematics at Gennevilliers, certainly do not constitute a call to turn our children into child prodigies in mathematics starting in preschool. In my view, all children of four or five years of age do not have to do division of four-place numbers in order to be sure of a happy future. Every child possesses different abilities and areas of interest. Thus we should not expect all of them to develop the same level of competence in all areas—let alone at the same time. What our results do make clear, on the other hand, is—and this is the essence of my message—that it is highly probable that up until now we have greatly underestimated the amazing abilities of human beings in the first years of their lives, especially their intuitive mathematical abilities; and that if they have trouble in school, it is not perhaps because the tasks we are proposing are too difficult for them, but rather because these tasks are not up to the level of their great abilities. Children just get exhausted doing tasks that do not interest them and that are not worthy of their great intelligence. All of them will not go as far as fast as some of them, and that’s fine; but all of them have the ambition to accomplish far more than we generally propose to them.

When they enter preschool, children should see a number frieze that goes at least once around the whole classroom and that goes up to 200, 300, or even 1,000! Their living intelligence, which has immense abilities that have not yet been recognized, must be nourished. Their enthusiasm must be kept alive. This is their greatest treasure and our greatest responsibility. Because later on, though the children will be able to perform the arithmetical operations, they may just be

doing them automatically in order to please us, without necessarily understanding what they are doing; and they will be doing them with a sense of effort and constraint. They won't be doing them *for themselves,* proudly, with their eyes shining, three, four, or ten times in a row without stopping and happily calling the younger ones over to show them how to do it. Along the way, we will have lost the essential thing: the vital and dynamic endogenous power that drives the greatest of human achievements. What would happen if we were to exercise force on a child of twelve months, just beginning to walk and explore her environment, in the following manner: "Wait! First do some leg flexing and stretching exercises for me, but not more than thirty this year. Then next year you will learn to walk." The child's motor development would be seriously hindered. When the child is setting out in life to master her world, who are we to stand in her way? What right do we have? In the name of what? In the name of some curriculum? It is really time to review our priorities. Because when we limit children in the name of some preestablished program that is badly adapted to their individual enthusiasms, it isn't the children that we're limiting, it isn't them that we're stifling, but rather this vital endogenous energy, this mixture of joy, pride, and the feeling of invincibility and power that is the vehicle for the formation of their intelligence as well as for our society's greatest innovations. What we have before us are not "pupils" or "learners." What we have before us are *human beings,* talented, alive, moved by a vital inner force and sophisticated knowledge that we are still far from understanding. We are the pupils. We are still unaware of so many things that are needed to guide the development of intelligence. So let us, in trying to guide our children, always maintain an attitude of observation and study. Let us be humble.

I couldn't say it too many times: we do not know the limits of human potential, and we cannot know them because we have limited its development through our collective erroneous beliefs. That is exactly what I was trying to show through the experiment I carried out in a vulnerable and disadvantaged neighborhood. It is now high time that we looked at the marvelous being a child is with the greatest possible humility, as if to say, "I don't know what secrets you are hiding in your luminous being. I still barely understand how you function, but I know that your intelligence is powerful, brilliant, and orderly. I will be there to guide you and make sure that what you possess will *never* be trampled on. I don't know what you have within you, but I will be there to help you to bring it out into the light."

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Another point. The class results we have noted are not an invitation to pounce on the instructional material we have briefly presented. Let’s be completely clear about this. Although it has been devised with genius, it could remain without effect if it is used in a very academic, cold manner devoid of enthusiasm, and without the positive and fruitful interaction that comes about naturally among children of different ages. In our class, the material was, like any other instructional material, only a support, an aid that offered joyful and energizing activities to the mastery-seeking intelligence of the young children. It was a particularly intelligent aid, I must admit. Nevertheless, the essential—what really enabled the children to blossom as much as they did—was the positive, collaborative, compassionate, and trusting bond between the children. I am referring to all that they ventured to do because they felt loved, considered, and respected; all that they ventured to ask and to share, and that they took the time to show each other. This human dimension is really what makes the difference. Bringing new material into the classroom is not the priority here, but rather life, love, trust, freedom, and enthusiasm. On that fertile ground, new activities can certainly be progressively introduced. Before making big changes that disrupt the instructional and pedagogic workings of a class, it seems to me necessary and of the highest priority that the adult first adopt an attitude that is conducive to positive human bonding within her class. This was really the foundation on which the success of the experiment in Gennevilliers was based. It is essential to understand that spending a fortune on acquiring material without doing what is necessary to build and inspire a group of children of different ages who are autonomous, collaborative, and generous, would be a sad waste.

7

Beginning to Read and Write

The words we employ to speak are composed of a succession of sounds, and in order to preserve a trace of our oral language, the human beings who preceded us achieved something marvelous: they created graphic signs—letters—to represent the different sounds and fix them on paper. That is how we began to write—that is, to *encode* the sounds in graphic signs. And in a second phase, we began to read—that is, to travel the path in the opposite direction and *decode* the graphic signs into sounds. This grapho-phonemic correspondence is called the *alphabetic code.*

In contrast to the learning of oral language, which is naturally brought on by a biological predisposition, it seems that we do not possess neural circuits specifically dedicated to dealing with the alphabetic code—that is, to reading and writing. Current research in the cognitive neurosciences indicates that in order to read, our brain *retrains* or *repurposes* another area of the brain initially intended for an entirely different use: recognition of faces and objects.[1] When we learn to read, this zone begins to encode the letters we learn, which then allows us to recognize them quickly. This area is then increasingly taken over by the process of encoding letters, and then of hundreds of words. In order for us not to lose our ability to recognize the faces around us, our brain reorganizes itself and installs circuits for recognition of faces somewhere else—in a part of the cortex. Isn’t the autonomy and intelligence of nature amazing?

READING REORGANIZES OUR BRAIN

The fact that these circuits are retrained entails some constraints. To understand them the cognitive neuroscientist Stanislas Dehaene and his team, in the laboratories of Neurospin (at the Paris School of Neurosciences), performed MRI scans on numerous children and adults, literate and illiterate, French-speaking and non-French-speaking, coming from privileged and underprivileged environments, in order to understand the progressive transformation of these circuits as well as the mechanisms by which they work. Of course, this research still needs to be refined and developed further, but already it is providing us with precious information.

One essential discovery is that the *association between the sound and the letter must be explicit.* For example, although we might regularly encounter a person in the subway and even say hello to him each time we see him, we will be quite unable to name him. To associate a name with a person, it is not enough to see him; it is *necessary* for someone to give us his name. Similarly, although a child might regularly see a letter, and she will certainly recognize it, she will be quite incapable of knowing the *sound* that it produces if no one ever tells her what it is. As a consequence, having a child learn words and phrases by heart and encouraging her to discover on her own the sounds the letters make is a mistake. It is equivalent to placing somebody in front of a crowd, making him look at all the faces, and hoping that by some magic the names of all those people will come to his mind. If this person finally ends up associating some names with some faces and feeling a little less lost in front of all those faces in the crowd he recognizes but can’t name, it will only be because some nice person will have kindly whispered their names to him. In the same way, a child who has to learn words and phrases by heart as a means to learn how to read will no doubt eventually get there—with effort, pain, and patience—but this will be due to the help of her parents who will have been kind enough to whisper the sound of various letters to her in the evening when she was doing her homework. Thanks to a supersized effort on the part of her mind, hardwired to detect the regularities in her environment, she will discover on her own the association of letters and sounds that were never explicitly and clearly explained to her. Her reading skills will surely have gaps in it, and her parents will always have a bad memory of the efforts they were forced to demand of their child—without themselves understanding what the benefits of the task might be. As far as the child is concerned, she will very probably have negative feelings about reading. “Pedagogical experimentation in classes confirms it: children who are explicitly taught what letters correspond to what sounds learn to read faster and understand

writing better than other children who are left to themselves to discover the alphabetic principle," writes Stanislas Dehaene.[2]

It should be pointed out that this neural retraining is not without its inconveniences for our children. At preschool age the area of the brain involved in reading is not yet totally "retrained" for recognition of letters. It continues to identify objects as faces. This transitory functional cohabitation brings about a bit of a lag. That is, when the area of the brain specialized in the recognition of objects and faces perceives the right profile and the left profile of the same person, it provides the information to consciousness that it is the same person. And during this transitional period, when a child sees the lowercase letter *p* and the lowercase letter *q*, that area of the brain provides the information that they are the same thing. This confusion is completely normal. Researchers have found that it reaches its peak between five and six years of age. In our class we saw it around four or four and a half, since the children were starting to read in the second year of preschool and thus were specializing their neural circuc07y earlier.[3] Thus it is highly probable that children do not immediately perceive the difference between letters that are mirror images of each other. Many of them could likely do mirror-image writing and write from right to left without any problem. This is normal, because for their brains, it's still the same thing.



The mirror-image confusion in writing disappears as the neural circuits become specialized in the recognition of letters. Though some guidance is needed at this stage, this phenomenon need not become a preoccupation. Care should be taken, on the other hand, not to let it persist too long.

THE MAIN PRINCIPLES OF READING

The alphabetic code needs to be explicitly presented to children. This is the first great principle of teaching reading. One must give children the sounds of the letters without leaving them to discover them for themselves.

However, before presenting the sounds of the letters, the science concerning reading tells us that it is essential to help children *hear the sounds* in words. This

means helping them to discriminate the smallest units of sounds (called *phonemes*) that make up the language. For example, the word *pony* contains four phonemes and the word *bat* contains three.[4] The ability to hear the phonemes that comprise words is called *phonemic awareness.* The quality of this awareness in a child is the factor that is most predictive of his future reading ability. Traditionally, the development of this awareness begins with the discrimination of syllables. The word *pony* contains two syllables—*po-ny*—and the word *banana* contains three—*ba-na-na.* Children in preschool learn to hear the syllables in words and, among other things, to count them. Then gradually, and generally by the last year of preschool (five-year-olds), they are asked to discriminate the phonemes contained in the syllables. In the class at Gennevilliers, we did not take this detour via syllables, but instead went directly to inviting the children to discriminate phonemes. From my observation of many children, both from privileged and underprivileged backgrounds, French-speaking and not French-speaking, and on the basis of many experiments that have demonstrated this—notably in Montessori schools in France and other countries—it emerges clearly that children do not need this detour via syllables. Quite to the contrary, this approach slows down their entry into the alphabetic code. After having been trained for nearly three years in preschool to distinguish the syllables in words, children end up considering them to be an indivisible whole and therefore have difficulty when it comes to separating the syllables into the smaller units of sound, the phonemes, that are encoded in letters. We want to lead children directly toward the great doorway to reading, but following this method of emphasizing syllables, we lose them in the corridors of instruction. Let us not forget that their brains are hardwired to analyze the sound units of their language and to specialize in them, and that they have already completed this exercise effortlessly in the first year of their life—without any formal teaching. So here what we must do is draw the attention of children to small sound units—which their intelligence has already analyzed and encoded—and get them to be conscious of them.

Working this way, I have seen an enthusiasm in the children that is not aroused by cutting words up into syllables. It seems that to them, this minute study of sounds makes total sense. The joy they manifest in understanding that the words they pronounce are composed of very small sounds is tantamount to discovering a key concept of language. It is a sort of linguistic “Eureka!”

This directly phonemic approach, as opposed to the syllabic one, might seem complicated to us adults, and it is a normal reflex for us to propose a progression

that is intellectually gentler in our eyes. But we must yield to the evidence: the results of the syllabic approach are not satisfactory. And we tend to forget in considering this point that the intelligence of children works in a complex and sophisticated fashion. As we have already pointed out, recent studies tell us the opposite of what we have long supposed: children do not learn language in a linear fashion. All the levels, from the simplest to the most complex, seem to be fixed in engrams from the start. If during the first months of life, this highly creative period, we had spoken to our children only in syllables, then in words, then in phrases, by the age of three they would have been totally incapable of speaking correctly. Hearing the sounds in words is no more complicated than understanding the grammatical and syntactical rules of their language intuitively and without explanation. For us that may be totally counterintuitive—children seem so immature. But within their little skulls they harbor learning mechanisms of unequaled power and complexity, and these permit them to embrace the world in all its subtlety. It is highly probable that we are complicating their task by trying to make it easier.

Numerous scientific studies have been carried out to determine the efficacy of methods using these two basic principles: *explicitly teaching the correspondence between sounds and letters* and *the development of phonemic awareness.* These studies indicate that this method is by far the most appropriate one for all children, dyslexic children as well as children who have no learning problems.[5]

Another major principle revealed by the science of reading is the importance of guiding children in their entry into reading in a gentle and progressive way, intelligently orchestrating the introduction of new difficulties. It is, for example, advisable to begin reading with simple words, then to gradually introduce more complex words, and then add instruction concerning silent letters and function words.

THE METHOD USED IN GENNEVILLIERS

The three guidelines we followed to help our children master the alphabetic code and begin to read with joy involved three components: having the children hear the sounds that compose words, explicitly presenting them with the graphic correspondents (letters) of the sounds, and very gradually increasing the level of difficulty of the readings. To do this, we adopted certain pedagogical tools developed by Dr. Maria Montessori, taking care in our case to adapt them to the

specific qualities of the French language. Maria Montessori initially developed her language material for the Italian language. Thus I should point out again that this material was only an aid for us, a means of sustaining the enthusiasm of the children. The essential instructional means for helping children in their autonomous mastery of the alphabetic code was and remains the quality and regularity of individualized, compassionate scaffolding. This is, moreover, the reason I decided to use only five or six activities to get our children started in reading, spread over the first two years of preschool (three- and four-year-olds). In the final year of preschool (five-year-olds), most of the children no longer made use of these activities. They read children's books. Using only a few support activities, we were able to focus strongly on the transmission of reading skills through supportive, individualized, and warm human bonding.

The test results for the first year indicated that nine out of fifteen of our four-year-olds had begun reading, as well as one three-year-old. The test reports told us that "on average, the children are far above the norm in phonemic awareness."[6] In fact the children demonstrated a very refined phonemic awareness, usually found only in elementary school children, because we did not take the syllable detour.

By the end of the second year, almost all of the five-year-olds as well as 90 percent of the four-year-olds had begun reading. The children devoured children's books. Every two weeks around fifty children's books had to be borrowed from the public library to satisfy their appetite for reading. Every day they took one or more books home to read them in peace and quiet, surprising their parents by preferring to read rather than play video games or watch TV. On a daily basis, we were able to observe that this great thirst for reading brought with it a distinct improvement in the children's level of language, both in terms of vocabulary and syntax. The test report for the second year told us that the children "exhibit comprehension of the text they have just read at least as good as that of an average student in second grade."[7]

The third year, the readers in the class underwent MRI scans in the laboratory of Stanislas Dehaene. Analysis of results showed strictly normal reorganization of the brain in connection with reading, but a year and a half ahead of the norm.[8]

FIRST PRINCIPLE: HEARING SOUNDS

Without going into too much detail, here is how we proceeded at Gennevilliers

in developing the children's phonemic awareness. In a pretty box we put a bunch of very small objects we bought at a toy store. We had, for example, a bicycle, some thread, a bag, an elephant, a hat, a bear, a screw, a skirt, a baby, a ladder, a saxophone, a piano, a truck, a chair, a cradle, a pineapple, a cat, a rabbit, and so on. We regularly changed these items so the children wouldn't get bored with them. We did what was necessary always to present *a great variety of different sounds* for the children to hear, with emphasis on the "attack" phoneme (the first) or the final phoneme (the last).

Here is how I went about it. I invited a child to take the box of objects and we sat down together at a table on a mat. Most of the time, two or three other children came over to watch. Thus they also benefited informally from the presentation. The first several times, the objective was to draw the attention of the child to the first sound in the words. In order to avoid beginning with too high a level of difficulty, I picked three objects whose attack sounds were particularly distinct, with regard to both the level of sound and the positioning of the mouth, such as shoe, lion, apple. As I placed the objects on the table one by one, I exaggerated the pronunciation of the attack phoneme, as well as the positioning of my mouth, in order to make the sound as clear as possible to the child: *"shhhhhhoe"; "lllllllion"; "aaaaaapple."* After having pronounced each word, I asked the child to pronounce the word the same way I did, so that he would become aware both of the sound and of the positioning of his mouth. For children who had trouble hearing the sounds, I often associated a gesture with the sound. For example, for the hard *g* in *goat*, I would put my fingers on my throat to show that the sound vibrated at that spot.[9] This multisensory approach made the discrimination and reproduction of difficult sounds much easier. Once the three objects were in place on the table, we repeated their names one or more times, always in the same way, in order to familiarize the students with the different attack sounds.



At the time this photo was taken, we had in the box a bed, a bowl, a pig, a wheel, a strawberry, a dog, a sled, an ant, a screw, an orange, a pail, a basket, a key, and a bicycle.

I next asked the child, “Can you give me the object that begins with *ssssh*?” If I had really taken the trouble to clearly pronounce the sounds during the presentation and to check to make sure the children were also pronouncing them precisely and in an exaggerated fashion, they succeeded in choosing the right object on the first try. I would continue, “Can you give me the object that starts with *lllllll*?” And finally, “Can you give me the object that starts with *aaaaa*?” Then we would start over with different objects, increasing the difficulty over a period of days—that is, by proposing objects whose attack sounds were less contrasting, such as *j*am, *sk*irt, and *s*oap.

A few days or a few weeks later, when the child was capable of easily identifying the attack sounds of all the words we presented to him, I tried to direct his attention to final sounds, like the *m* sound in *drum.* I began first with contrasting sounds such as *houssse, arroooow, bananaaaa.* Then I went to less contrasting final sounds, such as *caggge, doggg, sleddd.* This activity was presented several times a day every day, of course with different children.

This exercise was presented to children of three beginning right after they started preschool. Some of them began on their very first day, with a great deal

of enthusiasm; others began after a few weeks, the time it took for their enthusiasm to emerge. It is generally accepted that one must wait until a good mastery of language has been attained before introducing sound games. Children who had not correctly mastered oral language or who were even having trouble with speaking—such as with a stutter or confusion about different sounds, or who simply couldn't speak normally—were very much in need of such activities. In the beginning, being affected myself by prejudgments of this nature, I asked these children to wait awhile before participating in this kind of activity. But after a few days, their desire was so strong that they were going on their own to the older children to get help. I therefore decided to heed the desire of the children and abandon my preconceived ideas. And I was right to do it. These children benefited greatly from the phonemic approach, which seemed to clarify the main phonetic principles in their brains—especially in some of their brains, which were already specialized in a different language and had not been able to follow the flow of their new language. Through this exercise, their perception and pronunciation of their new language was clarified, especially as a result of the movements of the mouth and the lips having been clearly demonstrated. Contrary to received ideas, these little enjoyable and informal exercises were effective in a very direct way in refining the linguistic expertise of these children.

In parallel with this, every day when we were together in our group circle, I would ask three or four of our older pupils, "Jasmin, what do you hear in *banana*?" The child would reply "*b-uh-n-a-n-uh,*" counting on her fingers at the same time. "Six, that makes six sounds!" These little daily games never lasted more than three or four minutes and were done just in passing, but they served to refine the phonemic awareness of the little ones. Breaking the words down into their constituent sounds ended up seeming quite natural to the children. But you are probably wondering how our older children ended up with such a precise phonemic awareness—it was developed through the following activities.

INTRODUCING THE ALPHABETIC CODE

When the children began to be able to isolate the sounds in the attack and final positions of words, we presented the *graphic signs* that represented them: the letters of the alphabet, as well as letter combinations such as *sh, ch, th, wh, ck, ph, ng* for consonants and *ai, ay, ee, ea, ie, ei, oo, ou. ow, oo, ey, ay, oy, oi, au, aw* for vowels. These are called digraphs, or double letters, and they encode

sounds in the language that the simple letters do not.[10] Thus we gave the children a graphic sign for every sound in the language. All these signs were presented in cursive script with the letters attached to each other, cut out of sandpaper and pasted onto wooden tablets.

I would then say to the child, "You remember that in *mmmmonkey* you hear an *mmmm* sound? Well, look here, I'm going to show you how we write *mmm.*" Then I would place the letter *m* in front of the child, trace it while pronouncing the sound, and then invite the child to do the same.

Today, thanks to certain studies and from our own experience, we know that tracing the letter while pronouncing its sound very definitely fortifies memorization both of the shape of the letter and its sound. This combination of pronunciation with tracing is highly recommended in Stanislas Dehaene's monumental work *Reading in the Brain.* This is also confirmed by experts on specific learning problems.[11] The more multisensory learning is, the more effective it is.



Most of the time, three sounds were presented to the child at a time for a three-period lesson. These might be three letters or two letters and a digraph.

When we presented a letter to a child, we took care to give her the sound most frequently encoded by that letter (in cases where the letter is used to encode more than one sound). For example, for the letter *c,* we gave the child the sound *k* as in *cat* rather than giving her the sound *s* as in *cement,* because the letter *c* encodes the sound *k* more often that it does the sound *s*.

You will note that at this stage, the name of the letter is not given to the children. This is because research has strongly recommended separating the *name* of the letter from the *sound* it produces, even at the risk of causing children

to make reading errors. For example, if a child thinks that the letter *p* encodes the sound *pee* and the letter *a* encodes the sound *ay,* he will read the word *papa* as *peeay-peeay.* To avoid all confusion, we gave the children only the sounds of the letters. We rigorously observed this principle, because we had seen from experience the difficulties that teaching the name of a letter before its sound could cause children to have. The first year at Gennevilliers, we took children into our second-year group who had already done a year of traditional preschool and had therefore learned the name of some letters rather than their sounds. When they tried to read, their progress was impaired by what they had initially learned. For example, they read the word *dog* as *deeojee,* and obviously this gave them no chance to understand the meaning of the word, and therefore they had no interest in reading it. It took some time to make them understand that the letter *m* makes the sound *mmmm* and not *em.* For these children, getting started in reading was clearly impaired by the instruction they'd had, which unfortunately in certain cases was already firmly ingrained.

Once they knew how to read, the children learned the names of the letters naturally, particularly thanks to songs like the alphabet song, but only after reading had become automatic and there was no longer any danger of confusion. As long as a child was still not reading smoothly, we never brought up the names of the letters. So we never told a little one, "Here's the letter *ef,* which makes a *fff* sound." We just said, "Here's *fff.*"

We present all the letters of the alphabet this way, as well as the digraphs. For the digraphs we said, "You remember that in the word *chhhhip* you hear the sound *chhhh*? Well, look here, you write *cccchhhh* like this." A lovely *ch* pasted on a tablet was then presented to the child. I traced the digraph while pronouncing its sound and invited the child to do the same. The children loved some of these digraphs, like *ch* or *ee,* which encoded sounds they heard frequently in words. We presented these very quickly, even sometimes the very first time the sounds came up, and they were easily remembered. The presentation of digraphs this soon might seem premature, but proceeding in this fashion is recommended by eminent psycholinguist Liliane Sprenger-Charolles, who also recommends showing the digraphs to the children as one graphic unit, which is what we did.

For silent letters, such as *g* in the word *sign,* we said, "This letter doesn't make any sound. It's silent." The children traced it while keeping their lips shut tight or putting a finger over their mouth to indicate that it made no sound.

By means of our letter and digraph cutouts, all the sounds the children had heard in the game with the small objects took on a material form. They could *see* and *touch* them. Of course the first few times, we presented letters and digraphs whose sound was easy to hear and reproduce. For the most part, we used *a, i, o, m, sh, oo, s,* and *l.* Also it is very important to be careful to present these sounds to the children without a final *uh* sound: *mmm, shhh, ssss* rather than *mmmmuh, shuh, ssssuh.* Otherwise, when the child tries to read the word *mat,* for example, he would decode *mmmmuhat* rather than *mmmmat*. This would considerably impede access to the meaning of the word and slow the child down in his achieving competence. Pronouncing consonants without the final *uh* might require a bit of training, but it is an effort that it is essential to make. Our lack of precision can become an obstacle to the child's learning to read.

TRANSMISSION AMONG THE CHILDREN

The children enjoy very much showing the letters to their little classmates or tracing them together with them. They pick a letter, and each child traces the shape of the letter with her finger while pronouncing the sound it encodes. This kind of "horizontal" learning is tremendously effective. The children spend many moments in the course of the day playing at letters together. They learn very fast. Vertical, teacher-controlled instruction can never reach this level of effectiveness. A few times I have had the experience of presenting three letters to a three-year-old who requested it, but who was really not ready—he did not yet remember the sounds of letters. I therefore steered him to other activities. Most of the time, however, he continued to trace letters with other children. And when a few weeks later I sat down next to him to try to present the letters to him again, I was amazed by the number of letters he had learned "by himself."

The same phenomenon also would occur between two presentations of letters. One Monday I presented three letters to a child, and when on the following day I presented three more to her, she already knew many more than she had the day before. All it took was for her to have played at tracing letters with a classmate. In a still more extreme case, a child of three, Ilyes, wanted me to teach him to read. He wanted to do what the intermediate children (four-year-olds) in the class were doing—most of them were already enthusiastically reading children's books. This was the first year of our experiment, and this little fellow seemed to me to be much too young to learn how to do this. Therefore I guided him in the direction of other activities that were likely to offer him as big a challenge but

still be more accessible—in my opinion. I had concluded that he would not be able to remember the sounds of letters, even though I had not tried to present them to him. He insistently asked me three or four times, but seeing that I was not going to help him, he did it by himself. One morning he took out the letter cutouts, lined them up on a mat in a very orderly fashion, picked one of them out, and went to ask one of the intermediates what the sound of the letter was. The older pupil traced the letter while repeating its sound. Then Ilyes went back to his own mat and did the same. I watched the scene with a feeling of tenderness, continuing to think that all this was happening too soon. Nevertheless, I let Ilyes do it. When he did it again on the following two days, I saw that he was remembering the sounds of the letters quite well, and I decided to film his achievement. This turned out to be a very good thing, because at the end of three more weeks, the little boy knew enough letters to decode a word. When he felt he was up to it, he spontaneously took some short "reading tickets" on which were written small actions to be carried out (this reading activity was intended for the oldest pupils, who had already begun reading). I rushed over with my camera with the idea of showing his mother this courageous attempt on the part of her child. But imagine my surprise when he succeeded in decoding what was written on the ticket.[12] The ticket he had in his hands said, "Sing!" (which had a digraph in it, which he read like any other letter). "*SSSiiinnng.* Sing!" he said victoriously, his face lit up with joy and pride. And he sang. He then continued with the rest of the tickets, thus giving me a lesson that I am not inclined to forget.[13]

The great majority of children are not able to read after only manipulating the cutout letters. The following steps are often necessary. But the experience described above reminds us that there are no rules, and that it is essential to allow each child to follow his or her own passionate endogenous inspirations.

STRENGTHENING COMPREHENSION OF THE CODE

Once children knew a certain number of the letter sounds we suggested that they compose words themselves, using the movable letters and digraphs. This activity enabled them to effectively deepen their familiarity with the alphabetic code by actively manipulating it. The movable signs also freed them of the need to write, which they couldn't yet do at this age. First we asked them to compose the name of one of the objects in the object box that they were accustomed to using in analyzing sounds. For instance, we might help a child to compose the word *bag*.

We would ask him to listen for the first sound in the word, then to place the letter corresponding to this sound on his mat. So having placed the letter *b*, he then heard the sound *a*, so he put the letter *a* to the right of the *b*. Then he heard the final *g* sound and placed the letter *g* after the *a*.

By doing this, a child is *composing.* He is encoding a sequence of sounds in graphic signs, following the code of Western languages, which requires the signs to be written from left to right. This spatial convention, by the way, is not at all obvious to children at the beginning; however, they assimilate it rapidly.

To begin with, the children could use the small objects. But in addition we soon asked them to compose words in areas of personal interest to them. For example, I suggested to children to encode the names of colors, animals, dinosaurs, and the first names of members of their families. At this stage, it was of little importance for the words to be spelled right since the children were unable to read them back. The essential was for them to be able to enjoy encoding sounds. If they wrote *kat* for *cat*, it still fulfilled the objective of the activity. They had not only heard the sounds composing the word, but were also able to place the letters that encoded the sounds in the right order, meaning from left to right! A child of four who does this performs a triple feat. Only when they reach the point of being able to read their composed words back do we take care to have them spell them correctly.



A child in the class at Gennevilliers has formed the words ***cochon*** (pig) and ***vis*** (screw) using movable letters and digraphs.

THE SPONTANEOUS EMERGENCE OF READING

After a few days or a few weeks, depending on the children and the regularity of their use of the movable alphabet, encoding gradually begins to become automatic. From that point on, encoding requires less effort from children. They begin spontaneously to read their compositions back: *pppooonyyy, mmmaaammmaaa*, *hhhaaattt*, the child will say aloud, decoding one by one the words she has just composed. She will have begun to read without realizing it, as naturally as could be, and will be surprised if you exclaim joyfully. When the children began spontaneously to read back the words they had composed the first year at Gennevilliers, I was always very moved and surprised by the ease with which this phenomenon occurred. I said to a child with great joy, “You know how to read!” And the child looked back at me with total incomprehension, not seeing why what she had just done had brought on such enthusiasm on my part. I think the children did not even realize that they had just entered the world of reading without any effort. They quite simply did it the way a very small child utters his first word, just because he’s ready to.

I remember one day I was sitting in the sun by a mat with a child, helping her to encode a few words she liked. They were the first names of her brothers and sisters. A child of four, Yunes, passed near the mat and, while continuing on his way, pronounced the words we had just composed. I turned around, touched and surprised—I hadn't noticed that this child knew how to read. Yunes's mother told me that that same year, having a great time and very proud, Yunes had taught his twin brother Amin to read, who was in second-year preschool in another place. Yunes hadn't done anything extraordinary. He had simply given his brother the key to the alphabetic code: the sound of the letters. And since Yunes was already reading short children's books at home and greatly enjoying himself at it (he particularly liked funny books), his brother wanted to read too.

The first few times I observed this spontaneous emergence of the ability to read, it was very moving for me. It meant that *there was no reason learning to read had to be the complicated transition that everyone feared it was.* It was just one more thing achieved, *an easy one,* for the super-talented human being that is the young child. So the basic source of the difficulty has been our way of presenting learning to read to children and not their abilities. I already saw in my mind the vast number of teachers who would be relieved by this news, and I rejoiced for the many children who would be spared exhausting and ineffective systematic exercises.

Often, when I sensed that a child was on the verge of being able to read (especially because she had started to become automatic in her composition of words), I went and got a tray with small squares of paper arranged on it along with a pencil and a stapler. I put this tray on a table and sat down at it with the child. I then wrote a short, simple phonetic word,[14] such as *pig*, on one of the squares of paper. I handed her the piece of paper, saying, "See here, I have written a secret. Can you read it?" The face of the child lit up. She held the piece of paper close to her face and tried to decode it: "*pppppppiiiiiiiggggg*, pig!" To make sure she had understood, I said, "Yes! Can you go around the classroom and find what I wrote on the paper somewhere else than on the paper?" Then the child went happily skipping around the classroom, hopping around trying to locate a pig (there was one in the box of small objects). I repeated this exercise four or five times. The child read the word and then went around the classroom searching for the objects whose names I'd written on the paper. Then I stapled the squares of paper together and the child proudly took them home with her.

The children often eagerly reread this little trophy, alone or to their parents,

whom they also asked to write down new little secrets for them. A parent told me one morning, “We were writing down little secrets all evening long! He didn’t want to quit.”



Here is the main material that allows children to begin to read, quickly and with enthusiasm. There’s paper, a pencil, a pair of scissors for me to cut the pieces of paper with, and a stapler so I can deliver the treasure to the children. There is also a roll of Scotch tape (for cases where the objects involved could not be placed on the table—such as “wall” or “sink”—I asked the children to go and stick the paper directly onto the object it referred to).

Discovering reading in this simple and lively way, children reacted as though they had discovered a secret magic code, which, by transforming letters (or groups of letters) into sounds, allowed them to enter into the thoughts of another person, without the other person having to say a single word. For example, when I wrote a word for the first time on a piece of paper for a child—only writing it, without opening my mouth—and, by decoding it, the child gained access to what I had been thinking without speaking, for him it was like discovering a real secret code, which opened the door to a new means of communication. I can assure you that children perceive writing and reading *for what they really are*—that is, a very ingenious mode of communication—rather than as a piece of drudgery imposed on them without any sense of social bonding. They have the feeling of having achieved something really exciting. After this discovery, some of them are unable to stop doing it for several days. They constantly ask to read little secret messages, or they write them themselves to their classmates.

Sometimes they try to explain their discovery to a younger classmate, who doesn’t completely understand what his older friend is trying to teach him, but who listens all the same.

And while they are making this new acquisition, the motor skills of the children have had time to ripen further. That being the case and since they have also spent a long time tracing the shape of the letters over the previous months using the sandpaper letter cutouts, they can now trace the letters without having to use the movable alphabet to give form to their ideas. At this stage, the children write “phonetically,” but as they go further with their reading and begin to read regularly, they gradually learn the codes of proper spelling. They then get into reading as they did with oral language—that is, with a burning desire to practice it.

At that point all written material becomes something to be decoded: billboards, cereal boxes, shampoo bottles at bath time, and even their parents’ text messages. The children wanted to read everything so they could uncover all the hidden messages. It matters little that they hadn’t been introduced to print-style letters yet; they worked on decoding the printed material like archaeologists trying to decipher hieroglyphs based on their existing knowledge.

As soon as the children had started to read, either spontaneously by reading back words they had composed with the movable alphabet, or after working with the little words written on pieces of paper, they were gradually able to make use of a dozen reading folders, among which there were: (1) four folders of short phonetic words without digraphs, of which two contained grayed-out silent letters, and (2) eight folders, one for each of eight important digraphs. Each of the twelve folders contained ten images to which the children had to associate the corresponding word. For this material, having high-quality images as well as having most of the words as ones the children were familiar with were essential for holding their interest.



The twelve reading folders used at Gennevilliers.



A child of four decodes words written on small cards that have a silent letter (grayed out). Once she has understood the word, she will associate it with the right image.

With the reading folders, the children accomplished the same task as when they wrote their little secret words: they had to read a word and associate it with the object it designated. Here it is a bit more abstract because instead of real objects, we have images. But that doesn't trouble the children at all, on the condition that they have already worked through a "live" and very concrete stage. These reading folders are used only as a support for what the children learn through human bonding. They do not really represent a pedagogical activity. The pedagogical moment is the moment we joyfully share together every day, with a sense of bonding, with good humor. These activities are complementary. They would have little value used by themselves.

And indeed, along with this activity, I continued regularly, every day, to write words for children individually, taking into account the level of progress they had reached. For example, if a little girl read the digraph *sh* very well in words but not necessarily the digraph *oo,* I got the tray and wrote some words with the digraph *oo.* She could then improve further using the folder on the digraph *oo.*



Anna writes words with the digraph ***on*** for a child of four. After writing ten such words for her—or more if the child wants to keep going—she gathers the pieces of paper together and staples them before giving them to the child. Later the child can use the ***on*** folder to improve further.

FROM DECODING TO READING AUTOMATICALLY

After having begun to read, children pass through a decoding stage that demands their effort and attention. For a word as simple as far, *for* example, they first have to recognize the letter *f* and associate it with it the corresponding sound *fff*, then recognize the letter *a* and associate it with the sound *aaaa*, then finally recognize the letter *r* and associate it with the sound *rrrr.* Then by pronouncing this series of sounds aloud (*ffff-aaa-rrr*) and *hearing* it, the child will recognize the word *far*! This leap into reading is called decoding. This first stage demands conscious effort as well as considerable attention from the child. Nevertheless, decoding gradually becomes automatic and requires less and less conscious effort.

A few weeks later, when the child sees a word that she has *already read*, her brain will analyze the succession of letters and sounds much faster, without requiring very much conscious effort. Thus the more the child reads, the more

words are recognized and decoded very quickly by the brain. At this point we speak of *automation* or the *direct path* of reading. That is, just like you, the child will no longer have the impression of decoding but of directly accessing the meaning of the word without going through the phase of deciphering. This is what automatically happens for you when you read words now. You directly access the meaning by following the words with your eyes; you no longer have any sense of decoding. Nevertheless the research is very clear: decoding is what your brain is doing, but it does it extremely fast. The brain does not recognize a word as a whole; it decodes it more or less rapidly.

READING WORDS

Decoding is a high-effort phase in which brain circuits are retrained to become specialized in reading. It is only a transition—passing faster or slower depending on the child—that leads to automatic reading. To help children not to become discouraged and to rapidly move on to the next phase, every day I exchanged little messages with them, taking into account their individual progress. This gave them very strong support and encouragement in moving ahead toward automatic reading. I asked Anna to help me in this task by also writing little messages to the children who were starting to read. Joyfully offering the most effective support we could during this transition time was a priority in our class at Gennevilliers. We worked to sustain the enthusiasm of the children in this sometimes laborious stage through totally individualized scaffolding, tailored as closely as possible to their needs, their personality, and the level they were at.



A little girl of four at Gennevilliers, who had recently begun reading, decodes phonetic words Anna wrote for her.

Most parents, eagerly pressed by their children during this period, also were very happy to help.

Every day and several times a day, I called for moments of exchange in which there was a sense of complicity between us and the children. I would write down ten words of increasing difficulty, which I then stapled together. When the word contained silent letters, I simply underlined them before passing the message to a child, who knew that this sign indicated the presence of a letter that was not to be pronounced. There were words like *mat, bit e , car, cub e , sun, moon, writ e , li gh t, kitten,* and so on. The children clamored for these warm moments, which, I repeat, I tried to make enjoyable, as much fun as possible. It was this daily regularity of “live” reading in a framework of lightheartedness and bonding that allowed the children to pass rapidly from the decoding stage into the stage of real reading.

The fact that these moments of sharing were tailored to each child’s individual progress was totally invisible to the children, who had absolutely no idea they were pursuing an instructional path. They simply had a sense of experiencing a shared moment of joy, and success!

The grown-ups took immense pleasure in writing brief messages to the little ones, who in any case were pestering them to do it: “Mama, can you write me little secrets? Please, please, just one.” Obviously the adult never got away with writing just one word.

For reading entertainment, the children also had available to them a small chest with drawers labeled with numbers or themes (continents, geometric solids, objects in the classroom, etc.) in which there were slips of paper with ten words on them. A child read the words, cut them out, and taped them onto the objects corresponding to them in the classroom. We also had a drawer containing the first names of the children in the class. The children loved cutting out the names of classmates and taping them to the arm or chest of the child named. Another drawer had the names of animals, which were to be taped to the little animal figures kept in a basket.

We had lots of visits from inspectors, scientists, and journalists at Gennevilliers. They always left with pieces of paper taped to their skirts, pants, purse, and so forth. They might or might not notice this. A few of them realized when they got home after work that they had served as pedagogical aids, and sent me little delighted notes of surprise.



A child of four scotch-tapes the names of geometric solids on the corresponding objects.

READING SENTENCES

When the children had become sufficiently automatic in reading words up to three syllables, I wrote them short sentences. These sentences often called for them to carry out an action, which made it possible for me to be sure they had understood it. I made them gradually more complex. “Smile!” “Roll!” “Say ‘three’!” “Ring a bell!” “Roll on the mat!” “Say hello to a friend!” “Look at the ceiling!” “Cross the classroom, open the door, and close it.”

Various requests of this type, already written, were available to them on little printed and laminated “tickets.” Thus, as a parallel activity, children could also take one of these tickets on their own and play with it alone or with a classmate. More and more, they understood the implicit rules of silent letters—we didn’t have to underline them anymore. The same thing applied to the prepared tickets —as the children used longer and longer tickets, it was no longer necessary to

gray out the silent letters. Sometimes even, when they were writing out an action to be performed by a classmate, without any prompting, they included the silent final letters. By frequently reading words with a silent final *e* in the reading folders and elsewhere, the children's brains had discerned a regularity, an implicit rule.



A boy of four reads a prepared ticket inviting him to perform an action. The silent letters at this stage are still grayed out in order not to complicate decoding.

Up to this point, the instructional supports—reading folders and reading tickets—had been written in cursive script so as to present the letters to the children as they had first learned them. However—and no one really knows why or how—neuroscientists specializing in reading have found that once reading has become automatic and children can easily read sentences, their brain is capable of decoding any kind of letters. And it's true—once the children in the class were able to read sentences in cursive script, they were equally able to read print-style letters (upper- and lowercase) without our having to teach this to them. Once they were able to read sentences, they spontaneously attempted to read simple, printed picture books from the library. Either by themselves or with the help of older classmates, they discovered and decrypted these new characters. When they didn't recognize a letter or a group of letters, they would quite simply come and ask, "Céline, what's that?" pointing to the unknown letter. I would give them the answer and off they would go to continue their reading.

At this stage, when they had naturally begun to pick up small books to read, the children were confronted with new spellings, such as *ph* for *f*, *ee* and ea, *ew*

and *ue*, which encoded sounds that they knew already but in different written forms. At that point we had to present these *homophones.*[15] We had an activity for this. But in three years, I only had to present this activity three or four times, because the children learned the encoded sounds in new spellings without instruction by reading the books they liked.

We didn't use any more instructional material for reading. Once the foundations were laid, we turned our energy and attention toward setting up and maintaining a nice library, offering levels and kinds of content that could satisfy the needs and desires of every child.

READING BOOKS

Once a week we went to the public library to get new books. We did not choose books solely for their instructional value. I would even say we chose them mainly on the basis of the enthusiasm they were likely to arouse in the children —as opposed to in us, or in the school-district officials. And this is a very important point: once decoding had been learned, if the books they have available to read neither interest nor inspire the children, automatic reading will not occur. It is even highly likely that their ability to decode will regress.

At Gennevilliers, we noted that the books that were most conducive to automatic reading were books that made the children laugh. The children reread them dozens of times in a row, sometimes bursting into loud laughter that was shared by their classmates. The *King Daddy* series by Alain le Saux and the little books by Stephanie Blake and Mario Ramos were big hits. Of course we didn't want to limit the literary palette to these kinds of books, but to make available a great variety of themes, illustrations, and voices, so we could meet the individual interests of the children. The children's enthusiasm has to be the beacon that guides our forays into the ocean of children's literature.

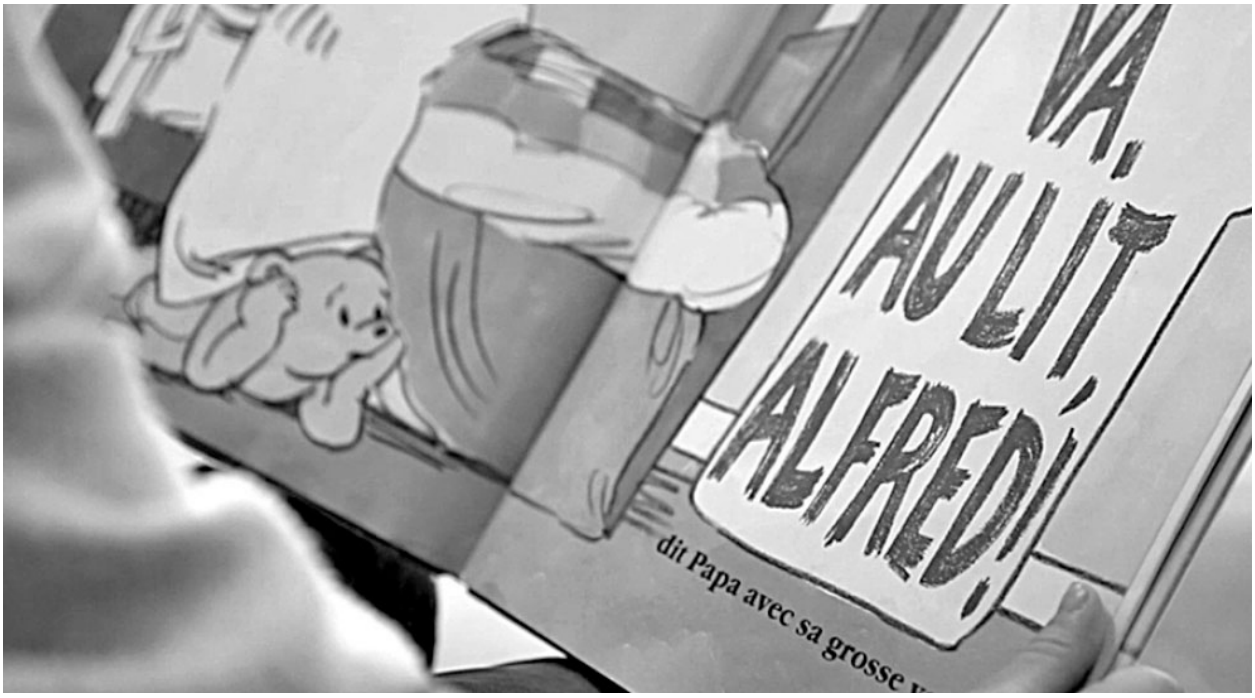
The library rapidly became a focal point of the class. This was the place where the children communicated to each other the desire to read, where they developed their bonds, where they laughed and talked together. We made sure this reading corner was well lit, spacious, comfortable, and conducive to order and calm. There were a great enough number of books on hand to attract the curiosity of the children, but not so many that it would lead to disorder.

I also read out loud lots of new stories during our daily group sessions. They would be lively and fun stories, not instructional ones. I read without

interrupting myself, very theatrically and with a great deal of humor. The children hung on my words, and the desire to read and let themselves be absorbed in a story grew in them. I generally did not stop every page to ask them what they had understood—I did that only when absolutely necessary. Instead my primary objective was to give them the feeling that reading could transport them to amazing places.

Sometimes I would ask Anna to very dramatically read some of the dialog while I took the part of the narrator. The children spontaneously emulated this pattern and would get into groups of two or three at a table and read books, taking different parts: for example, one child would be the narrator, and two others would voice the characters. They laughed, and they also got into arguments when one of them took the part supposed to be read by another child, but the conflict would soon be defused by their desire to continue. What a joy it was for them! What a tremendous urge they had to read and share their discoveries! Some of them spent the whole day reading and then continued at home. To the great surprise of their parents, most of them no longer wanted to watch television. They begged their parents to get books from the library. One mother recounted, “If she brings home ten books, she reads them that night…. She reads better than her ten-year-old brother!” A father wrote, “At night, she’s the one who reads the story in her mother’s bed.”

So the children set up their reading sessions either by themselves or in small groups and later would ask me if they too could read in our group circle. Every day or almost every day, a child or a small group of children read a story out to their comrades, acting out the voices.[16]



A little girl reads a story to her classmates during group time. (It reads, “Go to bed, Alfred!”)

Bear in mind that children in the class reached this level of reading using only six materials during their three years of preschool: the little objects for analyzing sounds, the rough sandpaper letters, a movable alphabet, ten reading folders, words on pieces of paper to be taped up, and a few booklets presenting the homophones (and these were used very little). The essential part of the instructional material was the *human part.* It was the live scaffolding, individual and dynamic, that Anna and I were able to provide to the children that made it possible for them to begin reading with joy and delightedly devour the tens of books that we got for them every week. The eminent specialist in the science of reading, Stanislas Dehaene, confirms that this living and nondidactic approach is essential. He urges teachers to focus their attention on teaching the alphabetic code to begin with, but once comprehension of the code is adequate, the best approach is not to present myriad instructional activities, but simply to foster the desire to read by creating an exciting framework for it within which children can be active.

In the same way that humans learn and naturally assimilate the irregularities of oral language by hearing it spoken and speaking it, children naturally learn the irregularities of written language by hearing it and *reading it.*

THE SPONTANEOUS BEGINNINGS OF WRITING

The sandpaper letters and digraphs are direct preparation for the movements of writing. In tracing them, the movements of writing become established as engrams in the child's brain. This is the reason the sandpaper letters and digraphs are presented in cursive form. This way the child's hand is prepared naturally and without effort for the style of writing of her culture.

Currently in France, in the public schools, we introduce children to writing by having them print in uppercase letters, although in reality they will never have to write or, for the most part, even read these characters. And then, after their three years of preschool, we ask them to abandon this kind of writing, and we sometimes get angry because they have trouble doing it. The reason we've been teaching this "stick" writing for decades is certainly because it seemed to us that straight lines were easier for children to make than the forms of circular writing. Now, for my part, I have never seen a child of three spontaneously fill a blank page with vertical and horizontal lines. Children of that age naturally scribble in a circular fashion, making lots of little curls on the page. At the time they enter preschool, tracing horizontal and vertical lines requires motor and inhibitory-control capacities of children that they don't yet possess. Simplifying to "stick" letters is based on an intellectual belief that, in reality, complicates the task at hand. It hinders and slows the acquisition of writing, which then seems laborious to children, and makes it more than likely that they will at first turn away from achieving this end.

So on the contrary, to aid in the development of writing in children, the relevant thing to do seems to be to refine the circular movement they naturally make by having them trace letters with their fingers. And once their motor capacity allows it, they will effortlessly make the shapes their brains have previously encoded. There's no need to make rows of attached cursive *a*'s. Having mechanically made the movement many, many times, once their motor coordination has matured at around the age of four, they will spontaneously write the letter. And since at the same time they will have learned to compose words by placing the movable letters in sequence, many children will *spontaneously* write whole words on loose scraps of paper: their first name, those of their classmates, or other words—in cursive script. We found dozens of little pieces of paper in the classroom with spontaneous attempts at writing on them, without ever knowing who their author was.



One of the first attempts at writing of a four-year-old child. He had asked to write his name by himself on the back of a little book of “tickets” that Anna had handed to him as I filmed the exchange. Note that he uses a print-style capital *K*, because we had made the decision in the class to write capitals in print style rather than cursive.

When writing began to happen spontaneously with the children, all we had to do was to help refine their shaping of the letters. For that we used notebooks, which the children were very happy to be using. They trained in writing letters, then words, then sentences (which they often copied from children’s books) between two lines. We gradually reduced the space between the lines. A few children of five finished their last year of preschool able to write in a very narrow interlinear space indeed.

THE IMPORTANCE OF VOCABULARY

When the child decodes *sssoooffffaaa,* he pronounces the sounds out loud and tries to assemble them. He is helped in this assembly by his personal vocabulary. If the word *sofa* is part of his vocabulary, there will be a click: “*Sofa*, the word is sofa!” If he doesn’t know the word, the click won’t happen, even if he has

assembled the sounds correctly. He'll look at you with big eyes and won't understand, although his reading was correct. The first steps are very much helped by this "deductive" element, and therefore by the richness of a child's vocabulary. After reading a word and apprehending the meaning of it, the brain registers the word and the meaning associated with it. The next time, it will read the word faster. By contrast, a child who has no access to the meaning will be greatly hindered in her progress, and her interest in reading will dwindle. As I have pointed out several times, richness, precision, and variety of vocabulary were a main priority in our class.

Once children know how to read, reading plays a big role in the enrichment of their vocabulary. The more children read, the more extensive their vocabulary becomes. And the vocabulary of those around them expands as well. Through their generous readings, the older children in the class enabled the younger ones to discover many words as they listened with beatific admiration to the older ones' stories. The little ones would sometimes catch themselves and interrupt their classmate's reading—more often than they would with an adult—and say, "Robert, what does that word mean?" Here again, the acquisition of vocabulary was "live"—active and interactive, dynamic and eminently social.

THE IMPORTANCE OF THE HUMAN BOND

Taking the time to offer each student special one-on-one moments, totally personalized, in which the whole of our attention and concern is devoted to them, is priceless. Our willingness to enter into relationship with each child and arouse their enthusiasm and trust is the primary force in the flowering of their intelligence. The instructional material plays only a helping role. It guides the teacher in the basic stages and supports the activity of the children by proposing relevant and appropriate objectives. But once we have become thoroughly familiar with the objectives of these instructional supports, we can almost do without them. So let us always remember that the material is nothing more than an ingenious crutch that we can lean on in helping the children. But it is the positive relationship—sustaining, collaborative, and respectful between the adult and the child—that is *the* central force in encouraging the flowering of their intelligence. We will come back to this point later on, but for now let us note that the essential tools that we made boundless use of at Gennevilliers were time, patience, respect, and acceptance of individuality. The interests and rhythms of each child were the focus of our efforts.

READING AND LIBERATION

I will conclude this chapter by recalling that transmitting to children the ability to read and the taste for it is not a small thing. Reading not only organizes thought, is not only the key to social integration and professional success—no: the ability to read is liberating. It gives autonomy and freedom to master any subject matter. No one knows better than individuals themselves what knowledge they lack for self-fulfillment, and reading is the means par excellence for possessing this knowledge in a fully independent manner. Our job in the end is not to guide children toward the fulfillment of what they are—or what we want them to be—nor to point them in the direction of overcoming their supposed deficits, but rather to give them the means to stay connected to what they are and to satisfy their creative urges by themselves. Love is one means to this, reading is another. Thus we have a big responsibility. In addition to our unconditional and compassionate support, one of the essential tasks that falls to us is transferring possession of the liberating alphabetical code to the children with delicacy, seriousness, and wonder, knowing that we are handing down a perennial treasure to its heirs.

It may be true that we don’t possess neural circuc07y especially for reading, but if nature is willing to reorganize our cerebral cortex to give over a network as important as the one built for the recognition of faces and objects to be used for learning to read, then it must be an acquisition that is fundamental for the development and evolution of humanity.

AT HOME

I am often asked if the instructional material for sensory refinement, for introducing culture, for mathematics, and for reading and moving on to writing can be used at home as well as in school, or for home schooling. I hope that through this book I am succeeding in communicating the elements of an answer to that question by making the point that the essential, whether at home or in school, is not the material but all the many living, rich, immersive, and real experiences we can offer our children: living and interacting with people of different personalities, knowledge levels, and ages; reading many stories with different tonalities and colors; singing, painting, sculpting, doing origami, drawing, dancing, playing freely, making music, laughing, traveling, swimming, observing animals, insects, nature; playing improvisational construction games,

building real cabins in the forest; or else simply taking the time to do nothing or to daydream.

Both in school and at home, it would be interesting to have children sign up on a voluntary basis for workshops or small groups devoted to animal care, gardening, painting, pottery, sculpture, climbing, theater, singing, judo, playing a musical instrument, dancing, cooking, repairing things, astronomy, nature exploration, yoga, and so on. In school, such workshops could be available all week, led by outside teachers or by parents who are experts in one of these areas.

It is all these activities, going on in a warm and supportive social framework in which children can explore, that are so very precious for the formation of their intelligence. It is these activities that nourish their plastic intelligence striving for mastery. These kinds of activities are irreplaceable, and we have to fight for them so that our children can gain the benefits they offer. The instructional material is only complementary. It is only an aid, a means of making certain real experiences still more engaging and refining them.

Thus if you are considering setting up a teaching situation at home, realize that it will only be of benefit for the powerful intelligence of your child if it refines the intuitions she is developing in the world and if it provides further comprehension of her real experiences. Meaningfulness is to our intelligence what oxygen is to our organism. The activities we present at home absolutely must be connected to real life in order arouse the enthusiasm and intelligence of the child.

There’s another element to take into account. The instructional material has little benefit when it is presented to a child *alone,* because a whole community of children of different ages is what makes it come alive. At home, you may have all the material and you may certainly have spent a fortune, but the essential will be missing, that is, the whole ecosystem that gives the material its depth and interest: younger children to whom your child can demonstrate the activities—thus consolidating what she has learned—as well as older children she can observe with admiration, from whom she can ask help and from whom she can learn an enormous amount. No adult can compete with this catalyzing social effect. A single adult, or even two, even three, even though they may have all the material at their disposal, can never make this material so alive and effective as the richness of a group of children of mixed ages can.

In sum, recreating a classroom at home with material for one or two children does not seem really worthwhile to me. The experience of a friend of mine who

decided to do home schooling for her little three-year-old boy made that clear to me a few years ago. She invested a lot of money to acquire the materials and organized a beautiful, luminous activity space. But her little one did not really take an interest in the material she presented to him, and he spent very little time in that space, which was a big disappointment to his mom. He was lacking the catalyzing effect of a group of children. In the place of the dynamic of emulation within a group, the child perceived the immense expectations of his mother, who wanted to teach him lots of things. But in spite of her love and her lovely material, my friend could not on her own supply the power and the variety of a socially rich situation to her boy.

I think a good compromise would be to choose the activities and materials that best suit the individual inclinations of our children, always making the effort to bring them to life within the framework of a galvanizing human community, and always as a supplement to rich, complex, intuitive, and non-instructional experiences in the world. So I invite readers to make their own choice, their own experiments, their own errors, and to always be guided by the manifest joy and enthusiasm of their children.

PART THREE

DEVELOPING FOUNDATIONAL INTELLIGENCE

8

The Periods of Sensitivity

In the first part of this book we have seen that intelligence is a particularly dynamic unity that changes its structure through its interaction with our experiences. We then explained that this plasticity is extremely strong and powerfully found in young children. In the third part of this book, we shall see that in the course of the brain's explosive maturation process in young children, it undergoes various periods referred to as "sensitive." These are periods during which specific abilities are established. At those times a tremendous proliferation of neural connections occurs within specific brain circuits. All children talk, stand up, touch everything around them, or want to do everything themselves at approximately the same age. For each of these successive advances, the brain, in a very organized and universal way, orchestrates the further development of its immature neural pre-wiring. When a child is passing through the sensitive period of language development, for example, the synaptic connections made in the language areas of the brain are extraordinarily numerous. Children are then fascinated by our speech—the words we use, the songs we hum. They experience the urge to gather the particular external information that will nourish this blossoming circuitry. When children are going through sensory development, they explore the world through their senses. They can't stop "touching everything."

These sensitive periods gradually gather in intensity until in a few months they reach a peak of plasticity in which the connections of one region of the brain become remarkably numerous. During these incandescent periods of brain formation, learning is rapid, joyful, and robust—if of course the child has the

opportunity to encounter the specific experiences that its intelligence is calling for. After this period, the number of neural connections occurring progressively diminishes, and the sensitive period fades. Learning the same things after this period will require conscious, repeated effort on the part of the child, effort that is often a strain because the brain circuits are a lot less plastic. So learning becomes much slower, much more strenuous and difficult. Thus these sensitive periods constitute veritable windows of opportunity that need to be recognized and not overlooked. Research tells us that what is being built during these periods is the foundation from which the future skills of the child will manifest and be refined. In the same way as its foundations determine the stability of a house, what the child builds during these times of increased plasticity will determine the quality of its future abilities.

"Behind that," Stanislas Dehaene explained in his course on brain plasticity at the Collège de France, "lies the discovery that the effect of inputs from the environment varies according to the moment when they take place."[1] Therefore we have to be alert and provide to our children what their development requires *at the time* it requires it—not before, not after, but right then. Before these periods, all efforts, however intensive, have little effect. After them, the organ or function in question gradually loses its plasticity, thereby making learning more and more difficult the further one gets from the privileged moment.

RECOGNIZING THE FORMATIVE PERIODS

The first thing that should alert us to the presence of a sensitive period is the pronounced interest of the child in some element in the environment or some activity, as well as the ease of learning she manifests. Thus when we see that she is very attentive, very quick to learn, it is very probable that she is passing through a period of creation with a great deal of latent potential that needs to be nourished.

And when the marriage between inner needs and external responses is a good one, the child manifests extraordinary satisfaction and a state of calm. She radiates luminous enthusiasm. Concentration, fascination, speed on the uptake, ease, joyful satisfaction, and calm are the external positive indications of the presence of a sensitive period.

TWO SENSITIVE PERIODS IN THE FIRST YEAR OF LIFE

During the first year of its life, the child passes through two major periods of sensitivity during which the language circuits and the sensory circuits of its brain produce neural connections and mature at a great rate.

Have you already noticed the intense concentration with which your baby listens to the words you speak to her with tenderness? Have you already observed how she smiles and how our words seem to fill her heart with joy? This lively, concentrated interest and this obvious joy indicate that the baby is already, only a few hours after its birth, going through a period of strong sensitivity to language. This sensitivity to language started even before she was born, and from the moment of her arrival in the world, the newborn is already "tuning in" to aspects of the language of her environment in order to create her own linguistic capability. Research tells us that when we speak to a newborn, the musicality and sonorities of our words are already activating the neural circuits that pre-equip her for language.[2] And that is the reason that for countless ages, we have been singing pretty lullabies to our children. Thanks to these "instructions" we are inadvertently giving and that make our babies totally happy, within four days of their birth newborns are capable of recognizing the particular musicality of their mother tongue and of preferring it to other languages![3]

The sensitive period of language thus happens very early. It begins before birth and reaches a peak of plasticity before even age one. So although they cannot yet speak, children are already very powerfully assimilating the regular features of their language and other general impressions about it. They will begin to say their first words based on the information they may have gathered months before. This inner, invisible activity secretly precedes and prepares the linguistic abilities of the child. This unseen phase of maturation is fundamental. The good news is that most parents already realize unconsciously that it is going on, because in spite of themselves, they can't resist commenting out loud on everything their child does during the first year of life.

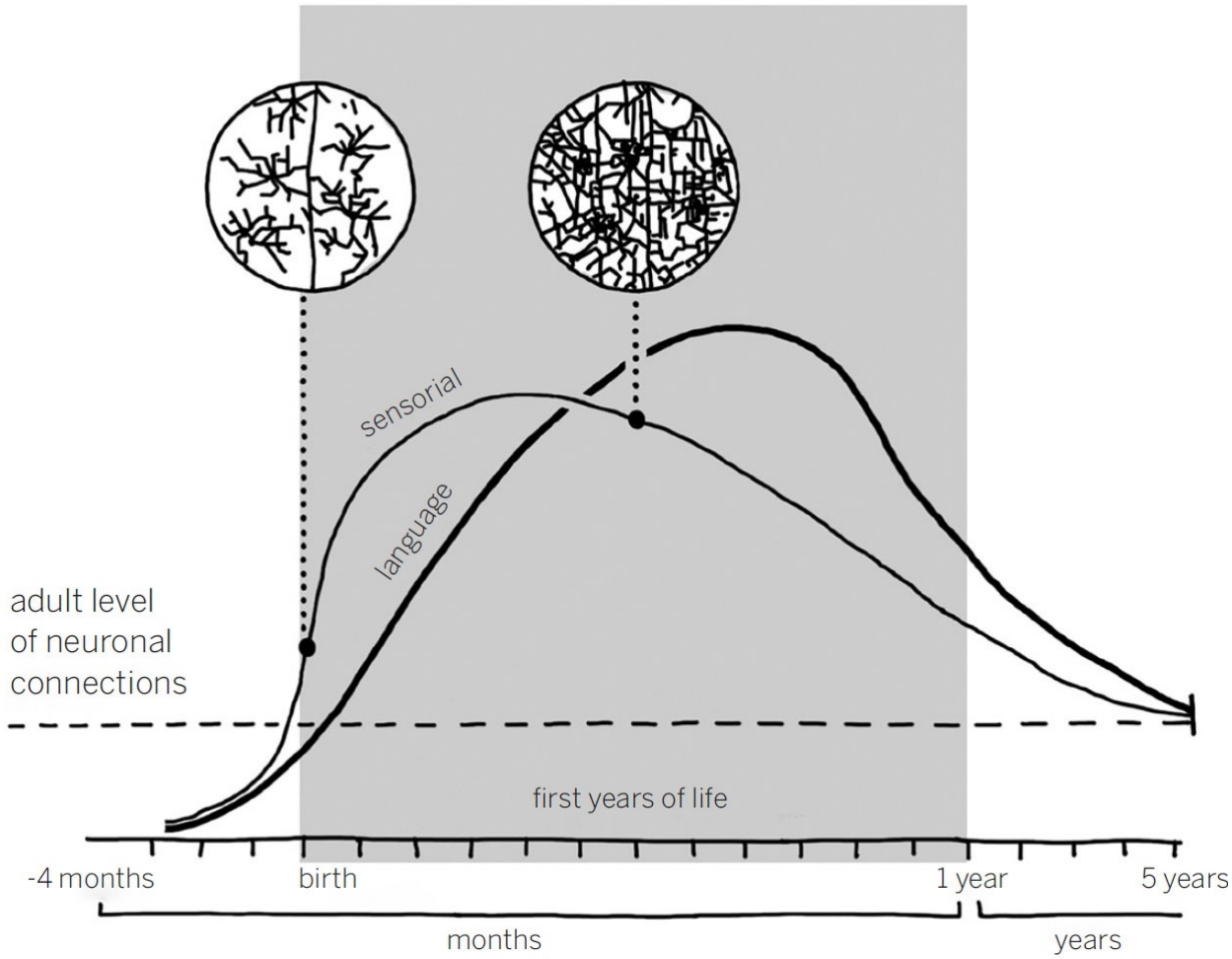
This information coming to us from neuroscience research is exciting. It confirms that the pedagogical attitude we adopt instinctively toward our children is guiding us toward the right kind of scaffolding. We are right to do what we are already spontaneously doing, and we should go on doing it with confidence.

In the first year of its life, the baby goes through another major sensitive period, also very early on—that of sensory development. Nearly from the beginning, it is exploring the world around it, again very avidly and with an

extraordinary degree of concentration. It observes, touches, tastes, listens, and so on. During this period we have a great deal of difficulty keeping it from touching everything and from putting everything in its mouth. Of course this is completely normal, because the baby is working on constructing the foundations of its intelligence. It has to gather a great deal of information about the world through the channel of its senses, and try though we may to keep it from touching such and such an object or putting some other object in its mouth, it *must* do it in order to nourish its fast-developing intelligence.

These periods of linguistic and sensory construction are explosive. Starting at ten months, the number of neural connections being formed diminishes significantly until finally, at the age of three, they reach a level more or less the same as that of an adult!

So at three, when a child begins preschool, it has already laid its linguistic and sensory foundations. It is no longer in the stage of creating its abilities; it is entering into a phase of refining what it has already built. The incandescent, explosive, foundational period of forming sensory and linguistic abilities takes place mainly during the first year of life, when the child is driven by a vital and urgent passion to explore the world and to soak up our words. This period builds the foundations on which human intelligence relies for its further development.



During the first year of its life, the infant passes through two major periods of gathering sensory and linguistic impressions. What it accumulates then will serve as the basis for the deployment of its future intelligence. Graph inspired by the scientific graph of Lawson Parker, entitled “Neural Network” in “The First Year,” *National Geographic* (January 2015). Sources: Charles Nelson, Harvard Medical School; Pat Levitt, Children’s Hospital, Los Angeles; also in the paper of the National Scientific Council on the Developing Child (2007), “The Timing and Quality of Early Experiences Combine to Shape Brain Architecture, Working Paper 5” (2007); see also C. A. Nelson, *From Neurons to Neighborhoods* (Washington, DC: National Academies Press, 2000).

However, it is important for us not to see in this information a reason to overstimulate our children with linguistic or sensory impressions during the first year of their lives. As I already pointed out in the first part of this book, this data should primarily remind us of the importance of supporting all the things that our child is doing spontaneously. It is enough just to facilitate its spontaneous explorations of its real-life environment, which should be secure and of decent quality, and to give priority to the daily warm linguistic interactions it loves so much. It is not necessary to do anything extra. The point is simply to be aware of

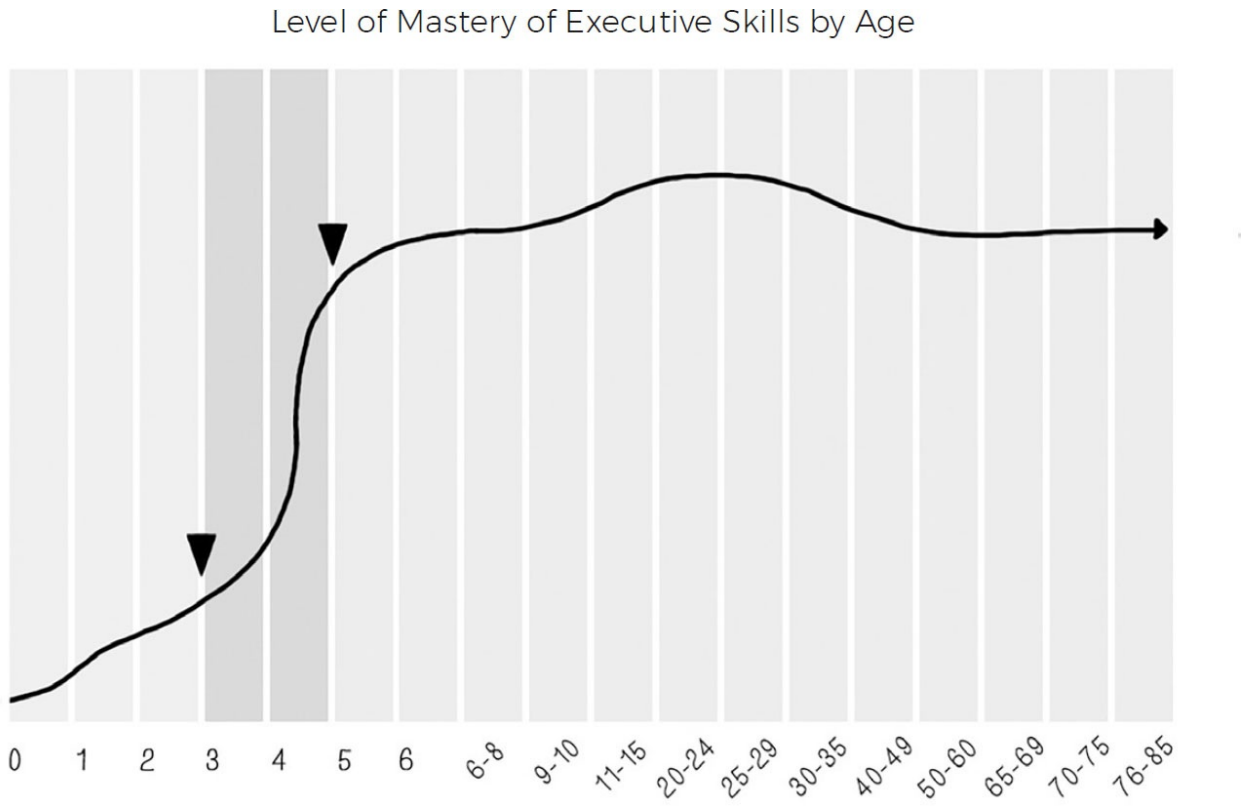
the importance of all these little everyday things that we already naturally do with our child, and to protect them.

In the preschool class at Gennevilliers, as I have already mentioned a number of times, we gave a high priority to language. It is enough just to look at the graph on the previous page to see why that was essential. We wanted to take maximum advantage of the window of plasticity in language development, which is already beginning to close at three years of age. That does not mean that once this period is over, children can no longer expand their linguistic capacity. They can still do that, thanks to the plasticity of the human brain, a plasticity that lasts throughout our lives. Nevertheless, what is built during these sensitive periods requires no effort and is solidly established as engrams. After these periods, children can pursue the formation of their intelligence on this firm basis.

It is pointless to try to impose our program—nature already has hers. The embryonic human potential of which the baby is the depository is going to attempt to develop itself further in the course of the sensitive period. All the children in the world are going to passionately explore the world sensorially and immediately put back in their mouths the object that we have just confiscated. All of them are going to stand up at approximately the same age, and all of them are going to launch themselves into the project of taking their first steps around the age of one. All of them, from birth on, are going to manifest a lively sensitivity to the language of their environment and go through a veritable explosion of language somewhere around the age of two.

THE DEVELOPMENT OF EXECUTIVE SKILLS

We pretty much take these universal times of maturation for granted. We *know* that children walk and speak around the same time in their lives. What we are much less aware of is the other potentials children have, like the potential for what are known as *executive skills*, even though these are the foundational skills of our intelligence, without which human beings simply could not function properly. These skills also develop during the first year of life, with a period of explosive growth between ages three and five.



The executive skills develop a little after birth. It is essential to support their development starting in the first year of life. The period from three to five represents an important window of opportunity during which these skills grow very fast. Source: Center on the Developing Child (2012), “Executive Function (InBrief).”

Executive skills are skills that allow human beings to be autonomous and attain the goals they set for themselves in an organized, controlled, and well-ordered manner. When they are developing these skills children are driven to act on their own in order to exercise them. They then firmly reject our aid, first with a hand gesture when they can’t yet speak, and then when they can, they confidently ordain, “Do it self.” If we are able to respect this need and if we help children to do everyday things by themselves from the earliest age, they will naturally develop these essential functions. And in fact we see that these skills are often more predictive for overall professional and social success than IQ.

Supporting the development of these foundational skills was one of our main preoccupations in the preschool class at Gennevilliers, and it was one of the key factors that allowed us to have such a positive impact on the children.

9

The Executive Skills

The executive functions are essential. They are the cognitive skills that make it possible for us to function, to act in an organized fashion in order to attain our objectives. The experts highlight three main functions:

- *Working memory*, which represents the capacity to retain information in one's memory for a short time.
- *Inhibitory control*, which represents the capacity to control oneself, to concentrate, and to inhibit distractions.
- *Cognitive flexibility*, which represents the capacity to detect one's errors, to correct them, and to be creative.

When we want to undertake something, whether it is doing the dishes, solving a mathematical problem, making a declaration of love, initiating a dialog, learning to play the piano, or devising a system to clean up our polluted oceans, we have need of these three skills. To attain our goal, whatever it is, we need good *working memory* in order to hold in memory and organize a variety of information; we need good *inhibitory control* to stay concentrated, control our impulses, our emotions, our inappropriate actions; and finally, we need *cognitive flexibility* in order to readjust our strategies in case of error and act with flexibility and creativity. These three skills sustain our functional intelligence and our ability to make an impact on the world. They provide us with the possibility of accomplishing whatever our intelligence commands, of acting successfully, and of swimming with confidence in the great pool of life.

In schools, teachers are frequently confronted with pupils who have

underdeveloped executive skills. If they have weak inhibitory control, the least distraction makes them lose their concentration, they have trouble waiting for their turn to talk or to carry out an action, and they have trouble controlling their emotions. They easily get into conflicts with their classmates, resort more readily to violence, and show little perseverance. If their working memory is not developed enough, they forget instructions, they have trouble organizing their actions, and they do not recall the meaning of the paragraph they have just read. Finally, if they lack cognitive flexibility, they have great difficulty in reorganizing their actions when needed, get easily discouraged if their strategy does not work, and do not necessarily recognize their mistakes. According to the Center on the Developing Child at Harvard University, "Even when only a couple of the children have underdeveloped executive function abilities, an entire classroom can become disorganized, and precious time will be diverted from productive learning activities. This can have a profound impact on the overall climate of the classroom and is often reported by teachers as a source of exasperation and burnout."[1] These children themselves feel at a disadvantage in relation to their classmates. They are not capable of following the complexity of a game, for example, and thus may well find themselves sidelined by their peers.

On the other hand, children who have developed good working memory, good inhibitory control, and good cognitive flexibility get better scholastic results and, when they are older, succeed better in exams, get into better universities, get better jobs, have stable social relations, have better health, and are less subject to food and drug addictions. But beyond that—and this is what really interests us here—they have the means to learn anything they want to learn and to attain the goals they set themselves in life. Moreover, these skills are considered by the experts to be the biological foundations of learning. The Center on the Developing Child at Harvard notes in a report: "In many ways, coming to school with a solid base of these foundational executive function skills is more important than whether children know their letters and numbers."[2]

THE BIOLOGICAL FOUNDATIONS OF LEARNING

When these skills have been solidly developed, children are capable of retaining information, organizing their activity, controlling themselves, and seeing and correcting their errors. They find innovative solutions when needed and show perseverance. That is why the development of these skills was a priority in the class at Gennevilliers. We did not hesitate to spend a great deal of time on

developing them, holding back when necessary for several months the presentation of activities with more "academic" goals, like mathematics activities or language activities. In any case, the children would not have retained the content. We had to concentrate on the essential—the rest could wait.

It was very striking to find that once these skills had matured further—that is, once the children were capable of functioning in an orderly way in the daily routine without constantly needing the help of an adult—they assimilated basic knowledge with great ease, speed, and pleasure. Finally, as the eminent scientist Adele Diamond, who is an internationally known specialist in the development of these skills, often points out,[3] the best way to help our children acquire academic knowledge is not to focus on teaching this material but rather to facilitate the development of the executive skills that will allow the children to effectively master the material.

MORE PREDICTIVE THAN IQ

Many studies show that the level of development of executive skills is frequently more predictive for success and overall progress than IQ. One very well-known test, called the "Marshmallow Test,"[4] was designed to measure the relationship between the level of inhibitory control and adult success. Five hundred children of four years old were tested in the following manner: a marshmallow was placed in front of the child, then the experimenter left her alone, seated in front of the marshmallow, for fifteen minutes, saying before leaving the room, "If you don't eat the marshmallow while I'm gone, you will get an extra one when I come back." Not all the children showed the same level of patience. Some of them had great difficulty in putting off immediate satisfaction and waiting for the experimenter to return. The experiment had the following revealing results: The children who were successful in delaying immediate gratification and waiting for the experimenter to return did not necessarily have higher IQs, but several years later, the children who showed greater capacity for self-control at the age of four had more friends as teenagers, managed their stress better, had higher self-esteem, expressed themselves better, got into better universities, and had more satisfying jobs when they reached adulthood. Moreover, they had fewer alcohol and drug problems at the age of thirty-two and were in better health—no matter what their IQ was.

"Providing the support that children need to build these skills at home, in child

care and preschool programs, and in other settings they experience regularly is one of society's most important responsibilities," we are told by the Center on the Developing Child at Harvard. Because, "contrary to popular belief, learning to control impulses, pay attention, and retain information actively in one's memory does not happen automatically as children mature."[5] As fundamental as these skills are, we are not equipped with them at birth. As with language and all our embryonic skills, we are born with the *potential* to develop them—or not—depending on how much opportunity we have to exercise them.

The good news, once again, is that all that is needed to permit the full development of these skills is simply supporting the spontaneous activity of children and not hindering it. There's no need to come up with pedagogical methods from another planet. When children try to do things by themselves, we just need to be ready to aid and encourage them. Their spontaneous drive toward independence is the *outer* manifestation of an *inner* maturation that is creative, sensitive, and fast.

We will see in greater detail further on how we helped our children to develop these essential skills during their three years of preschool. But before getting to that, I would like to talk about an important point that I had learned intellectually from research, but that it took me three years of experience to truly integrate and understand. I think it is a key piece of information that I did not perceive as such before Gennevilliers.

BETTER SOCIAL RELATIONS

If we are equipped with good executive skills, we also wake up socially. We are better able to control our emotions and express them, analyze situations, manage our stress, and relate to conflict situations through appropriate and accurate decisions. As a result, we are better able to enjoy harmonious, lasting, stable, and well-developed social relations—research is very clear on this point. But this information seemed somewhat trivial to me before my experience with the children in my class. It seemed all too obvious, taken for granted.

But there is a big difference between words on a page and real experience with children three, four, and five years old who have developed good executive skills. Children being capable of controlling themselves, of taking a step back in situations of conflict and emotion, of analyzing and expressing their emotions calmly—none of that can be taken for granted. I *knew* that it would happen, it

seemed completely logical to me, but I had not experienced the real impact of it. I was as surprised as the parents were by these changes in behavior. We did not *aim* at creating such developed social capabilities in the children; it was just one of the consequences of the good development of their executive skills. The recreation director of the school told me one day in front of the camera, “We often have new activity leaders at the school, but they all very quickly identify the children in your class on the playground by their behavior. They’re calmer, they’re not afraid of us, they speak to us as equals, and they know how to sort out their conflicts by themselves without having constant recourse to an adult.”

10

Promoting Day-to-Day Autonomy

When their skills develop, children want to do everything “by myself.” They want to walk by themselves even if they can hardly stand up; they push our hand away in order to eat by themselves when they can still barely hold a spoon. They want to put on their clothes by themselves, put their shoes on by themselves, sweep with a broom by themselves, get the laundry out of the washing machine to help us hang it out, and may even spontaneously try folding towels. They want to do concrete, real things that fully engage their functional intelligence. All these simple activities do in fact allow them to exercise their developing executive skills in an optimal fashion. Children have to *memorize* a sequence of actions covering a short period of time and plan them out in order to attain their objective. They have to *control* their movements, their impatience, and external distractions; and most important, these real activities immediately show up their mistakes, which allows children to quickly readjust their strategy and to show *flexibility.* If a shoe is put on wrong, children see that and have to find a solution; if the clothes fall off the clothesline, they see that and have to figure out how to make them stay on. Thus these activities exercise not only children’s working memory and inhibitory control, but also their cognitive flexibility. They see their errors in a completely neutral way, look for solutions, and keep at it, sometimes showing great creativity.

A longitudinal study[1] confirms that by permitting children to realize everyday activities of this type, we give them a better chance of becoming well-developed and autonomous adults—and this is true no matter what kind of social environment they grow up in. Researcher Marty Rossman studied the lifestyle of eighty-four three-year-old children and then checked on them again at the ages of ten, sixteen, and twenty-five. The results were amazing: those who had taken part in household chores from the age of three had more highly developed self-control, sense of responsibility, and autonomy as adults than those who had

never performed household chores or who *had only begun performing them as adolescents.* They also had better relations with their families and their friends, better academic records, and were more independent financially. The researcher concluded that participation in domestic tasks from the age of three was a determining criterion—more than IQ scores—for success as an adult. So let's allow our three-year-olds, who are just asking for it, to use that broom!

It's not that little children are manic. Rather the fact is that all everyday jobs nourish their developing executive intelligence. Between three and five, children avidly seek out activity the way butterflies go after flower nectar in the spring. Teachers, haven't you noticed how the little ones push one another aside to get to be the one to pick up the pencil you dropped, to pass out notebooks at the end of the class, or to wipe off a table full of paint? Their functional intelligence is crying famine. They are willing to lie and to push each other out of the way to get to be the one who gets to pass out the paper plates at snack time. Schools put children in the absurd situation in which they are deprived of active and real activity at the very time that their functional intelligence is in the peak stage of development. Then they get scolded at the age of six because they do not have the ability to memorize, to plan, and are not able to exhibit autonomy, self-discipline, flexibility, or creativity.

The absolute demand of little children to do things by themselves is therefore not willfulness and not manic; it is not happening merely by chance and it is not a particular trait of character. It is a manifestation of their intelligence demanding to engage. And when it does engage, don't try to hold it back—you will just be exposing yourself to an outburst of resentment. The intelligence in the peak intensity of its developing stage will defend itself against you with unexpected force.

WHEN THEIR INTELLIGENCE DEFENDS ITSELF AGAINST US

Let me tell you a story that illustrates this very well. In our class, we had a three-year-old who was accustomed to having everything done for him. In the morning, he sat on the bench in the hallway, totally passive, his body slack and his gaze lost in space, completely letting himself be taken care of by the adult who was taking off his shoes and putting on his slippers. In the class, he was completely aimless. He bumped into chairs when he walked around, fell often,

and was incapable of selecting any appropriate and constructive activity. Doing things by himself was really of no interest to him. He spent his time annoying his classmates and destroying the classroom materials. I decided one day to ask the adult who accompanied him in the morning to leave him with me for a few minutes before it was time to go into the classroom. I took on the job of helping him take off his shoes, put on his slippers, and put his things away on the shelves. I also took the time to explain to his parent why I was doing that. I wanted to help her child do things himself so that he would be able to learn better and control himself better in class. The parent thought that was a somewhat crazy idea, but she agreed.

The following days, in the morning, at noon, and at the end of the day, I stayed at the child's side, showing him how to take off and put on his shoes, and how to put his things away, hoping that would arouse the desire in him to do things on his own. After only two days, he picked up a taste for doing things for himself. He seemed to take great joy in it. And then right away in class, his behavior began to change little by little. He was calmer, he took pleasure in selecting one or two activities on his own, and he persevered longer in them. This shows the great advantage of the sensitive periods. While children are still at a high point of plasticity, anything is possible, and it happens very fast. This was a big victory for me. This child had been reconnected with the inner urge that drove him to develop his intelligence through his own activity.

However, on the third day at noon, when the child had gone out into the hallway with his classmates to put on his shoes by himself at a leisurely pace, I heard a piercing scream. It was such a primal cry that I didn't even recognize the voice of the little boy. His grandmother had arrived before the bell rang and, being in a hurry, had grabbed his shoes out of his hands and had tried to put them on him herself. The little boy had grabbed his shoes back and taken off running toward the school exit, squeezing them to his chest, with his grandmother in hot pursuit—and me right behind her, trying to catch up to both of them. The child stopped halfway down the hallway at the bench of another class, crying and fearing another attack by his grandmother. "Bad boy!" she was shouting. "I'm going to put your shoes on for you. We're in a hurry!" "I think he only wants to put them on himself," I said to her, "and I think it's important for him. He wants you to let him do it." And I put myself between him and his grandmother. "Go ahead," I said, "put on your shoes. Your grandmother will wait. I'll stay here." Though still sobbing, the little one calmed down and put on his shoes, applying himself mightily, under the angry and impatient eye of his grandmother.

This story illustrates well the real nature of the reactions that we can sometimes take for mere self-will. When we are short on time and we refuse to let a child button up her coat herself, if she protests violently, *it's not her* who is resisting our heavy-handedness; it is the whole of the intelligence of humanity that is squawking because it sees an obstacle to its development. This is a *negative* sign of a sensitive period. And let's be clear, even if your child loves and respects you, she will fight with all her might against you in order to follow her biological directives.

Maria Montessori compares these moments of intense rebellion to the alarming fever spikes that are characteristic of young children. "As we know, it is quite common for a child to have an alarmingly high fever as a result of slight ills that would leave an adult practically undisturbed; but a child's fever can disappear as easily as it comes. Similarly, at the psychic level, there can be a violent agitation arising from a child's exceptional sensitivity without a proportionate outer cause."[2]

DON'T GET IN THE WAY

Allowing children to fully develop their executive skills, which are fundamental for the formation of their intelligence, is within the reach of all of us. All we have to do is not prevent it from happening. Instead we have to promote the spontaneous, creative, and formative activity to which the child is naturally driven. The Center of the Developing Child at Harvard University is very clear on this point: favorable environments for the executive development of children are those in which adults, starting early on, progressively lead children toward increasing their mastery of autonomous behavior. Adults can do this, for example, by helping children dress by themselves, clearly express their ideas, make decisions in everyday matters, fold their clothes, make a fruit salad, or help children younger than they are—all the while looking to step aside more and more and finally cease intervening altogether. In fact it is of the utmost importance during this period to learn not to be too invasive. Only the children themselves, through their own activity, can build *their own* executive intelligence. We adults cannot build *their* intelligence on their behalf through *our* activity. We can only help them from the very earliest age to do by themselves whatever they are able to do by themselves, guiding them, encouraging them, and then progressively getting out of the way. Nothing more. No need for extraordinary activities. In the first years of life, the ordinary is extraordinary.

As I was preparing to write this part of the book, I witnessed a scene that is very representative for this period. A child of around two was walking in the street with his grandfather, holding his hand. They were about to go down a stairway that I was about to go up. We were going to pass each other. As they started down the first step, the grandfather continued to hold his grandson's hand to make sure he would get down it safely. It was amazing then to see the wonderstruck and triumphant look in the little boy's eyes as he realized that he would soon pull away from his grandfather's control and exercise his capacity for autonomous action in a very stimulating way. And that's what happened. He tugged on his hand to get his grandfather to let go. The grandfather resisted, but the little boy's command wasn't long in coming. "I do it self!" the little one said in an assured tone. The grandfather released his grandson's hand, with caution but also trust. The child spontaneously grabbed onto the railing to make sure of his own safety, and climbed down the stairs at his own pace under the supportive and benevolent eye of his grandfather. It was such a simple scene but at the same time one that was doubly moving for me. Two great forces were shining forth here: the *spontaneous will* that was driving the young human to master the world through his own activity, and the *love* that led this adult to wait patiently for the child to complete his quest.

DAY-TO-DAY AUTONOMY IN THE CLASSROOM

Since at this age children are building the essential functions of their intelligence through autonomous but guided activity, promoting autonomy was the primary criterion we applied in setting up our preschool class in Gennevilliers. The whole environment as well as the human scaffolding was intended to allow, support, and facilitate the children's autonomy.

We helped and encouraged the children to be autonomous all day long. They had to select on their own the activities they wanted to engage in (out of those that we provided), and we encouraged them to work on them independently all the way through to completion. Obviously, we made ourselves available when the children needed us, but they themselves had to put away the material they had used when they were done with it. We encouraged them to get dressed by themselves after nap time, to wash their hands by themselves without getting water on the floor, to go the bathroom by themselves, to unroll and roll their work mats in an orderly fashion, to blow their noses by themselves when necessary, to sweep up the scraps of paper left on the floor after their scissors

activities, to wash a table soiled with paint by themselves, to dust off the instructional materials, to get rid of the dirt on an activity mat by brushing it off, to fold and put away their own things, to put their chairs back in place quietly, to walk around the mats on the floor instead of over them, to open and close the classroom door quietly, and so on.

We took all the time needed to help the children achieve autonomy in their minor everyday actions. Because once the children were autonomous, were able to memorize various actions, to plan them, to exercise self-control, to stick with things, and to correct their errors by themselves without calling on an adult, they became calmer and more sociable—and more joyful too! And then they were able to get on very quickly with the basic learning processes. So we devoted the majority of our time to showing them individually all the actions they needed to be able to perform in order to function autonomously.

We were in no hurry to get to the presentation of cultural instructional activities, especially the first year. Most of the children were not yet at all autonomous or were only barely so. They were incapable of making choices by themselves or working all the way through an activity by themselves, and they had great difficulty concentrating and memorizing. So our priority lay elsewhere. We waited six months to present the letters of the alphabet to some of the children in the intermediate section (four-year-olds). I recall a very lively little girl, who talked and moved around a lot but was absolutely incapable of remembering anything or of expressing herself clearly. She wandered around the classroom, unable to choose an activity among those we had made available to her; and when she did start one, she didn’t finish it. I had in fact tried to show her some of the mathematical and language activities, but she didn’t remember anything. This little girl was way behind. She was bad at counting compared to the other children of her age and didn’t know any of the letters. I have to admit that I was worried, and despite my theoretical knowledge, I regularly continued to present the beginning parts of the mathematical and language activities to her for fear that she would not acquire even the most basic knowledge. All in vain. I had a lot of trouble getting her attention, and when I did, the following day she wouldn’t remember anything anyway. In the end, I could do nothing but wait, hope for the best, and focus my scaffolding efforts on developing her autonomy.

For six long months, this little girl participated only in practical activities. She took care of plants, washed tables, and spent lots of time looking after the little ones. She also learned to make knots and to paint and leave the easel spotless when she was done. Slowly her behavior changed and became more structured.

One day she asked me to show her the letters, which I did. She still had much more difficulty remembering the letters than her classmates. I showed her a few of them from time to time, but without pushing too hard. However, when one of her best friends in the class got off to an explosive start at reading, she also wanted to learn. Many of you will probably not believe this, but this is what happened: within a few days, this little girl, who was now more in possession of the cognitive means to attain the goals she set herself, learned to read *all by herself*, with no more help than her daily exchanges with her friend. And she did it with *no difficulty at all.* Anna and I were totally stupefied. I still find myself very moved today, remembering the initial difficulties this little girl had, to tell you that she became one of most fluent and effortless readers in the class. Her stunned mother told me, “She reads better than her brother who is in the fifth grade!”

TAKING TIME TO DEMONSTRATE CLEARLY

When we demonstrated acts of autonomy for the children—for example, when we demonstrated rolling and putting away activity mats—we did it in a clear, slow, precise, and logical manner to allow optimal absorption of these movements by the children. And to achieve greater cognitive clarity, we avoided language: we demonstrated the actions without speaking. This was because speaking during the demonstration would have hampered assimilation of the actions by creating dual-tasking (listening and watching). It would have directed the attention of the children more to what I was saying than to what I was demonstrating. Now, the main objective of these demonstrations is to effectively transmit an action that will facilitate autonomy. Nevertheless, of course we named all the materials before the demonstration and talked about it afterward with the children if necessary. But with the little ones, we were really careful to separate the two tasks: either we talked or we acted. This was because for them these two activities demand an intense cognitive effort; therefore they had to be dissociated in order to avoid a cognitive conflict. When the two were divided, they could assimilate both movements and vocabulary.

In the course of these slow and silent demonstrations, the children concentrated fully on our movements, fascinated, hypnotized. Some of them watched the entire demonstration with their mouths partly open and without even blinking.

In order to for them to be able to exercise their inhibitory control and their

working memory optimally, we had the children wait until the end of the demonstration before reproducing it. “First I’ll show it to you, then it will be your turn to do it.” That way the children had to *inhibit* their desire to start doing until the end of the presentation, while *keeping in their memory* the series of movements to be executed and the goal to be attained. This was an extremely effective way of training inhibitory control and working memory.



Anna shows a little boy how to roll his mat properly. Afterward, the child will be free to try it himself.

The first few times, most of the children had trouble successfully executing the series of movements we presented, but we let them work on it and find solutions for themselves. We didn’t help the children unless they asked us to or unless they were on the verge of getting discouraged. We did not intervene before that point because all the time the children spent trying to find solutions on their own was time they spent exercising their executive skills in an extremely effective way.



The children did not immediately succeed in reproducing, in as orderly a way, the movements we had shown them. But with time, practice, trust, and perseverance, they got there.

We would also explain the purpose of each little demonstration: “I’m going to show you how to roll your mat.” This is a very important point, because without knowing the purpose, the child would not have any reason to remember the movements she was being shown, no reason to plan them out, no reason to remain flexible in her strategies. She would simply be lacking any definite goal. Nevertheless, let us make no mistake here: the main purpose of these activities is not an external one, it is an internal one.

THE OBJECTIVE IS AN INNER ONE

The primary objective is not for the child to correctly roll up her mat, wash, pour water, put on her shoes, or perfectly fold her laundry. The main objective of these activities is to provide situations that let her practice her executive skills by *trying* to wash, to screw a screw, to put on her shoes, or to fold a piece of cloth perfectly. The essential thing is what the child is building within herself in attempting to attain the goal we have set for her—it’s the effort she puts out. That is why it is important to propose to the child an activity she can’t succeed in

right away and that will require a major executive effort from her—while always being careful not to let her get discouraged. We should note that a child who succeeds immediately, without difficulty, in an activity proposed to her should be given the chance to practice with an activity of a more stimulating level of difficulty, even at the risk of annoying her and, in some cases, of her starting to annoy her classmates.

It is also very important not to interrupt a child who is repeating an activity many times, even if the external objective has already been attained: a child who is washing a perfectly clean table, even for the third time in a row, or who is buttoning and unbuttoning the same button for the tenth time, should be allowed to continue undisturbed. Because what is totally motivating him is not the *finality,* the achievement of the final goal—it's not the clean table or the buttoned button—but all the activity in itself that is allowing him to exercise his executive intelligence in full formation. When children repeat something in this way, they seem totally absorbed in their activity. They are driven to exercise their executive intelligence in the same way as they are irrepressibly driven to explore when their sensory circuc10y is developing. Their engagement and concentration are astounding.

OUR ATTITUDE

When children are trying to do things by themselves, our primary responsibility —and our main task—is to restrain our reflex to want to help them to "do it properly." Because by indulging that reflex, we short-circuit their creative activity. Our job is to show the children a few key movements to get them started and then let them do things themselves, remaining at their sides so as to be able to offer discreet and noninvasive support but progressively stepping aside completely. This mental posture represents a real balancing act for us. We have to be able to give help that provides orientation but does not get in the way.

As I see it, this kind of scaffolding is based on the following three points:

- clearly demonstrating the key actions;
- then letting the child carry them out and find the solutions to his problems;
- providing discreet help (pointing the way) before he gets discouraged.

This approach requires some practice, but it is indispensable. Because, as paradoxical as it may seem, children only learn by themselves—*all by*

themselves. They need our help to fully win their independence. They need us to provide them with the key elements so that they can then explore on their own, and they need our watchful presence in order to take risks. Our presence, therefore, is indispensable. But it is also indispensable for us to be able not to substitute our activity for theirs and to know how to increasingly fade out of the picture. The Center on the Developing Child at Harvard clearly explains that the more the adult encourages and *helps* the child to win her autonomy by showing her how to do things and then progressively fading away, the greater opportunity the child will have of attaining full development of the essential cognitive functions of her intelligence.

PRECISION

We always presented movements and actions very precisely. Precision generates immense pleasure in children, because it presents a very effective challenge to their quickly developing executive skills. To attain the same precision as we presented to them, the children had to do more *memorization* of the order and exactitude of the movements, *control* them better, and correct them accurately.

The more difficulty a child had in concentrating or controlling his movements and emotions, the more we had to be sure to pick out an activity that required great precision, and moreover, we would exaggerate the precision of the movements in our demonstration. This precision attracted his attention and demanded total concentration from him. Occasionally children had their hands tremble as they were trying to reproduce these movements because they were trying so hard to control their own movements.

Gradually the children developed better inhibitory control, which in turn reinforced their ability to control their emotions and manifest self-discipline. This transformation could be rather rapid. Sometimes in a few weeks, agitated children whose behavior was rather unpredictable and uncontrolled, who were incapable of waiting a few seconds so as not to interrupt one of their classmates, became much calmer, more attentive, and showed a quality of self-control they would have been incapable of a few weeks earlier. Starting with the first year, this was the transformation most noted by parents. They observed a new and spontaneous calm and discipline in their children, even at home. I have no doubt that this positive evolution on their part was due to the practice of the real, everyday activities we had presented to them.

INDIVIDUAL GUIDANCE

As I have said, these demonstrations were individual. Why? Because at the age of three, children's inhibitory control and working memory are still weak. If our presentations were given to a child along with two or three of her classmates, she would forget the movements we had demonstrated during the time it took for each child to do them in turn. On top of that, she would not have the ability to wait while two or three of her classmates went through them. Individual demonstration, on the other hand, can provide a level of difficulty that is interesting but not discouraging. The child only has to memorize and learn to control herself for the length of time of the presentation. Finally, individual demonstration makes it possible to provide just exactly the help needed by each child. This is much less a possibility when presenting to small groups. We can quickly identify which children have trouble controlling themselves, memorizing over short time spans, or changing their strategies when they are not working. With such children, we have to be more patient and trusting, and we have to encourage them more than we do the others. We have to ask them to do these kinds of exercises every day to help them to train, develop, and progressively master their executive skills. Quite obviously, this total individualization requires a great deal of autonomy on the part of the other children in a preschool class. This group autonomy takes some time to build up in a class. At Gennevilliers, this was the work of an entire year.[3]

IMPROVING ON ONE'S OWN

We also drew children's attention to things that would require them to readjust their actions autonomously. For example, when I showed children how to walk around in the classroom, I made a big point of avoiding walking on the mats. Therefore, when children, in moving around, walked on a mat, that immediately gave them an error signal that encouraged them to control their movements better. The same thing went for the other demonstrations: when I showed them how to roll a mat, I made a point of the fact that my mat would stand up on its end afterward; so if the child's mat would not stand up when it had been rolled, the child knew that it was badly rolled (we used small mats that, though flexible, were stiff enough to stand up when rolled). So the children could detect their own errors when practicing and could correct themselves without needing us to come back and help.

An error that showed up in this manner would sometimes generate a spontaneous urge for self-improvement in the children. They would repeat the action in question any number of times until they could do it without error. In our class, I saw certain children rolling up their mat ten times in a row until they got it to stand up perfectly. When this sort of thing is happening, the sole task of the adult is not to interrupt and to protect this constructive repetition.

PRACTICAL EVERYDAY ACTIVITIES

We asked the children to perform practical, very ordinary, everyday activities—among other things, to take care of the classroom themselves. For that, we put at their disposal real objects, and we picked *breakable* ones. Unlike a plastic item, a breakable object provides immediate feedback for clumsy movements. That kind of feedback invites children to readjust their strategies and control their movements better. Thanks to these kinds of little details, the children rapidly developed more graceful, orderly, and precise movements. We also took care to pick out aesthetically pleasing articles that the children would find attractive and would arouse their desire to take care of them. And of course, we chose items that were adapted to their size and strength.

For example, we provided the children with rags or feather dusters to dust the shelves with. As always, we showed them how to do this and then we left them to it. First they took the various objects off the shelves and put them on mats, then they dusted first the material and then the shelves with their rags or feather dusters. When they were done, they got a kick out of seeing that the dust was now gone and that their work had been effective. Then they put the materials back on the shelves in the right places (which they had memorized beforehand).

An activity as simple and ordinary as this calls for quite significant use of children’s executive skills. They have to memorize the various stages of the job, organize their actions, and put everything back in its place. For a child of three, this can represent a real challenge.

An unmistakable indicator I could rely on to let me know where we were in the development of a child’s executive skills was something like this: when a child was capable, after having painted at her own individual easel, of leaving all her materials completely clean, putting her work—covered with fresh paint—in the right place to dry without getting any paint on her classmates and leaving the classroom sink and the sponges completely clean, we knew that she had

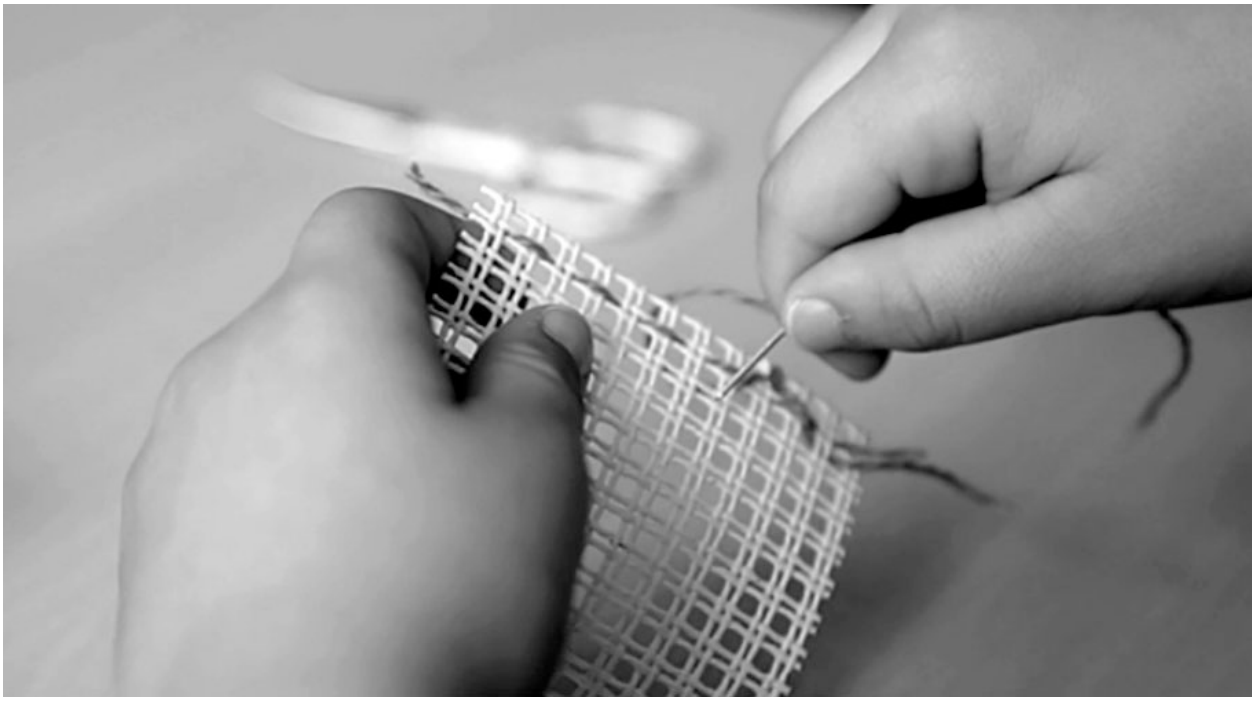
developed solid executive skills. The correlation was amazing: children who were capable of that were often very quick to learn, were calm and composed, and for the most part had peaceful and long-lasting social relations. This might seem to some like a purely made-up correlation, but to us the link was very clear.

We also had a tray for the children with everything on it needed to take care of the plants in the classroom. A child would pick one that had not been watered recently, and he would turn over the soil a bit, cut off the dead leaves, remove the dust from the leaves with a damp sponge, and water it carefully. He would then return it to its place, checking to make sure that the cachepot didn’t have excess water in it. Then he might move on to another plant. I like to give the names of the plants during my presentations: spathiphyllum, gardenia, ficus, rubber plant, and so on. Some of the children really liked that.

The children loved to take care of the big rubber plant that presided over the class. They wiped its broad leaves with a damp cloth to make them shine. The results were very gratifying! Other trays and materials were available to them for polishing the classroom mirrors, cleaning the tables, sweeping, sewing, and washing the small rags we had used, hanging them out to dry, folding them, and then putting them away. They were given little brushes to clean their individual activity mats if they needed it.[4]



A child of three wipes the dust off the leaves of a plant with a damp sponge.



A child of four practices simple needlepoint on a piece of canvas. The objective is to have the child progressively do finer and finer work until she reaches the point where she can sew scraps of cloth together.



A child sweeps up scraps of paper that were left on the ground following a découpage activity. He had previously swept the scraps into a pile with a broom.

Children of three and four are truly fascinated by these activities.[5] The abilities they quickly developed through doing them—concentration, organization, memory, perseverance, self-confidence, flexibility—were then generalized to all other areas of learning. They became capable of controlling themselves and warding off distractions so that they could concentrate on any task whatsoever and manifest their self-confidence, their bold sense of initiative, and their great autonomy. They found effective and relevant solutions to all the problems they ran across. Gradually they called on us less and less. By taking charge of their environment by means of real, everyday activities, the children developed solid functional intelligence.

We didn't have time to do more for children of five and older, but it would have been very interesting to propose more motivating activities of a higher level of difficulty to them: braiding, knitting, building little huts or small pieces of furniture out of wood, making pieces of clothing, and so on. We could have had a clay tray for making vases, pots, even bricks, which after having been dried and painted could have been used to build little houses outside.

PRACTICING AN ACTION

One of Maria Montessori's great ideas, which we made use of at Gennevilliers, is that children need to practice basic actions before engaging in activities that might be more complicated for them. Children need to train before they are able to serve themselves a glass of water at a table on their own, to hold a spoon firmly, to get dressed by themselves, to hang up clothes with clothespins on a clothesline, to water a plant, to squeeze out a sponge in the sink without getting water on the floor, or to correctly cut something out of a piece of paper. Therefore we proposed all kinds of precise, real, everyday activities for the children and allowed for them to practice these simple actions separately. And they loved that. You had to see how gravely, how joyfully, and with what composure they carried out these movements. They radiated certainty, dignity, and confidence. Most of the children lost all sense of agitation; their movements became calm and orderly, and their state of mind more stable. Something inside them was both nourished and calmed.

Practicing these movements, which were a part of an ordered activity with a definite objective, enabled the children very effectively to practice their executive skills.

I would like to draw your attention to one point here. It is important for these practical activities to have an objective that is connected to a culturally meaningful activity. If children are asked to transfer lentils from one dish to another with tweezers or to put chestnuts in an egg carton with pickle tongs, that won't make any sense to them. Then it will just be an activity aimed at exercising visuomotor control that has no intelligible connection with the cultural environment and no respect for the sensibilities of human intelligence. It seems to me to be of primal importance for the actions to *make sense* culturally.



From left to right and top to bottom: pouring water into a cup; pouring water into two glasses; buttoning little buttons; making knots; making loop knots; snapping snaps; zipping a zipper; folding cloth; holding a spoon; cutting paper; pouring from a pitcher; squeezing out a sponge with precision.

HANDLING REAL OBJECTS

You will certainly have observed the passion little children have for everyday objects. In addition to their desire to explore their environment sensorially, they are often attracted to activities that invite them to exercise their executive skills. Who hasn't at some time said to a child who was reaching for that oh-so-exciting jewel or music box that played automatically when opened, "Don't touch that!"? Notice how your child is attracted to the keys sticking out of cabinet doors, and how he would happily spend hours emptying your kitchen cabinets even though his room is full of toys. No toy could possibly compete with the fascination of real objects. Plastic boxes, plastic tea sets, plastic food items, false objects, false food, false musical instruments, and other substitutes for our reality are quickly broken, lost, or forgotten. Our children get tired of them in a hurry, and then they want new ones that are more colorful, more this or more that. The endless vicious cycle is set in motion, and the children are never satisfied. And this is quite normal. Their intelligence cannot exercise itself with those kinds of objects. They simulate reality without ever equaling the interest of objects used by adults, and they are very frustrating to children's developing executive intelligence, which can only "make believe" with them.

We tell him no, and send him back to his entertainments: "Go play with your toys!" And he doubles up with rage, screams, cries; his starved intelligence has just been frustrated. We start getting in a fight with him. But it's a big misunderstanding: the child does not want to upset us or disobey us; he wants to be fed. If we don't want him to handle objects that are precious to us, why not offer him others, less precious but just as down-to-earth and exciting?

This is how Maria Montessori came to the idea of presenting really little children with all sorts of boxes and real objects on little trays or in little baskets, which the children could handle and explore at will. One small basket contained a few keys and padlocks that children could lock and unlock; another one contained bolts with nuts that could be screwed on and screwed off; another one had different kinds of bottles; and another one had different kinds of boxes with a variety of mechanisms for opening and closing them.[6] When children perform these activities, their neural circuits organize and reorganize themselves as they learn and understand how their environment functions. Children rapidly develop self-assurance and mastery of actions that allow them greater autonomy. They could never attain this level of dexterity and confidence and aroused intelligence with plastic toys.

Tea sets, toys, and food made of plastic will soon be left behind in favor of

real, nourishing, and really satisfying activities. Let's go back and focus on the essential: before needing toys, our children need to be accepted into our lives. That is something we must understand. What young children are basically looking for is not distraction. They are hardwired to explore, understand, and master the world. Let's not distract them from this grand mission that has fallen to them. And let us see clearly how seriously they take it. It's not a matter of their individual will; it's a universal force of nature. Nature drives young human beings to understand the world and the customs of their social group through their own activity. And when they have the opportunity to do this, that brings them immense satisfaction that is bigger than they are, that makes them joyful and radiant and makes them develop.



A child tries to figure out which key fits the padlock he has picked out.



A child of three and a half tries to find the right nuts for the right bolts.



A child tries to open a bottle he chose from a tray of bottles with different opening mechanisms.

HELPING CHILDREN EXPRESS THEMSELVES

Being successful in expressing their thoughts plays a very important role in the development of children's executive skills. Children have to make use of their *working memory* to retain ideas during the time it takes to organize and formulate them. They have to show *inhibitory control* to regulate their impatience and frustration. And finally, they have to apply their *flexibility* to reformulate their speech and make it more precise if the person they are talking

to doesn’t understand it. For a little child, taking the time to express herself in a precise manner is a remarkably effective means of developing the essential functions of her intelligence—working memory, inhibitory control, and cognitive flexibility—which are called upon here in an optimal manner.

Therefore it is very important to take the time to listen to children and give them the time to formulate what they want to say without hurrying.[7] That might seem like a big waste of time, but it is the best investment of our time we can make. On this point, research has been unequivocal: supporting children in their desire to speak is one of the most efficient means of helping them develop their executive intelligence, their self-confidence, their logical thinking, as well as their vocabulary.

This approach was central in our class. Any child who had the need to express something or to recount an event had our entire attention, and all the children knew that it was futile to disturb us or try to get our attention at that moment, because our presence and compassionate attention was totally directed toward the child trying to say something. The others knew that and respected it because we did the same for everybody. They never broke in on each other. Occasionally little bystanders even went so far as to remind a classmate trying to interrupt an exchange: “Stop that, don’t you see that William is trying to talk to Céline? Just wait!” Moreover, this waiting was quite beneficial for the children who had to do it: it made them exercise their inhibitory control.

HELPING CHILDREN TO BE PATIENT

To help children to wait while we were busy with another child, we asked them to place their hand gently on our shoulder without speaking. Thus without being interrupted or disturbed, we were notified that another child wanted our attention. The children knew that we had gotten the message and that we would give them our attention as soon as we had finished our task or exchange. All of them found ways to calm their impatience: some of them fidgeted, others stepped back and looked at us from a distance, and others decided to listen to the exchange taking place. But in the last case, sometimes when I finally turned around and asked, “Yes, Faisal? What did you want?” the child would just look at me with big eyes. Having become absorbed by the exchange he had been listening to, he had quite simply forgotten what his own request had been about. He would return to his activity, and if the idea suddenly came back, he would run

back to me at high speed with a big smile on his face. Naturally, this time I immediately took the time to listen to him before his thought escaped him again.

Silently putting their hand on our shoulder when we were busy was a very simple procedure, but it had the big advantage of engaging the children's executive development in a particularly powerful way. They had to learn not only to wait patiently, but also to keep their idea in mind the whole time they were waiting, without letting themselves be distracted by the conversation going on in front of them. For a child of three, this is an incredibly complex task. Nevertheless, little by little, they succeeded in being amazingly patient, centered, and capable of holding on to the thought in their mind for a long time. The most tenacious ones were capable of waiting for ten long minutes. Most of the children, tired of waiting for me to finish my exchange with another child, decided to find a solution to their problem by themselves. They did this not by going to ask Anna, who most of the time was as busy as I was, but by asking a classmate, or simply thinking the problem through a little. Thus at such times they were practicing their cognitive flexibility. This way of doing things, taking the time to give one's attention entirely to one child at a time, really promoted the autonomy and executive development of all the children. Doing things this way, we had the opportunity and the time to give step-by-step support to the efforts of that one child while obliging the others to exercise self-control, memory, and cognitive flexibility!

Today there are many studies, like the one with the marshmallow, that suggest that practicing inhibitory control is central for helping children to develop and maintain good social relations, show perseverance, and attain the goals they set themselves. Moreover, as we saw earlier, it has been largely proven that the capacity for self-regulation at an early age correlates more strongly with scholastic success than IQ. Without overemphasizing this point, I think it is worth pointing out that we are talking about a key skill here: taking the time to help a child develop her patience and her capacity for self-control is doing her a big favor. But once again, we must be careful. This skill is not one that children learn alone. It is extremely important for the child to work on this ability with the aid and compassionate scaffolding of an adult.

DEVELOPING GOOD INHIBITORY CONTROL

It was my custom in our class to frequently propose short and entertaining group activities that required the children to exercise inhibitory control. We quickly

saw extraordinarily positive results from this. I invite you to try these activities with your little children. You will see what a kick they get out of them. This is because they allow them to exercise a skill that is in the peak stage of its development, so the neurobiological response is immediate: satisfaction and joy.



Two children walking a line.

For example, we taped a big oval on the floor with colored tape. We asked the children to take off their slippers and walk on the line, carefully placing one foot in front of the other. Children love this activity, which they tend to do spontaneously in the street. They love walking on lines, beams, tree trunks, curbs —thus exercising, without knowing it, their motor skills and their inhibitory control. For some of them, especially the littlest ones, it’s a real tightrope exercise! Although this exercise is very simple, the control it requires is a big challenge.

When a child begins to move more easily on a line, you can make the task more difficult by putting an object on his head or having him hold a bell that he has to keep from ringing. This requires him to show greater finesse and control. Children appreciate this level of difficulty that presents a big challenge to their inhibitory control while at the same time providing very clear error signals. If the object falls off their head or the bell rings, their movements have to be more precise. Children will often spontaneously go around the oval many times trying to perfect their control.

In our group circle, I regularly proposed other types of little exercises aimed at training the inhibitory control of the children. They were *motor inhibition* exercises. For example, I moved both my hands for a few seconds and then added a head movement. I asked the children to imitate my movements. After a few seconds, I stopped the movement of my hands but kept up the head movement. I continued this way for two or three minutes, demonstrating movements and then asking the children to inhibit some of them. The children liked these games a lot, and I was careful never to go on with them for more than a few minutes in order to not tire them out.

Progressively, and always in the group, I introduced exercises of *total motor inhibition.* Later this led to regular exercises of "self-presence." While the children were sitting cross-legged around the circle, I asked them to close their eyes and put their hands on their knees or between their legs, whichever they preferred, and then I turned off the light. I took my place among them again, and guiding them with my voice, I asked them to keep various parts of their body totally immobile. I called their attention to their hands resting on their knees, as well as to the various parts of their faces, their arms, their feet, and so on. When they were perfectly still, I called their attention to their bellies, gently inflating and deflating. The children then entered a state of great calm, and silence pervaded the classroom. We heard sounds that were usually inaudible—the sound of the second hand of the classroom clock, the buzz of a fly, or the muffled voice of the teacher in the classroom next door. I asked the children to listen to these sounds, guiding their attention from one to the other. Numerous studies show today that exercises of this type, related to the meditative approach of mindfulness, significantly develop the inhibitory control of children and bring about remarkable positive changes in their everyday lives. Children learn more easily, their attention strengthens, they are better able to manage their stress and their emotions, and their social relations become more settled and calm. One study shows that doing this practice for twenty minutes a day for five days is enough to produce significant results.[8]

This is in fact what we observed with great surprise in our class. These regular exercises of control, attention, and mindfulness progressively re-centered the children. As we went along in our practice, the children grew generally calmer, their movements seemed better controlled, they moved around with a certain grace, handled objects more delicately, moved their chairs in a more considerate manner, and their social relations were more settled and calm. They gained mastery over their movements and their emotions, and they were more alert and

sensitive to noise; background sounds that they did not seem to hear before now bothered them. One of them might say to me during the morning session, “Céline, there’s too much noise. Couldn’t you tell the children to pay more attention?” I was surprised by this, because even though I am sensitive to noise myself, I had not found the noise level that high. Nevertheless, I went ahead and asked, “Children, could you please listen to the classroom sounds?” I was impressed by the control the children were capable of. As soon as I asked that, and without even having to raise my voice, the whole class—except for one or two of the little ones, who didn’t understand what was going on—came to a stop and listened. We heard only those two little ones who had kept talking or walking without realizing that the whole class had gone still. I then asked the children to resume their activities more calmly.

Let us note in addition that games as simple as Red Light, Green Light or Simon Says are good, playful ways for the children to practice inhibitory control.[9] These kinds of enjoyable games calling on children’s ability for self-control are spontaneously played by children of the same age in many cultures, because these are activities that answer the need to exercise cognitive skills that are in the process of being developed.

THE EMERGENCE OF CRITICAL SELF-DISCIPLINE

One morning Stanislas Dehaene and Manuela Piazza came to visit our class. While the children were carrying on autonomously, we were getting in a heated discussion and, without realizing it, were getting louder and louder and pushing up the noise level of the class. One of the children pointed this out to me. The classroom was indeed very noisy. The children were physically calm enough, but all of them were talking loud, because our voices were drowning out theirs. So I suggested to the children to stay still and listen to the classroom sound in order to get the noise level back down. They all instantly froze. I remember the expression on Manuela’s face. She was very impressed by the instant and total “obedience” of the children, brought about by a hardly raised tone of voice on my part. But this ability to respond to my request was not obedience. I never tried to train the children to respond to external commands. There were two reasons they responded positively and immediately to my request: first, they liked silence and loved to experience it; second, they were *capable* (thanks to our training of their inhibitory control) of responding to their desire to hear it by going stock-still. In other words, the children *wanted* what I asked of them, and

they were capable of doing it.

But the children were not *obedient.* If what I asked of them seemed right, they responded positively at once. But if the request of an adult was not appropriate, interesting, or positive, they would not respond positively. One of them, in order to get out of it, might politely say, “I’m just in the middle of doing something else.” As you can well imagine, this sort of thing did frequently occur when inspectors were visiting. If a child was rolling up a mat and an inspector, for the purposes of evaluating the child, asked, “Tell me, what are you doing?” most of the children, a little annoyed, would reply, “I’m rolling up my mat.” But others, not seeing this as a valid question but perceiving instead the intention to pass judgment on them, would simply not reply at all. I am sure the children felt that these were not sincere and genuine questions, but rather little tests, asked for the purpose of judging them—and they just would not put up with that.

That is why the word “obedience” is not entirely appropriate. The children were very sure of themselves and ready to render immediate service if something was appropriate and seemed right, but it would take quite an effort to get them to do something that seemed irrelevant to them. I was very proud of them at such moments. They were right on the dot, centered, self-assured. How did they learn that? I have no idea. It was part and parcel of the qualities that emerged in them as their intelligence began to manifest according to its own laws. However, Anna and I noticed that the more developed the children’s executive skills were, the more they also showed a critical sense. I found that extraordinary: at the same time they were becoming capable of doing *anything,* they were learning to be discriminating and to judge the relevance or the validity of actions presented to them.

I remember the first time a child responded negatively to one of my requests. A little one was trying to get my attention, and since I was busy, I asked one of the older ones to help him. The older one replied, “Céline, I am also busy at the moment. Could you ask one of the other older children?” The child’s tone was so assured and unequivocal it felt like getting doused by a cold shower. I regained my composure, looked at what he was doing, and smiled. Here was a manifestation of autonomy I had never thought about. Obviously, these children had as much right to be busy as I did, and it so happened that this child really was. He was completely involved in a math activity that required all his attention and thought. I replied, “Oh yes, that’s true. I hadn’t seen that. You’re right.” When he had finished his activity, he came over to me to find out what he could do to help me. I was happy about this true confidence the children had

developed.

When a child does not respond positively to our requests, we feel offended. But it's doubtless the case that our request is not very appropriate. And if we succeed in becoming aware of this and of readjusting our demands and expectations, then we are beginning to tread on the path of a harmonious relationship.

This liberating self-discipline is born within. It is useless to try to impose it from the outside through reasoning, reprimands, or punishments. It arises on the inside and emerges on the outside when a child is left free to act and follow his own constructive endogenous inclinations.

RESPECTING THE NEED FOR ORDER

Little children pass through a period of great sensitivity to order, during which time they are particularly attached to categorizing things: everything has to have its place, has to be kept with objects that resemble it, and has to be used in one particular way and in no other. This phase seems to help children to develop the logical sense that is inherent in human intelligence. This sensitivity reaches a peak around the age of two and nourishes the development of executive skills: children have to organize, make choices, and sometimes correct them in order to attain a new, more satisfying level of order and logic. Dr. Maria Montessori identified this period, and I am certain that everyone who lives with little children knows it too.

Even when we ask them not to, young children try spontaneously to organize the world in a very ordered and very *logical* fashion. Researchers have noted that young children spontaneously put together objects that resemble each other or have features in common, and that they separate objects that do not resemble each other. In one study, objects were presented to very little children, only eighteen months old. For example, they were given four horses made of different kinds of plastic mixed with four pencils. The researchers then held out their hands to the children, palms upward, without saying anything. The eighteen-month-olds systematically put the four horses in one hand and the pencils in the other! The researchers added that a particularly precise and meticulous little girl noticed that one of the pencils had lost its point. After attentively looking at the outstretched hands of Alison Gopnik (the psychologist performing the experiment), she then caught hold of one of her mother's hands so she could

have a separate place to put this special, defective object.[10]

This kind of categorization is spontaneous and universal. It seems to be constructing the logical mind that we will benefit from later on. And indeed, this sense that seems to be inherent in human intelligence continues to incite us when we are adults to put order in all that we do. When we organize our files, we put all our insurance papers together, bills go into another file, and so on. When we set up our kitchen, the pots go here, the cooking utensils there. And why shouldn't it be the other way around? Each person has his own set of logical connections, which—watch out!—have to be respected in order to not upset the landlord or the boss! Haven't you already said to your spouse, "But why are you putting the pot lids here? They belong there!" And your spouse has no doubt replied, "Oh yeah, why is that? I think it makes more sense to put them here." And that really gets our goat. Our inner organization is disturbed.

We create order everywhere—in our houses, our offices, our schedules, our knowledge, and even our social relations. We organize and categorize our outer world in order to orient ourselves and structure our thinking.

Starting very early on, children do the same thing in order to build up their logical sense, structure their minds, and get a grasp on their outer environment. They arrange, align, and organize their toys, the shoes in the entry hall, the silverware, whatever they can get their hands on, according to logical connections or basic resemblance. Like us, they organize not only objects but also their daily lives: "No, Mama, you don't read this story, Daddy does," says the little girl, taking the book out of her mother's hands and giving it to her father; because in her head, this story is associated with her father. "No, Mama, it's not like this, it's like that!" and she revises her mother's action to show her how her teacher or her father does it. Or again, "No, it doesn't go there, it goes there," and she moves an object sitting on the edge of the bathtub one inch over.

All these manifestations are not acts of willfulness; they're not manic. In reality, they are the child's logical intelligence expressing itself—just like ours, but in a much more pronounced way because children are just in the process of constructing theirs. Beware, then, whoever stands in the way of this need on the child's part—they are exposing themselves to a rebellion as violent as this logical order is necessary to the child at this period in her life.

If a parent decides that this is just willfulness or whim and that such and such an object *must* be placed elsewhere, he enters into a struggle with the swiftly developing logical intelligence of his child. If the parent momentarily accepts

this placement, even if it seems absurd, he allows his child to freely develop her logical intelligence. Of course, it's up to the parent to distinguish spontaneous manifestations of logical intelligence from manifestations that are not that. One of the surest indicators is the level of concentration the child manifests. If you see that your child is concentrating hard and carrying out his action with great seriousness, you can be sure that it is a constructive action that should be respected.

If you have little children, observe them carefully. Up to the age of three, all these rituals of order have the *utmost* importance in their eyes. If we encounter this phenomenon without having been warned about it, we might think that our children are turning into rigid, tyrannical maniacs. Absolutely not. At about four years old, when the child has already been able to construct this logical intelligence, its period of hypersensitivity wanes, leaving behind it the imprint of a harmonious logical intelligence, which is fortunately much more flexible. Quite naturally, if we have no warning, this creative period might be bewildering for us.

This is what happened to a friend of mine when her son was exactly two. He kept arranging *everything.* And he did it in an extremely orderly fashion. For him it was not just a question of placing objects so that they were perfectly aligned, they also had to be logically arranged by colors or by resemblance in shape. My friend, who found it quite natural for things to be somewhat disorderly, was astonished to see her little one manifesting such a need for logical order, and couldn't figure out where he had "caught" this mania. Surprised and amused, she took photos of her son's spontaneous works and shared them by email with a limited group of her friends, expressing her amazement: "We have a psychopathic maniac in the house," said the caption to her photo.



Nobody could have taught her son to make arrangements like that, certainly not my friend or her husband. Thus this was in no way a case of something taught or imitated, but clearly the expression of the *logical mind* in the process

of constructing itself. A young child is a being of order and ritual.

At Gennevilliers, we observed this in all our children. They spontaneously arranged the instructional materials in their places, especially the younger children. Moreover, they could get into real fits of anger if a classmate or a physical obstacle stood in their way. Disorder was intolerable to them. One might say it profoundly disturbed their mental order. I remember one afternoon in the class when three children were working together on a mathematics activity on one mat. Everything seemed to be proceeding harmoniously until the youngest one, who was three, began to get agitated. He *absolutely insisted* on placing himself between his two classmates in front of the mat where the material had been placed. His classmates were clearly refusing to accept this. The little one got angry and began to cry. I took this behavior for an aggressive attempt to force the situation and suggested that he reformulate his request and express it to his classmates more delicately. His classmates refused again. The little boy then began sobbing. His tears were tears of deep distress. I was surprised and asked why he wanted to be in that place rather than any other. He replied several times, “Because that’s the one I want.” His reply confirmed my suspicion—I thought this was a case of willfulness, a whim. But seeing him crying hard again and feeling very confused, I asked my question again in a different way. “Tell me, *why* is this place important for you?” He then pointed to the material on the mat and said, “Because on the mat, my material is in the middle, here, so I should be in the middle too. And Ayub should be here and Suleiman there.” He was totally distraught. Hearing this explanation, Ayub and Suleiman immediately repositioned themselves in the “right” places. The argument for order had won the day and there was no further contest.

During this period the child obeys an endogenous “creative” urge—something is going on inside her. So we must recognize this constructive period and respect it, keeping clearly in mind that it is only a phase, a transitory state of sensitive awareness. This phase very definitely participates in the strengthening of children’s logical sense, and by driving them to make choices and organize their environment, it permits them to draw upon their executive abilities. Once what needs to be built up is built up, this acute sensitivity disappears and leaves behind it a clearer and more structured mind.

11

Greater Freedom

The development of functional intelligence requires a minimum of freedom. If children strictly follow orders or highly micromanaged instructions from an adult, they cannot correctly develop their executive skills, which are not drawn upon. It is not the children, in that case, who are organizing, making choices, and detecting their errors, but the external framework they are embedded in. That is why for all the practical and instructional activities we have presented in this book, we have taken care only to present the key actions and concepts, thus leaving the children free to explore. Our approach was one of providing structure —but not strict directions. This is a very important point, because it is mainly through exploration and free activity that children can draw fully on the essential functions of their intelligence. If their activity is orchestrated from the outside, children do not have to make choices, their errors are detected from the outside, and it is often the adult who suggests how to correct them.

FEWER DIRECTED ACTIVITIES

One very interesting study[1] confirms this by showing that children who devote most of their extracurricular time to highly managed activities—very structured piano lessons, sports classes, and homework—develop executive skills of lesser quality than those of children who spend their time after school in free play, socializing with friends, with family, reading, or drawing. The latter, liberated from external structure and control that determines their course of action for them, are more capable of setting personal goals and finding the best and most effective means of realizing them. Their functional skills are naturally called on to prove themselves. This does not mean, however, that music and sports lessons should be abandoned; on the contrary, these activities are very important for the harmonious development of children’s brains. However, these activities would

doubtless be improved by being less heavily managed.

I'd like to tell you a story to illustrate this point. I was having dinner one night with a friend of mine and her family. My friend has a little boy who at that time was around four. There was also a girl of fourteen at the table who had been taking piano lessons two hours a week for several years. As we were having dessert, I heard a lovely melody being played on the piano. For a second, I thought it must be the young girl, but I saw she was still at the table. I turned around and saw the little four-year-old boy running his fingers over the piano keyboard with amazing fluidity and rhythm. When I recovered from my surprise I asked him what he was playing. He told me he didn't know, that he was improvising. A second shock for me. I asked my friend if her son was taking piano lessons. She said no, but that he spent a lot of time playing by himself or playing duets with another person who was more advanced than he was. So this child was profiting from informal, unguided lessons in which somebody was conveying basic knowledge of the piano to him and leaving him free to explore on that basis. The girl of fourteen, although she was hardworking and diligent and had had several years of guided lessons, was unable to play with the fluidity, ease, and freedom shown by the boy of four.

I have always been convinced that the best learning is done *by oneself*, with the indirect and nonintrusive help of another person. Here was a striking example. What had this child done? Nothing more than explore and follow his own enthusiasm, which had connected him with a great endogenous desire to play well. What had the adult done? Nothing more than allow the child to follow his own inclination by providing informal scaffolding.

Children engage quite naturally in nondirected activities of this sort. And we should note how they roll their eyes if we try to turn these moments of natural achievement into something formal. We could speak of "spontaneous activity" here, which in the end seems to be driven by inner urgings that are facilitating the child's development. The main task that falls to us adults surely consists essentially in recognizing these inner urgings and not getting in their way. This might require a colossal effort on our part. We have to call on our own inhibitory control, realizing that children are guided endogenously by biological directives with which we cannot compete—and trust them.

We shouldn't be misled if our children seem not to be learning anything significant and doing nothing but having fun when we leave them free to do things and explore on their own. We can be sure that they are in the process of

building something: their concentration tells us that some sort of inner development is going on. Obviously I am not suggesting abandoning our children to totally free self-education—I don't believe in that. As we pointed out in the first part of this book, the pedagogy of pure discovery has clearly shown its limits. Children are hardwired to seek the scaffolding of an expert and learn from her. They can't do without that structure if they are to learn. They have to be able to lean on that support to explore and learn. The aim is therefore to offer timely scaffolding and guidance that provides orientation without being intrusive. The cognitive effort, the reflective engagement, must be experienced by the child. Our job and our main challenge are to recognize this and not interfere with his or her creative activity.

But I must immediately, once again, sound a cautionary note with regard to digital activities or video games, which without a doubt attract children's attention, but seemingly for very bad reasons. These activities act on reward circuits in the brain that secrete large doses of dopamine and quite simply turn our children into "junkies." Though they cry out for this kind of activity, that's not necessarily because it's good for them. This is generally not a spontaneous inspiration—without a doubt we are dealing here with an addiction. So it is up to us to stay vigilant and be able to distinguish between those two. It is important when children are young to keep them away as much as possible from digital devices that destroy their attentional systems, undermine the quality of their sleep, and take them away from activities that are genuinely constructive for them. Cooking, reading, dancing, playing soccer, putting on a play, building an electronic circuit, constructing little outdoor shelters, repairing objects with found materials, taking part spontaneously in household chores—all these are activities that develop not only the essential functions of their intelligence but also their social, motor, and creative skills.

MORE NATURE AND LIFE

Just taking a walk in the woods with a child with the idea of gathering pinecones, moss, and some dead leaves to put together a herbarium or a botany display will enable him to be active and engage his functional intelligence.[2] He will search for things, figure out what's possible to find, make choices, and revise them if necessary. Stopping by a lake and throwing stones or small branches into it means realizing that all these things don't make the same sound, and some float and others sink. Although this activity is very simple, it causes

young children to apply their thinking process and their intelligence. Why? Because we to talk to them, listen to them, and comment on what is happening. And when we do that, when we help children to express what they are thinking and to formulate what they are observing, we are very effectively enabling their executive intelligence to develop. Walking in a natural setting, watching where to put their feet so they don't slip, taking little detours, walking over rocks, playing freely, or climbing trees—all these things considerably reinforce their executive skills by requiring them to make choices, to anticipate, to plan their actions, and to take measured risks.

Free play in nature appears to be an essential phase in developing children's creativity and their executive functions. It has been shown that children who regularly and freely played in a natural setting with their friends, imagining, for example, that they were cowboys or pirates, had the best ability to solve problems because they frequently had to come up with innovative solutions. Having developed their imagination in this manner enabled them to manifest creativity and flexibility. So let's let our children have sticks, stones, earth, wild herbs, leaves, flowers, bark, pinecones—and *time* to play, invent, construct, and tell great stories.

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Protecting Children from Toxic Stress

We have already introduced this subject in the first part of the book, but it is a good idea to consider it in greater detail, because it is very important. In order to allow children to develop unified and harmonious intelligence, it is essential to help them regulate their stress. It is equally important to help them avoid situations that are traumatic, physically or verbally violent, or humiliating.

PROTECTING CHILDREN FROM VIOLENCE

We already saw that repeated or prolonged situations of intense stress damage the immature brain of the child, and particularly the circuitry underlying the executive skills. This circuitry is situated in the most vulnerable part of the brain, the prefrontal cortex. In the case of adults, if we are simply stressed, tired, in bad health, or are not getting enough physical exercise, our executive skills, situated as they are in this particularly vulnerable area of the brain, suffer. At such times, we have much more difficulty organizing our activity, concentrating, sticking with things, and memorizing. We are much more irritable and much less flexible. Now, given that children's brains are immature, stress in their case causes not only transitory difficulties; when stress is repeated or prolonged, their immature intelligence can be greatly weakened, and if this situation continues, their capacity for self-regulation and action can be gravely impaired by the time they reach adulthood. According to Dr. Catherine Gueguen, "Major stress in early childhood acts on the prefrontal cortex and can cause destruction of neurons. This hampers its maturation and reduces its volume.[1] The prefrontal cortex then becomes hypoactive, and in adulthood, affected persons have great difficulty calming their emotions and impulses, and managing their stress. Brain imaging reveals that violent, anxious, hot-tempered, impulsive adults and those suffering from deep fears have very weak activity in their prefrontal cortex, at the same

level as what is observed in early childhood when the brain is immature.[2] Catherine Gueguen tells us that one of the causes of inadequate development in adults is connected with violence they suffered during childhood. Blows and hurtful words delivered by adults who are supposed to be protecting them, as well as indifference and abandonment, injure and damage the brain of young children who are hardwired to rely on the positive support and warmth of others.

Fortunately the human brain is capable of resilience.[3] With a great deal of effort and persistence, and with the help of positive and supportive relationships, it can repair damages caused during its immature period. The Center on the Developing Child at Harvard tells us that resilience can be set in motion at any age—the earlier the better. The brain has the greatest capacity for resilience when it is still very plastic.

> The single most common factor for children who end up doing well is having the support of at least one stable and committed relationship with a parent, caregiver, or other adult. These relationships are the active ingredient in building resilience: they provide the personalized responsiveness, scaffolding, and protection that can buffer children from developmental disruption. Relationships also help children develop key capacities—such as the ability to plan, monitor, and regulate behavior, and adapt to changing circumstances—that better enable them to respond to adversity when they face it. This combination of supportive relationships, adaptive skill-building, and positive experiences constitutes the foundation of resilience.[4]

Thus the research is very clear: environments that enable children to develop good executive skills are not only environments that promote autonomy, but also environments in which children are protected from physical and verbal violence, shouting, and repeated or prolonged stress. By now, numerous studies have appeared that show without a shadow of a doubt that early exposure to highly stressful environments is associated with deficient development of working memory, attention, and inhibitory control.[5]

HELPING CHILDREN MANAGE THEIR EMOTIONS PROTECTS THEM

To protect the basic functions of the intelligence of young human beings, it is essential to help them not only to avoid humiliating situations and physical and psychological blows, but also to manage disturbing emotional situations and the stress of their everyday lives by providing appropriate support. As we have seen, the main thing we have to do is act quickly to reassure children through our affectionate presence in order to rapidly lower their cortisol level via the secretion of beneficial oxytocin. Doing this is protecting our children's intelligence. Next we should help them label their emotions in order to further calm their alert systems. Then by helping children to analyze their situations, to step back from them and find solutions, we participate directly in the maturation of their prefrontal cortex and the development of their executive skills. If the circuc12y of their prefrontal cortex is allowed to thrive and flourish in this way, children will be better able to face stress and their own intense emotions.

Take the example of a child who has gotten angry with a classmate because the latter took his bike on the playground. You find him in tears—or with his fist clenched, ready to go on the attack. Let's begin by allowing him to calm down through our sympathetic presence, by listening to him, by consoling him, and by taking him in our arms if he shows the need for it. Then, once calm has returned to his little organism, we can help him calm down further by promoting the use of his prefrontal circuc12y—ask him to identify and *label his emotion.* "Are you sad? Angry? Tired?" Then ask him *why* he is feeling that. "Are you sad because Theo promised to leave the bike for you and he didn't do it?" Suggest that he *express* his emotion to his classmate: "You should maybe tell him what you're feeling, what do you think?" And if he can't do this by himself, suggest a sentence he could address to his classmate: "You could tell him, 'I feel sad because you promised to give me your bike and you didn't do it.'" If possible, ask him to *propose a solution,* and help him to formulate it if he can't do it by himself: "You could maybe ask him to take another ride around the playground and give it to you afterward?" If his classmate resists this again—which is rare because the classmate sees his emotion—then I sometimes make a fair decision in his place: "Yes, he'll give it to you after one more time around the playground —thank you, Theo." Soon a child who has not wanted to lend his bicycle will be ready to do so because his prefrontal circuc12y will be more mature and he will have developed empathy and self-control.

Therefore what is needed from our side is patience and trust. We must understand that this kind of development is a prime indicator *for us adults* of the level of the child's prefrontal development. The more children are able, in

situations of conflict, to express themselves and to show control and creativity, the more strongly good development of their executive skills is indicated. By contrast, the less children are able to control themselves, to make a fair decision, and to show empathy or express themselves, the more a level of development of their executive skills that requires our support is indicated. For a teacher, the playground can be likened to an observatory as well as a place to take advantage of all occasions to promote the development of these skills.

The first year, as well as at the beginning of each year after that, when we welcomed the new children, we had to show a great deal of firmness and patience. The children had little control over their emotions, their anger, and their frustrations, and in cases of conflict—which were quite frequent—we regularly had children taking a blow to the head or instructional materials being turned into weapons of war. I recall the first year having to stop a child who, beside himself, was brandishing a red rod and threatening a classmate with it. These situations are special ones that are not to be missed; they are even indispensable. They are perfect moments to help children to learn to manage their differences with calm by taking a step back. During the first weeks of 2011, we were spoiled in this respect. It was quite difficult for us to stay more than a few minutes with any child to individually present an activity. Often the child's classmates would be shouting loudly at us amid their squabbles. It became quite difficult for everyone to concentrate!

UNDERSTANDING OUR OWN EMOTIONS AND BETTER UNDERSTANDING OTHERS

Helping children to understand what they are feeling enables them not only to calm down but also to develop a greater capacity for empathy. Research indicates that empathic aptitudes are based primarily on knowledge of oneself and one's own emotions. Being able to identify what one is feeling oneself makes it possible to more easily understand what others are feeling. Tania Singer, a specialist in social neuroscience, writes:

> Another fact we learned from [a] series of experiments on empathy is that people who don't understand their own emotions—we call them *alexthymic*—show a lack of activation in … empathy-related brain regions. To empathize with others, you first need to understand your own emotions and bodily states. Empathy training

should therefore concentrate first on training people to recognize and understand their own bodily and emotional states.[6]

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Coming Back to Ourselves

We saw at the beginning of this third part that children's executive skills grow at a very great rate between the ages of three and five, but that they begin developing before that. So children who during their first three years of life have been able to operate on their own with the respectful and noninvasive aid of an adult, are "centered" for the most part by the age of three. They have developed good executive skills and are better able to control themselves than other children. For example, they are able to not interrupt when we ask them not to, they are confident, they have plenty of energy, they know how to set goals for themselves, they take risks appropriate to their abilities, and they show perseverance and creativity. They are not afraid of adults, they easily adapt to new situations, and they are capable of cooperating with others. They have strong characters, and they know what they want and are capable of getting it through their own abilities. Children who have not had an adequate opportunity to operate on their own often exhibit weak executive skills at the age of three. They have little control over their movements; are the first to join in with the silly nonsense of a classmate; get easily discouraged, easily distracted; constantly interrupt and have great difficulty in restraining themselves from doing so. They are subject to major fits of emotion, they are agitated and sometimes impulsive, they can be lacking in confidence, and they are always seeking the help of an adult.

However, as children begin to act on their own and take pleasure in doing so, their character becomes "normalized," as Maria Montessori put it. Montessori plainly indicated that this kind of low-confidence, agitated, and unruly character was in fact a *symptom* more than a natural physiological state, a symptom of weak development of the executive skills. According to her, children exhibiting that kind of character are in reality "functionally ill." But if we give them the chance to regularly and effectively exercise their executive intelligence, notably

by getting their hands and minds to work together in the course of everyday practical activities that make sense to them, they will gradually come back to focused, controlled, and confident behavior. They will go from a state of disorderliness, agitation, dependence, and nonconstructive imitation to a state of self-discipline, order, calm, independence, confidence, and creativity.

It is absolutely necessary for children who have not had the opportunity to develop the basic skills of their functional intelligence properly during their first three years of life to benefit during the next three years of their lives from an environment that encourages them—firmly if necessary—to build their intelligence with their hands and to engage in real activities that awaken their enthusiasm and their desire to act on their own. This is the greatest responsibility of a preschool. Supporting the development of children's functional intelligence through orderly and endogenously motivated activity must be its main priority.

Preschool used to be called "nursery school," but what children of three are seeking is not "nursing." They certainly need the solid ground of love and affection that the school should also be able to provide, but what they want above all, with the greatest urgency and determination, is to gain their own independence. And to support them in this task, we must give them their freedom, recognize that they themselves are the ones who are transforming their own intelligence and allow them to continue to follow the emancipatory guidance of their own enthusiasm. If we just do that and also make ourselves available to help them get where they're going, these young human beings will develop their ability to act in the world, attain their objectives, and gain complete fulfillment. I do not doubt for a single second that their world will be marvelously transformed in this way.

When we launched our experiment at Gennevilliers, the majority of our children had underdeveloped executive skills. Most of them were incapable of memorizing, controlling themselves, or paying attention. They allowed themselves to be distracted at the first opportunity and had very little perseverance. And since our class was based on a way of working in which the children carried on autonomously from morning till close of day, this executive underdevelopment was glaringly obvious. There was no framework imposing an external order with activities chosen and directed by the adult, where the organization of things was managed down to the least detail and determined by the clock. Without this external framework to guide their every move, the children were like rudderless boats crossing a choppy sea. They bumped into each other and hurt each other. With no self-discipline to speak of, the children

were training each other in chaos. Aggression, bedlam, tears, and broken or stolen materials were the order of the day. When we take away the external framework that we, the adults, manically maintain, which keeps children under control from morning till night, *everything falls apart.* We are then face-to-face with reality. And this reality is not a shining one. We see children, alienated from themselves, who are wandering through the world looking for what the limits are, incapable of setting any for themselves. With time, rigor, and considerable firmness, along with a very big dose of kindness and trust, we were able to help these children climb back up this steep slope, and I have to admit that this was frequently a very strenuous adventure.[1] Nonetheless, as these children became capable of exercising their executive skills by acting freely on their own all day long in an organized way, guided by our scaffolding, and by taking the time to express themselves as clearly and precisely as possible, they progressively and radically changed character. They mastered their bodies, became considerate, and were able to care for themselves and others. They were sociable, calm, and generous. We even observed physical changes: they seemed in better health and were more radiant.

I would like to conclude this third part of the book with a reminder that in order to guide children in an optimal, compassionate fashion, it is essential for us adults also to be in possession of solid and functional executive skills. We need good working memory to keep track of the most important facts about each child; we need good cognitive flexibility to adjust our strategies and respond in an appropriate (and perhaps creative) fashion to individual needs; and above all, we need good inhibitory control to manage and regulate our emotions, such as anger, frustration, and impatience. Research very clearly shows that stress, fatigue, illness, sadness, social isolation, and lack of exercise significantly reduce the availability of our executive skills. If we are tired, sad, isolated, sick, or in bad health, we cannot respond appropriately to the needs of children. We won’t have enough energy, we won’t be able to organize our priorities, and we will doubtless be rapidly overwhelmed; we will lack patience, we will be more irritable, and we will have less control over our emotions. And in the classroom, we perhaps won’t remember that we should be sure that such and such a child resumes the activity that interested him so much the previous day or that we should encourage another child to resume trying to make knots. We have greater difficulty being fully available and providing appropriate responses to the difficulties the children encounter.

Taking care of our own health and psychological state is therefore essential.

We are the most important elements in the children's environment. It is above all us, our presence, our availability, our intelligence that is the greatest force in helping the children individually and collectively to become autonomous. Thus rule number one, which is absolutely indispensable, is to take care of ourselves. We have to pay attention to this. It is the greatest favor we can do for our children. We have to rest, eat healthily, get exercise, have an active social life. The children need our energy, our compassion, our responsiveness, our patience, and our full presence in order to develop their autonomy. They cannot thoroughly achieve their independence unless we are really in good operational shape to guide them individually and collectively along this path.

I also can only advise teachers who want to transform their class practice to do so gradually, to set goals that suit their own rhythm and what is possible in their situation without subjecting themselves to undue pressure. Protect yourself from stress; don't overdo it. This seems to me to be an essential point. Guiding children properly and effectively entails our being able to re-center ourselves and become fully present to ourselves.

According to the Center on the Developing Child at Harvard University:

> Enhancing the development of executive functioning involves sensitive, responsive caregiving and individualized teaching in the context of situations that require making choices, opportunities for children to direct their own activities with decreasing adult supervision over time, effective support of early emotion regulation, promotion of sustained joint attention, and the availability of adults who are not under such pressure that they cannot make time for children to practice their skills.[2]

PART FOUR

THE SECRET IS LOVE

Love is not the first word that comes to mind when we talk about learning, and this is a fundamental error. We should proclaim it loud and clear, and it should be inscribed above the doors to our schools: *love is the instrument of the human soul*. We are wired for warm and empathetic interaction with others, and when we act in accordance with this great law decreed by our intelligence, everything becomes possible. This is not a naive and idealistic vision. The naive ones are those who do not experience the obvious in their hearts: a simple compassionate look, an outstretched hand, a smile, a bit of empathetic listening, and our metabolism embarks on the path to regeneration, both physical and psychological.

The Power of Bonding

“What if we could study people from the time that they were teenagers all the way into old age to see what really keeps people happy and healthy?” asks Robert Waldinger,[1] psychiatrist and professor at Harvard University. This is precisely the challenge he took up: “The Harvard Study of Adult Development[2] may be the longest study of adult life that’s ever been done. For 75 years, we’ve tracked the lives of 724 men, year after year, asking about their work, their home lives, their health, and of course asking all along the way without knowing how their life stories were going to turn out. Studies like this are exceedingly rare. Almost all projects of this kind fall apart within a decade because too many people drop out of the study, or funding for the research dries up, or the researchers get distracted, or they die, and nobody moves the ball further down the field. But through a combination of luck and the persistence of several generations of researchers, this study has survived.”

The project studied two groups of several hundred men from very different social milieus—students from Harvard and very disadvantaged teenagers from Boston. Seventy-five years later, the results were conclusive. “The clearest message that we get from this 75-year study is this: Good relationships keep us happier and healthier. Period,” is how the director of the study summed it up. Whether people are rich or not, whether they succeed professionally or not, whether they are in good health or not, “it turns out that people who are more socially connected to family, to friends, to community, are happier, they’re physically healthier, and they live longer than people who are less well connected.” And the experience of loneliness turns out to be toxic. “People who are more isolated than they want to be from others find that they are less happy, their health declines earlier in midlife, their brain functioning declines sooner and they live shorter lives than people who are not lonely.” Over the long term, Robert Waldinger concludes, “loneliness kills.”

The study also indicates that the memory of people who do not feel lonely "stays sharper longer," and those who feel they have nobody to count on "experience earlier memory decline."

The sense of bonding and the benefits that come with it are necessary for the eminently social beings that we are to function properly. But the Harvard study reassures us that: "good relationships don't have to be smooth all the time. Some of our octogenarian couples could bicker with each other day in and day out, but as long as they felt that they could really count on the other when the going got tough, those arguments didn't take a toll on their memories."

THE CHEMISTRY OF BONDING

When we bond with others in a generous, warm, and empathetic way, our whole organism flourishes and regenerates itself with extraordinary potency.[3] An encouraging glance, a hand extended to a person in trouble, and *everything,* absolutely *everything,* gets a green light—in the organism of the one giving as well as in the organism of the one receiving. Heart rhythm calms, blood pressure moderates, the immune system is activated, digestion is improved. And in the brains of everyone involved in a positive relationship, new neurons are created, particularly in the circuits related to memory, empathy, the moral sense, and decision-making. Neural connections thrive, our learning capacity, our empathic aptitude, our moral sense, and our ability to make appropriate decisions are strengthened. Thus when we are warm and compassionate toward a child (and also toward an adult), we behave in a way that exercises a powerful positive influence on their health as well as their cognitive, social, and moral capacities.

In our preschool class at Gennevilliers, we utilized this tool without moderation. We adopted a welcoming, warm, and empathetic posture, while of course at the same time being careful to stay within a structuring framework that sets clear limits. My feeling is that this posture was a real cognitive, moral, and social catalyst for the children in the class.

BONDING IS REWARDED AT THE MOLECULAR LEVEL

Our whole biological mechanism encourages kindness and bonding. When we are generous,[4] altruistic,[5] fair,[6] and trusting[7] toward others, our brain *rewards* us by secreting dopamine. Dopamine acts on the reward circuits in our brain,

creating a discharge of enthusiasm, energy, and pleasure that encourages us to do more of the same. The bounce provided by the secretion of dopamine also gives wings to our creativity—we feel stronger and more capable.

In the class, Anna and I felt these effects clearly. Bonding with the children (and with the parents) through a compassionate and welcoming posture literally carried us along. We felt energy, enthusiasm, lightness, and pleasure. We were always eager to get back to the children. This very powerful endogenous reward allowed us to keep up our attitude and energy despite the difficulties connected with setting up our experiment pedagogically and administratively.

BONDING MAKES US MORE EMPATHETIC

When we bond positively with others, our brains also secrete oxytocin, which brings a profound feeling of trust, connection, and well-being. Bonding does us good. The release of oxytocin also heightens our awareness of the intentions and emotions of others. It develops our empathic capacities, which permits us to bond more. We thus enter into a virtuous circle in which *empathy generates empathy.* By being generous and compassionate, we augment our own empathic capacities and also those of others. When we are kind, the brain of the person we are relating to also secretes oxytocin. That person also feels good and develops greater empathic capacities.

Thus we possess a powerful contagious force. Our kindness and compassion —our humanity—have an immediate chemical consequence within the intimacy of the brain fibers of others. Nicholas Christakis, an internationally known sociologist and physician, tells us[8] that the compassionate and cooperative behavior of one person can positively influence up to three levels of people in a social network; that is, a warm and kindly person can transmit this behavior to the friend of a friend of a friend, even without ever having seen the last one. Love nourishes the mind, elevates intelligence and creativity—and the best news of all: it has an immense power of contagion.[9]

Oxytocin, generated by warm relationships, also triggers the secretion of *endorphins,* which create a sensation of well-being and raise the level of *serotonin,* which stabilizes our mood and gives greater control over our emotions. All persons involved in an emotionally warm situation experience this succession of beneficial consequences: well-being, confidence, enhancement of empathic capacity, and greater stability of mood.

The least gesture of solidarity or understanding immediately provokes the secretion of oxytocin, and the virtuous cycle is launched. A person who offers help to another feels lightness, groundedness, and incomparable joy, while the person on the receiving end is calmed, regains confidence, and experiences relief from pain.

ISOLATION DAMAGES AND SLOWS THE DEVELOPMENT OF EMPATHY

On the other hand, asocial behavior that separates us from each other—such as rejection, egotism, violence, judgment, competition, disdain, indifference, humiliation, aggression—generates suffering, malaise, loss of motivation, depression, illness, and decline.[10] If there is one thing that my reading and research has made me understand, it's that all behavior that conflicts with the urge to bond is completely harmful from every point of view. When bonding is obstructed, *everything*, *absolutely everything,* in our organism gets a red light and goes off balance.

Instead of secreting beneficial molecules, we become prey to stress and our organism releases, in particular, cortisol, which puts our whole system in a state of alert—our heart rhythm accelerates, our blood pressure goes up, the effectiveness of our immune system diminishes, and our digestive process is hindered. As we saw before, if this state of stress continues, our health goes downhill.

Cortisol also attacks our brain structures. The development of new neurons is slowed, even stopped, as are connections between them, especially in the circuits associated with memory. The Harvard study cited above indicates that people who feel isolated "are the people who experience earlier memory decline." The circuits related to empathy, decision-making, and the moral sense are also impacted. Our learning ability, our empathic capacity, our moral sense, and our ability to make decisions decline.

WHEN ISOLATION OCCURS, OUR SYSTEM SOUNDS THE ALARM

The feeling of being bonded with others is so fundamental to our health and our intelligence that if we are rejected by our peers, our system immediately sounds

the alarm bell. In our brain, the same zone that is connected with physical pain[11] is activated. Feeling rejected *hurts.* When a child of three gets into an endless fit of sobbing because two of his friends don't want to play with him, he's not just being theatrical. He is undergoing immense suffering that he is incapable of dealing with on his own; his organism is in a state of alert.

And even though contemporary society drives us to separate from one another, we are not encouraged to do so biologically. When we behave in ways that risk leading us into isolation, when we are egotistical, unfair, competitive, individualistic, our brain does not release dopamine, and the reward circuits are not activated.[12]

Our nature is eminently social. Our whole organism shouts this out to us. I invite you to have a look at the "Still Face Experiment" videos on the internet.[13] They will convince you. These well-known experiments show a parent interacting normally with her baby; she smiles at it, talks to it, touches it. Then she adopts a neutral and immobile facial expression and continues looking at her baby without responding to its calls or glances. The baby begins trying to attract her attention with adorable expressions, then claps its hands, smiles, points its finger. Seeing that its seduction strategies are not working, it starts looking away and getting agitated. It cries, and expresses great anxiety.

From our birth on, we seek a connection with others, and if this contact disappears, we are in great distress. For the eminently social being who has just been born, it is a vital need.

BONDING IN THE CLASS IN GENNEVILLIERS

Before starting the experiment at Gennevilliers, even if I was totally convinced of the benefits of human bonding, I was far from imagining the real power of it. When everything in an environment is designed to continually promote positive encounter, mutual help, trust, understanding, and empathy, children bond, work together, exchange, laugh, and share all through the day. From that point on—forgive me for putting it this way—it's as though we enter another dimension. I have no other words for it. We rediscover the human being, its profound nature, its real abilities.

I was more than surprised. I was stupefied by the transformation of the children in the class. Everything in them began to blossom—their cognitive abilities, memory, empathic and social capacities, joy, enthusiasm, emotional and

relational stability, creativity, and even confidence in themselves and others. Although most of the children who arrived the first year had little confidence, were timid, and did not dare to speak to grown-ups, after a few months their parents were telling us that they had become sure of themselves, sure of others, trusting, open, and full of energy. Now they had to hold their children back from shouting a joyous hello to every passerby. Their moods had also stabilized. They were much calmer and happier. One mother who worked until late in the evening and whom I had therefore not really seen at the end of school, came one day after class when I was tidying up the classroom. She spoke to me with amazement: “What have you done to my son? I don’t know him anymore. He’s calm, open, poised, independent, and generous. He spends his time helping me and his brothers. He speaks well and he pays attention to what he’s saying. What did you do to him? Explain it to me.”

In the class, since we knew about the powerful benefits of warm, empathic bonding, we happily made use of the extraordinary instrument that is love. From the first day and during all the days that followed, we took care to surround each child with engaged, supportive, fair, and warm kindness. When we were with a child, we tried to be totally present to that relationship, and to be open to his or her individuality. We believed in every child, and in their difficult moments we supported them as an athletic trainer would: “You can do it, I have no doubt. I’ll stay with you every day if necessary. We’re a team, I’m with you. We’re going to get it done.” We might spend several days pretty much with a few children so that they wouldn’t lose confidence. They could count on us, and we took on the discipline of keeping the promises we had made them.

Of course, this was not to be seen every day. We could also be tired, sad, angry, upset, irritated. But we did our best. The children in the class did not all hugely surpass the requirements of the board of education—most of them, yes; but others who were way behind at least caught up to the norm, which already represented a remarkable and unexpected improvement. However, what we and the parents both observed was that, thanks to this warm, individualized, and trusting atmosphere, *all* the students regained confidence in themselves. For us, this was the most precious result.

This loving, trusting, and supportive posture rapidly spread among the children. From the first weeks, I was surprised to see a number of the children adopting our way of behaving or speaking. When a child was sad or even angry —and occasionally totally disagreeable—there was always a classmate who said to her, softly taking her hand, “What’s the matter? Are you mad? Are you sad?”

They reproduced our behavior and made it their own, sometimes bringing extremely creative and intelligent touches to it. “You look sad,” one of them might say to a slightly older classmate who seemed out of sorts. “What’s going on?” And if the classmate did not reply, they continued, taking his hand, “Stay with me for awhile, if you want.” But most of the time, the child who was questioned launched into a slew of explanations. He recounted everything that had happened to him. They would then try to solve the problem together. Anna and I were really touched by these scenes the first few times they unfolded before our eyes. What a joy to see the warmth and kindness that was motivating us gradually winning over the children!

Their empathic behavior also was directed toward us. I remember a week when I was particularly stressed. I had even broken into tears a few times in Anna’s arms. The administrative hierarchy was giving us a hard time. The class was liable to be shut down at any time, and the verbal threats and humiliation by the official inspectors were so numerous that I was thinking seriously of filing a complaint for psychological harassment. At such moments the children were extremely considerate and addressed their practical problems more often to Anna. For me, they reserved manifestations of great tenderness, coming to gently take my hand, or put their head on my shoulder.

One day when I was on the verge of giving up everything, exhausted by the energy I had to expend outside the classroom to keep our experiment going into the third promised year, and also discouraged by derogatory remarks, a child came up to me. I was sitting, spaced out and downcast, near a group of children engaged in an activity. The child took me in his arms and said, “You know, Céline, I love you. If you want, you can talk to me.” His affection brought me unexpected comfort. I squeezed him in my arms and thanked him. I had just, myself, experienced the extraordinary power of empathic affection, of compassion and sincere love.

I think I can say that *love* was the cornerstone of the success of the Gennevilliers experiment. I am sure that the trust, empathy, and faith that we manifested toward the children literally kindled their intelligence, their memory, their good disposition, their health, and their social and moral qualities. Tests could not measure this, but I have no doubt on this point. Recent studies have shown that the quality of the interactions between teachers and children is a much more predictive criterion for academic success than instructional tools used or smaller numbers of children in classes.[14] The first results in the Finnish

study “The First Steps Study” also point in this direction, indicating that a warm and empathic attitude on the part of the teacher promotes children’s enthusiasm and considerably increases their skills in reading, writing, and mathematics.[15]

Nourished by real activities that they could freely engage in and by love and affection throughout the day in the class, the children began to shine, and as unbelievable as it might seem, they even seemed to get healthier. They were much more beautiful and more luminous. These children were surrounded by a loving family circle of brothers, sisters, cousins, and parents. Their families were warm, attentive, loving, and were always available to help them. But it seems that being able to benefit, in parallel with this, from the bonding and affection they received from a larger social group composed of thirty small beings of different ages, while having the opportunity to be nourished by activities that motivated them at the moment they were open to them, contributed significantly to their development.

CREATING A FRAMEWORK CONDUCIVE TO BONDING

To promote social bonding, it’s not enough just to put a bunch of children together in the same room and support their autonomy. First of all, we have to bring together children *of different ages.* Now, traditionally we group children by their date of birth. Imagine the emotional and social violence we do to a child of three by putting him in the same room with thirty other children of three who are as independent as he or she is and who are no better at knowing how to express or control themselves. What a lot of stress his little organism must have to deal with under these circumstances! Is it any wonder that he clings to his parents’ legs to avoid having to go to school?

So the first thing we must do is respect one of the fundamental rules of nature, which is that it is desirable for human beings to learn from, and surround themselves with, other human beings who are not the same age as they are, who are a little younger or a little older. This gives them the opportunity both to teach things to the younger ones and to emulate the behavior of the older ones, who fascinate them.

Although an age mix is very important, that by itself is still not enough. Next, it is of primary importance to create conditions that will allow and support *interaction* between the children. One of these conditions, which we have already mentioned a number of times, is the ability of the adult to encourage

positive exchange and understanding between children. Another absolutely essential condition is the ability of the adult to put in place a structuring framework that sets limits and boundaries and also provides the children with a sense of security.

The children must perceive without any ambiguity that within this environment in which they are free to act, the adult is making sure that the integrity of each child is always respected. At Gennevilliers, as soon as a child deliberately violated the explicit rules of the class by not respecting classmates or, for example, by intentionally damaging any of the instructional material, our response was immediate and very firm. “That is a no. I cannot accept that. When you do that (and we would describe the scene in a neutral way so that the child would not feel judged), you are disturbing your classmate (or the material is damaged).” We would next require some solution: “Please stop that immediately and come with me; we are going to find an activity you’re going to like.” We then made sure to propose an activity that interested the child in order to reorient her considerable energy and put it to work in service of her development. Most of the time, this kind of problem came up with children who were not able to find a satisfying activity and who thus ended up discharging their unused energy in just any old way. For some, these behaviors came up regularly at the beginning of the year when they were first discovering the class. A period of adaptation was necessary—they had to learn to be autonomous.

In these situations, we exercised authority in a fair and confident way. We were kind and respectful but firm. The child didn’t have a choice. We did not hesitate to raise our voices if we deemed it necessary. As the children developed their executive skills and became engaged in activities that interested them, these behaviors progressively diminished and finally disappeared altogether.[16]

BONDING, NOT DEPENDENCE

Love and the various other names we give to this feeling—altruism, kindness, tolerance, trust, generosity, compassion—are not to be thought of as pedagogically or socially interesting options for the future. They are the very cradle of health, intelligence, and high moral and social qualities, of stability and emotional intelligence, of enthusiasm and creativity. Love and its various manifestations are *indispensable* right now for anyone wishing to provide guidance and support for the harmonious and creative humanity of tomorrow.

We *cannot* flourish and thrive in environments that isolate us and set us against each other. It's quite simply a matter of physiology. Because in such environments, although we might have everything, we are lacking the essential: the warmth and security of the great human family.

In our preschool class at Gennevilliers, we tried to recreate this feeling of unity. There were neither pupils nor teachers—just children and adults, all together on the path to individual and collective autonomy. The pupils didn't call me ma'am or Mrs. Alvarez, and I didn't call them pupils. We just called each other by our first names. No one was the authorized judge of the others, not even the adult. We spent our days in a horizontal unity, like the one that is felt in the bosom of a big family, where everybody wishes everybody else the best and does what they can to make the best happen for them.

But this peaceful horizontal way of working was not established overnight. The children who had spend a year in a "classical" preschool system needed a whole school year to become re-centered on themselves, on their own inclinations and their own judgments. Accustomed to a vertical system where the life of the class was ruled by the directives and assessments of the adult, some of the children continued to hang on our judgment, waiting for our orders and our feedback. Readapting themselves to a horizontal way of working presented major difficulties to some of these children. In preparing my TED talk in 2013,[17] I hesitated for a long time over whether or not to talk about this phenomenon that had been such a surprise for me the first year. In the end I decided to present broader subject matter in that talk, but I am happy to be able to share with you now a story regarding evaluations that made a deep impression on me.

When we began in 2011, the class was composed of two age groups, three- and four-year-olds, corresponding to the lower and intermediate preschool levels. Thus the intermediates had already had a year of traditional teaching in their first year of preschool. Starting in the month of September, I encouraged the children to participate in an environment in which they could freely choose from among the activities that had been presented to them individually. They were thus invited to be autonomous. Naturally I expected the four-year-olds to be more autonomous than the little ones. How surprised I was then, when the little ones, who had never gone to school, chose their activities and engaged in them in their corner with concentration and joy, showing their autonomy clearly, whereas the children who had already been to school had a terrible time even figuring out what the point of such an approach might be. If we did not tell them

what to do, they had no idea what activity to choose. Not only did they not have any particular interest in carrying on this way, but they were even afraid of what I might think if they made the wrong choice. They were lost. And when they finally did pick an activity, they eagerly kept eye contact with me, waiting for me to approve their choice and commend them on their work. They were constantly coming over to me and asking, “Is everything okay, Céline?” They kept looking for external feedback; they wanted my okay. I referred them back to their own judgment: “And you, are you happy with what you’re doing? Do you want to continue with it or let it go for now?” I saw from the astonishment in their eyes that my answer made them uncomfortable.

Some of these children were quickly able to cut their ties to their dependency, because even though they were disoriented by my answers the first few times, they would quickly go back to their tasks, thinking that it was fine for them just to get better at what they were doing. They then started getting into long periods of concentration and made good progress, progress I never could have gotten them to make by giving them external orders. This was progress that was possible only because the children had decided for themselves that it was necessary. These children quickly regained their autonomy. They would then come to me from time to time to show me their work with big smiles on their faces. They had no expectation that I would approve or disapprove—they just wanted me to look. Which I did. I would express my very sincere pleasure but in a neutral manner—that is, by describing what I saw without putting a value judgment on it: “Wow, you colored in the whole mandala with blue, red, and violet! Are you happy?” They would nod their head yes, give me a big smile, and head back to their place to keep working.

Obviously, growing children need our attention in order to develop, and they demand it. “Look, Mama! Look, I’m standing on the tree trunk!” But it is important, in order not to make them dependent on our judgment, that the attention we give them remains an “I see” rather than an “I approve.” The way we did it at Gennevilliers consisted in showing them our joy at seeing them happy with themselves; so rather than judging their deeds by telling them they were okay or good, which soon turns the children into dependents, we took on the discipline of describing what they had done, “You climbed up on that log and you kept your balance! Wow! I see that you’re pleased and I’m happy for you!” It’s a matter of supporting the children’s enthusiasm by sharing it with them.

As the weeks passed, I saw that the four-year-olds from the intermediate section who had the most trouble doing things by themselves and getting any

pleasure out of it were playing the role of “goody-goodies,” hoping to get my approval. For long months, they were unable to carry on an activity by themselves without getting some feedback from me. I still recall them plunging into an activity and then perking up when I passed by, hoping I would say, “Very good.” Which I never did. Finally, then, they would get up from their chair and come over to me, thinking that maybe I hadn’t seen them, and they would ask me, “Céline, is what I’m doing okay?” It took me a long time to get these goody-goodies to do without the omnipotent judgment of the adult and to get them reconnected with their own personal judgment. I really thought that for some of these children it was too late. The more they were “good pupils,” always the first to answer questions and respond to requests by the adults, the more difficulty they had in choosing their activities and judging the results of them by themselves. I could see them out of the corner of my eye watching me, checking out my facial expressions. I forced myself to remain completely neutral.

Some children suffered from this situation. Really, I can’t hide this from you; and I have to recognize that in thinking about it now, I get a lump in my throat. The scene during these first weeks was really depressing. They were four years old and they were completely decentered from themselves, dependent on the arbc14ary judgment of an adult, and motivated not by exploration and discovery but by the possibility of doing better than their neighbor and increasing their sympathetic capital with the teacher. And I still recall the little ones during this same time, totally unaware of what was going on with their older classmates, devoting long periods of time in their work area, alone or with several others, to activities that they enjoyed. They hardly paid me any attention. They carried on at their own pace, joyfully, with concentration, always exploring.

I have to admit that though I never doubted for a single second that all these children, despite coming from disadvantaged environments, would succeed in learning the basics and even do better than the norm, there were many moments in which I really doubted I would be able help some of them regain their autonomy. And I must tell you that helping them to read or count no longer had the slightest interest for me if they did not do it for themselves with joy, with freedom, and with total autonomy. To give them back the freedom that the school system had taken away from them, we found a system that seemed to work. We never missed a single chance to express our joy for them when we saw them interested in an activity: “Oh, I see you are enjoying this activity! I love seeing you happy like that. I hope you’ll find other activities you’ll like as much.” And since we expressed our joy at the efforts and successes of all of

them, the children of the intermediate section eventually stopped comparing themselves with each other, and their spontaneous empathic urges were able to come out.

Once this autonomy was reestablished, these children were no longer the same. Their character changed. They set themselves ambitious goals that we would have never dared suggest to them. They flourished and stopped comparing themselves to each other. What work, what patience, and what energy that had required of me! How hard it had been to see some of those clueless children unable to take their eyes off me, completely thrown off by this new classroom process completely devoid of exterior rewards and unable to reconnect to their own system of inner rewards. I had to find the right mixture of firmness, determination, trust, patience, and kindness. And I have to say that I regularly made mistakes. But it was the mistakes that made it possible for me to understand and, with the passing months, to adjust my attitude and find the most appropriate responses for the children.

What a relief when I realized, maybe in the month of February, about five months after the beginning of the experiment, that the majority of the older ones had again reconnected with their inner motivation. Freed from the bonds of dependence, the atmosphere in the class could finally become peaceful, harmonious, and horizontal. We could interact with each other and we could feel united.

One day I had to be absent. Since no substitute was available, the children were split up into a number of other classes. The following morning, a teacher handed me some papers and said, “Here, these are the activities I gave yesterday to your ‘pupils’ when they were in my class. I corrected them. You can paste them right into your class notebooks.” That was very nice of her, very straightforward, and I thanked her. I looked at the pieces of paper. It had been a writing exercise meant for children in the intermediate section. They had to reproduce various forms in order to exercise their hand in writing. Using a red marker, the teacher had corrected the work of these four-year-olds, who—let’s be clear about this—surely wouldn’t have been able to do any better after this blame-laden stroke of the red marker. Moreover, she had written in her best hand on one of the papers (the best one): “Bravo, Leah! Very good!”[18] I can’t put it any other way: this comment really hurt me. I had just gone through long months working to give this little girl back her sense of autonomy as well as her sense of compassion toward the other children. And there, under my eyes, I saw the *crime*

weapon. Never, never could I have imagined the impact of each one of these words written in red marker if I had not, leading up to this, spent those long months trying to give this “goody-goody” back her urge toward endogenous activity and her capacity for empathy.

To enable the children to experience social bonding and its powerful beneficial effects, it had first been necessary to cut the ties of dependence and reconnect them to themselves. When this was done, all that was needed was to encourage and support what began to manifest in them, both from a cognitive point of view and a social and moral point of view.

Encouraging the Expression of Innate Social Tendencies

As social beings, we are predisposed toward bonding. When we are born into this world, we are wired to *enter into a resonance with others* and are predisposed to act in a just and ethical manner, which enables us to live with others in certain harmony. We are endowed with empathic capacities and an acute moral sense, which manifest in the first months of life. Isn't that great news? Therefore we don't have to *create* empathy, the moral sense, or altruism in children. They are born with all that. We only have to support and encourage the development of these moral and social qualities, beginning first of all by recognizing them, then nourishing them in a positive fashion, and finally by giving them room to express themselves.

THE INNATE CAPACITY FOR EMPATHY

Whether a person we are interacting with is happy, joyful, kindly, furious, sad, or anxious, these emotions resonate in us. It has been shown that just simply listening to someone talk activates the same zones in our brain that are activated in theirs. When a human being is suffering, a zone in the brain specific to pain is activated; and when we see them suffer, this same zone is activated in our brain. Seeing someone suffer makes us suffer.

Another person's emotions, whether they are pleasant or painful, penetrate into the intimacy of our skull cavity, whether we like it or not. *Something of the other exists in us.* This empathic resonance exists in us from birth. One experiment has shown that a newborn needs only *one day* of hearing the crying of another newborn before it joins in the chorus of its pain.[1]

This innate empathic capacity spontaneously leads us to altruistic behavior. We have a natural tendency to soothe the pain of others, purely for their sake and without any expectation of getting any personal benefit out of it—except, of course, the benefit generated by the joy of coming to their aid.

THE SPONTANEOUS ALTRUISTIC URGE

At the beginning of life, the will to help others is not always very skillful. At fourteen or fifteen months, children will try to console another child by giving her a toy or a teddy bear that would be comforting to them if they were sad, without taking into account the preferences of the other. They still have trouble understanding that the need of another child might be different from theirs. The researcher Alison Gopnik recounts that after having spent a very difficult day at the lab, she collapsed onto her living room sofa and began to cry. Her son, who was not quite two years old, observed the scene. Wanting to help his mother, he went to the bathroom and came back with a box full of Band-Aids, which he put on her in a number of places.[2]

The altruistic urge is indeed there, even if at the beginning, the help it tries to give is not always appropriate. Research nevertheless shows that if we regularly draw a child's attention to the needs and intentions of others, the child will progressively manifest more refined altruistic behavior and supply increasingly appropriate help.[3] The most effective education for developing greater altruistic and empathic qualities in children is therefore, according to the researchers, an education that presupposes the existence of an altruistic predisposition in the child and nourishes it.[4]

An inspiring series of experiments[5] conducted by Felix Warneken and Michael Tomasello confirms the existence of a spontaneous altruistic inclination in young children. As soon as they begin to walk and move around by themselves, they are naturally helpful. The researchers put babies of fourteen months in a room with a person they did not know. This person was carrying out an activity in her corner of the room without paying attention to the baby. She wrote, hung out wash, or tried to arrange books in a cabinet. If she dropped her pencil or a clothespin on the floor that she did not manage to pick up, young children *who were just barely able to walk* spontaneously ran over to help her without anybody having asked them to do anything.[6] The same thing happened if she was not able to open the cabinet to put the books in. Surprised by these

unequivocal results, the researchers complicated the task in order to put the altruism of the children to the test. They repeated the experiment, but this time large objects were put in the way on the floor between the child and the adult. The child, who was barely able to walk, thus had to make a big effort to come to the aid of the adult in difficulty. Were these large objects going to put a stop to the altruistic urge? The answer was no. To the great surprise of the researchers, the children climbed over the obstacles and continued on their way to help the adult! The experimenters, who were very impressed, decided to put the altruistic zeal of the children to an even greater test. They gave them exciting toys, such as a fabulous ball pool. Would the desire to help be stronger than the desire to play? The answer was yes. When they saw the difficulty the adult was having, the babies abandoned their toy, crossed the room, getting over the obstacles on the floor as best they could, provided help to the adult, and then returned to their exciting game.

What is particularly striking here is that the children were not asked to do anything. In each case it was a genuinely spontaneous urge. Matthieu Ricard, a Buddhist monk and a researcher in cellular genetics, confirms, in a work giving an account of studies from all over the world on this subject, that the altruistic inclination is natural and universal, and that it can be observed in all children of this age in all cultures.[7] Altruism is thus not a cultural acquisition but a true innate tendency. Basically, we already knew this in our hearts, but it is quite delightful to have it confirmed by scientific research. So our role is only to encourage and nourish this tendency, which expresses itself spontaneously and preexists any and all instruction.

This work of “encouragement” will not require a big effort on our part. The joy and satisfaction that children get out of their generous deeds is immense! They themselves seek out these situations of mutual helping that make them feel so good. We have already pointed out that when pro-social behavior occurs, the brain secretes dopamine, which acts on the brain’s reward circuits and produces pleasure, well-being, and enthusiasm![8] One experiment showed the strength of this inner reward mechanism: a child of less than two who was given a piece of candy experienced greater happiness if he decided to give the piece of candy to another child rather than keeping it for himself.[9]

OUR PRO-SOCIAL TENDENCY DEFEATED

By isolating us from each other, our contemporary society has tended strongly to make us deviate from our deeply social nature and has encouraged in us individualistic, unjust, and competitive behaviors, which, by the way, make us sick. But when serious dangers arise—attacks, natural catastrophes, accidents—our basic nature resurfaces and the grandeur of the human spirit takes us by surprise. The first reflex of people involved in such disasters, once they are safe themselves, is to reach out a helping hand—if they are still physically and mentally capable of doing so. A research center, unique in the world,[10] has for more than thirty years been studying the human behavior that emerges in the immediate aftermath of such catastrophes. The conclusions are very clear: altruistic tendencies have been overwhelmingly observed. Egoistic or aggressive behavior appears only very marginally, contrary to what the media tend to make us believe. Some people risk their lives to help others whom they don't even know; others offer what little they have left materially—money, their car, their house, and so on. Seeing these altruistic manifestations *makes us feel good.* To know this, we only need to note the number of times a video showing an unexpected altruistic gesture by one individual toward another has been viewed on the internet. Reaching out one's hand to a person in need generates a strange feeling, a lightness, a marvelous presence, the surprising and very paradoxical sensation of taking a step toward being oneself. And this is certainly what we do. By offering help to someone, showing kindness to that person, we reunite with our own deeper nature.

This naturally pro-social tendency can nevertheless be blighted during childhood. For the still immature brain of a young person, violence, especially if it is repeated—slaps, insults, harsh judgments, humiliations, being told to shut up—acts like a knife wound that leaves scars on the brain network. It leaves tracks, automatic tendencies that the intelligence is susceptible to adopting later on. The studies on this subject are quite clear.[11] The atrophying of empathy in a person is linked to the way they were treated in childhood by those around them, and by the way they observed those around them behaving toward each other. We are born empathetic, but we are also born with a powerful learning mechanism, and we are very quick to model ourselves on the behavior of others, for better or for worse.

Not very long ago, I observed a scene on the Paris metro. A woman got on the train with her son of barely three. He went ahead of her and took the last available seat. She told him in a very harsh voice to get up. The child, who

seemed quite tired, squeezed over against the person next to him to make room for his mother. Furious, she grabbed her son, pulled him to his feet, and said in a loud voice that could be heard by everyone, “You’re going to stand for the rest of the trip, that’ll teach you! I’m sitting down, I’m going to be comfortable, but you’re going to stay like that for the whole trip.”

“Mama, please, can I sit on your lap?” he asked, sobbing and climbing onto his mother’s knees. But she pushed him away. “You stay standing,” she said. “I couldn’t care less how you feel.”

The child then was shaken by further sobs, which in spite of everything he tried to hold back. It wasn’t pain that was upsetting the child, it was anger. It was the anger of someone being unjustly humiliated in public, the anger of the weak who have to submit to ill treatment imposed by force. Blows were not needed to injure him. These humiliations leave tracks. Research shows that this kind of insulting, degrading behavior, devoid of kindness but full of violence, gravely damages the capacity for empathy of a child, immediately as well as in the future. This woman was certainly trying to get her son to understand that she wanted him to obey immediately and that there were no two ways about it. But without intending to, she was teaching him something entirely different: force legitimizes humiliation—even of someone one loves, and even when they are suffering.

THE INNATE MORAL SENSE

Young children will spontaneously aid adults in difficulty even if they don’t know them. However, research tells us that, confronted by a moral challenge, altruism becomes highly selective: children prefer, from the age of three on, to help kind people rather than people who hurt others.[12] Are human beings also born with a moral and ethical sense? Everything seems to point to a positive answer.

Recent research shows that we are all born with an ability to distinguish good from evil and spontaneously prefer good. That is in any case the conclusion of Paul Bloom, a cognitive psychologist at Yale,[13] as well as of many other cognitive psychologists who are currently testing very young infants on this point. One series of experiments showed that babies only six months old were able to distinguish good from evil and clearly preferred the former.

The babies were placed individually in front of a puppet theater. They

observed the following scene: A red figure is trying to climb a cardboard hill. It is unable to do it. Then another figure appears, a blue one, who helps the red figure in its climb by giving it a push. Then the scene replays in a different way. The red figure again can't manage to climb the hill, but this time a yellow figure appears at the top of the hill and prevents the red figure from succeeding by pushing it down. After this, the experimenter presented the babies with the two figures, the blue one and the yellow one, with no comment. He invited them to choose which one they preferred. The result was unequivocal: almost 100 percent of the babies preferred the figures that had shown pro-social behavior and helped the red puppet to climb the hill.[14] Of course, in order to make sure this result was not caused by color preference, the experimenters constantly changed the colors of the figures. And, regardless of its color, it is always the "nice" figure that is chosen by the child.

The experiment was then repeated with a different scenario. This time stuffed animals were playing at throwing a ball and the babies were even younger—only three months old.[15] The result was again unequivocal: almost 90 percent of the babies preferred the stuffed animal that had played and nicely thrown the ball back to the stuffed animal that had kept the ball for itself. At only three months old, human babies already possess a rudimentary moral sense, which seems to preexist all instruction. Not only do babies prefer persons who behave in a positive and cooperative manner; they also show a real aversion to those whose conduct is egotistical and negative. And if the experiment is repeated with a neutral figure—one who does neither good nor evil—and a "bad" person who behaves in an evil fashion, the babies still prefer the neutral person. Their natural aversion to "bad" is amazing.

The scientists from the Max Planck Institute in Leipzig who performed these experiments were quite surprised by the strength of this moral sense in children. They therefore decided to test it further. They repeated the experiment with one-year-olds, but this time at the end of the scene, at the point where the child was given the opportunity to choose between two stuffed animals, the good figure offered the children one candy, whereas the bad figure offered them two. Would the children's sweet tooth win out? As surprising as it might seem, the children opted to give up the extra candy and chose the "good guy"!

The only factor that changed their preference in favor of the bad stuffed animal was some feeling of connection: the babies chose the "bad" stuffed animal if they felt they had something in common with it. When, before the

playlet, the experimenter asked the children if they preferred Cheerios or Golden Grahams and then presented the two stuffed animals saying that the bad one preferred the same kind of cereal as the child in question, then eight out of ten children chose the “bad” stuffed animal. For young children, the feeling of affinity won out over morality and negative judgment. That is why, in our class, when any of our children got angry at each other, we avoided separating them and helped them to remember all the things they had in common with each other. The result was often immediate: an offended child who had been able to put words to his emotion would express it to his classmate and then bring up all the things that linked them with each other. The two would then go off playing together even better than before. The dispute then seemed only to have been a passing trifle. I was quite surprised by this. Sometimes it took only a few seconds for the children to resume playing together, laughing even though their faces might still be wet with tears. If we make an effort to emphasize the things they have in common, rancor does not last long in children’s hearts.

We spend a lot of time and devote a lot of energy to inculcating the sense of good and bad in our children. Now, these experiments show that they come into the world *with* this knowledge, and that once again it is not necessary to *create* something from nothing, but simply to recognize these very early abilities and foster their development by placing children in conditions where they can develop and find inspiring examples. One study shows that preschool children know that hitting is “bad,” and their opinion does not change if an adult assures them that it’s completely acceptable.[16] They are thus capable of knowing by themselves if an action is right or not. They know it in their hearts. This moral sense is so deeply established that in adulthood, when we witness an unjust or immoral action, the area of our brain that is activated is the same one that is activated in instances of disgust connected with an odor or a taste.[17]

We are therefore not beings who are meant to live isolated from each other in a climate of injustice, incomprehension, individualism, and immorality. We should clearly understand that one of our great responsibilities is to recognize the loving and fair-minded nature of children so we can support and guide it.

ENCOURAGEMENT THROUGH REWARDS?

How then should we encourage this embryonic social potential and make it flower? Should we reward children when they are generous or altruistic in order

to encourage them?

Tomasello and Warneken wanted to observe the impact of rewards on children's altruistic inclinations. They launched a new series of experiments with children twenty months of age.[18] This time, the experimenter randomly rewarded some children who had shown altruistic behavior with a toy and not others. The result was really very striking. *Contrary to all expectation, the children who were not rewarded continued to offer help, and those who were rewarded helped much less as the experiment continued.* The outer gratification quite simply short-circuited the inner gratification. The intrinsic pleasure was replaced by the extrinsic one. And visibly, this artificial external pleasure was much weaker than the natural inner biological reward. It did not encourage the children to persist in their altruistic behavior. In this experiment the children whose endogenous reward system was not short-circuited happily and spontaneously continued to help the adults in difficulty.

Unfortunately, we follow exactly this same sort of external reward system in schools. Children who learn on their own, following their own spontaneous curiosity, are naturally rewarded by the secretion of dopamine, which makes them experience satisfaction, joy, and enthusiasm; causes optimization of their memory; and incites them to explore continually in order to understand everything. There's no need to reward them to get them to do better; their inner reward system is already giving them wings, and they are ready to master and resolve all mysteries. The goals they set themselves following these inner urges are so ambitious that we would never consider proposing them. Then the child enters preschool. There, most of the time, she is cut off from this inner reward system: she has to labor to learn things according to the rhythm and demands of a school curriculum and the regime of external rewards in the form of grades or evaluations. Her whole system of joy and inner self-guidance collapses. Not only is the child no longer doing what motivates her, but if she does succeed in spite of everything in finding an inner motivation for doing what we require of her, this motivation will be neutralized by our exogenous rewards.

Under such conditions, even though young human beings are wired to learn, learning no longer interests them, and it no longer comes easily. At this point they are rolling their eyes about the whole thing.

Thus, in our preschool class at Gennevilliers, we made it a point not to short-circuit the children's endogenous inclinations. First of all, they could follow their own interests at the moment they arose without following a predetermined

external program. Next, they received no external rewards materially (stars, candies, points) or verbally (positive evaluations). I am deeply convinced that this way of doing things allowed the children to remain connected to their inner reward system and to learn much faster (and more lastingly). They went to school for themselves, to learn—and not because they had to. Their enjoyment of and passion for school was amazing. One of the main bits of feedback we got from parents, which you can see for yourself in the videos,[19] was the parents' amazement at what happened on days when there was no school: on days off, vacations, and so forth, their children were frustrated, even upset. One mother reported that during February vacation her daughter was counting the days until school started again. Another mother told us that her son cried so hard one Thursday when there was no school that she had to take him to see the closed schoolyard fence to convince him the school was closed. Another mother said, "My problem with this class is that when my daughter is sick I can hardly get her to stay in bed because she wants to go to school anyway." Many parents expressed their astonishment at this phenomenon. And to be perfectly clear, the children were not crying because they wanted to see Anna and me, but because they wanted to be in class doing their activities with their classmates.

RECOGNIZING SOCIAL PREDISPOSITIONS AND NURTURING THEM POSITIVELY

How then can we nurture these social predispositions and this inner moral sense if we do not reward them? To provide effective support for the development of altruistic behavior in children, research tells us we should do the following.

- Recognize the existence of an inner predisposition and consider children to be naturally empathic and altruistic. If we do this, children will naturally show more compassionate and generous behavior toward others.[20]
- Nurture this predisposition yourself every day, first by being affectionate, kind, and empathetic toward the child in question,[21] but also toward others.[22] These studies show a very clear correlation between the level of generosity of certain adults and that of their parents. The more generous the parental model is, the more generous the child is as well.[23]
- Provide children with situations in which they will regularly have the opportunity for altruistic behavior; feeling responsible for the well-being

> of others (in tutorials or mixed-age classes, for example) is an essential component in the development of altruism.[24]

These three elements were a part of everyday life for the children during the three years of the Gennevilliers preschool class. The development of their altruistic behavior was remarkable and was noted with considerable amazement by the children's parents during the first months.

In addition, research indicates that children have a greater probability of developing a strong moral conscience when their parents provide clear and fair boundaries for them, while still respecting the children's autonomy and inviting the children to respect theirs.[25] We tried to provide this kind of framework of compassion and respect for the rules to the children in our class, and it would seem, in view of the moral qualities that they developed, that our effort was successful.

WHAT BECAME OF THE CHILDREN IN OUR CLASS?

This is a question I am often asked. I believe that behind this question lies the fear that our children had a hard time going back to the traditional system that awaited them in elementary school. Were they able to adapt to the activities that were imposed on them? To limited autonomy? Did they retain their social skills? Did they remain as generous and empathetic as before? Did they achieve good academic results?

According to exchanges I've had with the parents and their children, the children are having pretty much the same experience as young children do when (at the age of three) they first enter the traditional school system as preschoolers. At first, it is difficult, then progressively, they adapt to the new conditions, more or less well, depending on the child. As for *all* children in France who go to school, some adjust well to this forced adaptation, others much less well.

Most of our children, despite the difficulties they had at first, afterward were among the best students in their classes. Their parents proudly sent me copies of their report cards. They also indicated that the pro-social abilities they had developed in preschool were largely retained. They were big helps to their classmates. Here is some feedback I received from parents.

> Kenza adjusted very well to elementary school. She continued to be very helpful to friends of hers who were having problems. For that

reason, when school starts again, after her own second grade class, she'll stay to help the first graders in the afternoon. Her report card is excellent; she participates a lot. She is still autonomous, expressive, and happy. I don't have any problem with her going to school, she likes going! In the evening, unlike her brothers and sisters, I don't have to check her homework. It's always perfect.

His two years of preschool had a very positive effect on Suleiman scholastically. They gave him a lot of confidence in himself. Today, he's a child with a thirst for learning. He's sure of his intellectual ability and is not afraid of taking chances. He hasn't stopped being self-motivating as far as reaching his potential is concerned. He's doing very well in elementary school and his grades are excellent.

Nothing particular to say about my daughter. Everything is going quite well. Her grades are very good. She is still happy, expressive, autonomous, and outgoing. She still helps other children as much as before.

Everything's going fine with my son. He likes going to school, has fun with his friends, and his report card is great. I'm proud of him. Would you like me to send you a copy of his report card?

As far as entry into elementary school is concerned, the results were very good according to teacher's reports. Nevertheless, the group awareness that Kamilya had developed was problematic at the beginning of the year, prompting such comments as "Too worried about the other children." By the end of the year, however, this trait of hers was accepted as being compassionate and generous.

Thus the difficulty that some of the children had in adapting to their new situation was essentially social. The children had trouble restraining their urge to help others, but they had to learn to restrain it because it disturbed the organization of the class.

Another problem some of the parents brought up had to do with the lack of meaning and individualization their children encountered.

The first year of elementary school is a big change for all children,

> and our child took it pretty well. However, I felt that my daughter didn't seem to find much sense in what she was being asked to fit into, a little like she was thinking, "There's no meaning to what I'm doing." On top of that, being submerged in an atmosphere that's sort of "one size fits all," the sense of personal development and personal expression she had such a taste for before seems to have fallen by the wayside.

This failure to take into account individual needs caused major problems for some of the children. I'm thinking particularly of those who had learning or language problems. Since they were no longer benefiting from totally individualized help in class, and since they were also no longer able to offer their knowledge to children younger than themselves, they lost a lot of self-confidence and began to feel "different," "not normal." Whereas before, in our class, all the children pursued subject matter at their own pace, and they *all* felt unique. The norm was difference, not sameness.

Living Together to Learn to Live Together

In our preschool class at Gennevilliers, the children spent the day together. They helped each other, knew each other very well, and accepted unquestioningly each other's very different personalities. Rather than comparing themselves with each other and judging each other, they were very tolerant and protective toward each other. How did we create this harmony? By simply not preventing it from arising. Instead of teaching the children how to live together in a theoretical fashion, we let them simply learn it from living together. They were free all day long to organize things among themselves and to interact with and encounter each other. In this way they experienced relationships and the emotions that they arouse, the best way to resolve differences, and so on. This autonomous life together, with children younger and older than they were, allowed them to develop a remarkable social and emotional intelligence.

To be sure, the beginnings are not obvious. Children arrive at the age of three already with behavioral models that are sometimes violent, which they have learned from their environment. Some of them were quite capable of coarsely and humiliatingly insulting a classmate who had accidentally bumped into them. Others were quick to raise a threatening hand in conflict situations. In these circumstances my response was immediate and firm. The children had to feel that even a hint of these kinds of scornful and humiliating behaviors would not be tolerated. We immediately gave the example of another way—a peaceful and respectful way—of expressing their emotions.

Sometimes, what was involved was not the expression of an emotion but a mere automatic reflex. I remember a little girl of three who would constantly say to any classmate who came near her, "Are you serious? You're fucking pissing me off." She was really surprised when I told her firmly, "I will not tolerate your

talking to your classmates that way. It's insulting and unpleasant. I don't think you'd like anyone talking to you that way. You can say, 'I would prefer working by myself, if you don't mind.' Don't you think that would be a nicer thing to hear?" She nodded her head yes. Often, very often, during the first few weeks I had to go back to her and suggest on the spot some other way of formulating her wishes. But with time, trust, firmness, and kindness, children change. They replace these automatic reflexes that they themselves end up feeling are inappropriate, and they evolve together.

I am not going to hide the fact that the first few months were hard. And as I said before, in order to help the children "come back to themselves," it was essential for us to be very present to ourselves. In dealing with children who may feel lost, cut off from their own inner guidance, we ourselves must be the structuring factor, the reference point. We must be grounded, straightforward, firm, fair, and trusting in all circumstances. This requires major work on oneself, I repeat, but it's something we can't get around doing. We constitute a human ecosystem—we can't ask the children to change their attitudes without changing our own.

Within the class, the example of our own behavior was really the determining factor. Our way of behaving and speaking was the model for the children six hours a day. Thus we had a tremendous responsibility to exercise a positive influence on the structuring of their brains. So it is a matter of primary importance that adults who want give positive guidance to children in their social and emotional development should learn how conscious and empathetic communication works. The way we express ourselves, without our knowing it, sometimes conveys a sense of judgment that blocks communication and brings about a separation between self and other. What is known as "nonviolent communication," or NVC, which emerged in the 1970s, enables us to learn to express ourselves with the greatest possible considerateness by constantly remaining in empathic rapport with the other, even in conflict situations. To me, it seems essential for all of us to familiarize ourselves with this process that promotes cooperation and dialog. Then we can transmit it directly to our children. When we exchange with them, or in front of them, we are teaching them how to exchange with us and with others. I would like to invite those who would like to learn more about this to read *Nonviolent Communication* by Marshall Rosenberg.[1] As he himself says in his book, this form of communication "contains nothing new; all that has been integrated into NVC has been known for centuries." All that is necessary now is to become aware again

of what we have forgotten in order to communicate in a harmonious, conscious, empathetic, and nonviolent manner.

At the same time, as I have already pointed out several times, we gave the children the tools they needed to manage their inevitable conflicts by helping them toward mutual understanding and by suggesting solutions that provided a positive outcome to the situation when that was possible.

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Strong bonding and strong compassion are the foundation on which any environment that is intended to guide children to full development must be built. What instructional material we have and the space we can offer don’t matter that much. What really makes the difference is the strength and quality of the human bonds among the children and with the adults. Of course material and activities are necessary in sufficient variety and quantity to facilitate autonomous and enthusiastic choice. However, I repeat, once the activities are in place, it is essential to offer the children all our humanity, our love, and our trust, so that the best of ourselves can resonate within them. These lofty emotions carry and elevate intelligence as nothing else can. If human beings receive this psychological nourishment all through their childhood, then when they reach adulthood, fraternity, altruism, and compassion are no longer an effort but are a natural state.

CONCLUSION

Let's Help People Reveal Their Beautiful, Luminous Nature

The discoveries of scientists studying human development are absolutely electrifying. My gratitude toward these researchers is immense. Their work reminds us—because, fundamentally, didn't we already know it?—that the young child is a being of love, an energy of goodness incarnate who above all seeks and loves the good, and frowns in the face of evil. Let us look at our children and remember they are made out of joy, love, and empathy. They are basically moved by altruistic and generous energies. They are the saviors of the world, ardent defenders of the helpless. We know this, but we forget it.

We forget it because these wondrous and luminous beings soon enter a system that shapes their plastic intelligence to fit an individualistic and competitive model. We can always try later to resurrect what we have stifled, but at the cost of what effort? How can we not understand that we are impeding and sidetracking their pro-social behavior from the youngest age—and that we continue to do this when they reach adulthood? How can we not see that we are sowing the seeds of what we later come to deplore? By failing to obey the law that calls for human beings to develop in a state of bonding, we are operating collectively at a diminished empathic level and also at a diminished cognitive level, a diminished metabolic level, and a diminished creative level. We are missing our real potential.

Cooperation, generosity, altruism, and human warmth should no longer be considered alternatives or merely attractive or healthy options. These values must be the foundation of any environment intended to accommodate human life

and help it thrive. Positive bonding with others is not negotiable; it is the key to individual and collective development. No teacher, no teaching manual, no educational institution, no instructional material, nothing at all—*nothing*—can compete with the energy and inner power that bonding generates. It makes miracles, causes us to flourish, to innovate. It lifts spirits and naturally opens hearts.

Let's stop coming up with a thousand and one pedagogical inventions, a thousand and one new methods. The solutions are much simpler, but unfortunately they require a real overhaul of our attitude. Let's give children what they are asking for—the freedom to be active within a rich environment where they can live with each other and with us in a relationship of trust and compassion. That is all the human spirit requires. But children are often restrained: "Stop talking to your friend," "No, don't sit next to that person, you'll giggle all class long," "Don't help him, let him work it out for himself." Just like putting forth tremendous energy to yank out the beautiful flowers that are growing with the marvelous vital force it takes to come up between the flagstones of our walkways, we are collectively putting out a colossal amount of energy to stifle the social energies of children that somehow manage to manifest even in sterile circumstances. We are fighting the laws of nature, and it is exhausting us. We cannot end up the winners in such an absurd fight. Let's allow our children to laugh together, innovate together, squabble together. Let's just exhale and save our energy to observe the spectacle of thriving human life. We must understand that our principal task is not "to do something," not to invent yet another new "method." Our job is essentially not to interfere with the natural method of our children, to respect their inner laws and directives. Our role as adults really consists in understanding them in order to not keep short-circuiting them.

I am, moreover, deeply convinced that these laws, which, tragically, we continue to meddle with, are seeking to guide us toward horizons of peace, joy, harmony, and great intellectual and social achievements. I have often been answered on this point with a hint of disdain and condescension: "You are young and naive. If things were really this simple, we'd know it by now." But no, we do not know it by now, and I would go so far as to say that the time has come for us to roll up our sleeves and do the work necessary to make these simple truths shine forth, because by ignoring them, we are collectively taking a wrong turn.

And let's not wait for our governments to start working in this direction. Let's not wait for them to require our boards of education to bring new life to our

classes, for them to allow naps for all children who ask for them, or for them to facilitate mixed-age classes. Let's not wait. Let's just do it ourselves. Teachers, teacher's assistants, school principals, here is my message. Let's not wait. Let's just do it ourselves. *You* are the experts. *You* have been in the field for years. You already know intuitively what we must do for our children. That is the whole point of this book—to say that your intuitions are accurate, that you are right; and to encourage you to continue on with the changes you have already initiated. We are more and more numerous. Let's go forward, each at our own pace. Let's make the improvements that seem possible and necessary step-by-step. Let's work together with the boards of education to create learning situations that are alive, dynamic, and conducive to the development of everyone—the teachers as well as the children.

Letting the experts in the field—teachers, teacher's assistants, and principals—do their work by instituting the changes they think are best for our children is the key to improving our schools. Most of the time, it's them—without institutional help—who face the torrents of angry resistance. By not supporting them with friendship, warmth, and compassion, we lose something very precious to us—their strength and their creative enthusiasm.

We often talk about the children, but we must also consider the teachers, who are exhausted. They can no longer deal with incessant reforms and their lack of freedom and the absence of explicit trust. Teachers also require trust. They need sincere and committed trust—trust that says yes, that supports, facilitates, and encourages. For the moment, I see no other way to bring new life to our schools. The teachers have solutions. Let's let them put them to work. What have we got to lose? Be honest. They are the ones holding the fort while the authorities continue to squabble. Let us finally recognize this at last and let them, the people who know our schools down to their last nooks and crannies, improve and beautify them. Our trust will multiply their powers, raise their spirits, and open unexpected doors.

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As I'm sure you have understood, the objective of this book is to bring to light the main principles of learning and development in order to draw your attention to what is essential regarding the necessary evolution of education. Young children must nourish their incredibly plastic intelligence through contact with the world by engaging autonomously in a variety of exploratory activities they

are drawn to within a well-organized environment. They must be surrounded by people of different ages who support and trust them. Once these major principles are understood, they must be applied within whatever limitations we face, which are different from one home or one school to another. It is not necessary to provide all these conditions. In our preschool class in Gennevilliers, for example, institutional and environmental limitations prevented us from bringing the children into contact with a rich and soothing natural environment, and the only space we had was that of the classroom, which limited our ability to provide autonomous activities. However, by working on some of the key points—a significant level of autonomy; ambitious, attractive, clear, instructional activities that progressively increase in difficulty; numerous positive interactions with children of different ages; and an attitude of equality on the part of the adult that was nonjudgmental and supportive—we were able to have a very positive effect on the progress and development of the children.

Thus our experiment is an encouragement to go forward step-by-step, according to the possibilities and resources available, without putting ourselves under useless pressure. Bear clearly in mind that the important thing is not to provide the children with an ideal environment immediately, but to move calmly in the direction of more and more favorable conditions for them, allowing ourselves time, not squeezing ourselves too much. Attaining perfection is not the goal—what counts is our enthusiasm, joy, and the will to go forward.

But above all, we shouldn’t go too fast. We have much to learn along the way. All the trial and error we go through on the road to our objective is indispensable. It is the essential pathway to learning and understanding the mechanisms that sustain the operation of this new system. In this way, just like the children, we can progressively readjust our inner models and beliefs. We must allow ourselves the time needed to tread this pathway. Let’s not run, because we have already arrived, we are already in the right place. Let’s just breathe and simply take the next step.

There are already a great many preschool teachers working in this direction. And they are not alone. For years, teachers on all levels have also been seeking, with the greatest compassion, to provide more physiological learning conditions, better adapted to the natural laws of childhood, in particular by promoting autonomy and a mix of ages.[1]

I hope this book will provide fresh impetus to those who are still hesitating. I want to say this to you in all friendship and with the greatest feeling of

solidarity: let the children reveal themselves to you. Their radiance will amaze you. Their creativity, their joy, their love, and their generosity are overwhelming. When children begin to develop what they *are*, their universal human traits and their individual uniqueness, it is like witnessing the sun rising. You the spectator are profoundly touched. The radiance of these free minds begins to transform *you*. I was far from imagining what a great imprint these children would leave on me. I saw their humanness, their light, and the love and joy that pervade them. And especially, I understood one fundamental thing: all that cannot be taught. We must simply leave it the space to express itself and guide it with the deepest admiration and respect.

You parents who are reading this book and who think your child is extraordinary, especially gifted, and unique: you are right. Our children are extraordinary, gifted, and unique. And if our schools are incapable of bending the knee and serving this budding expression of humanity, then they're in big trouble. Because humanity can no longer wait; its potential has to be liberated now so it can shine with its full power. We should say to children: "You are a being naturally endowed with reason, empathy, imagination, creativity, and generosity. There is nothing I have to create in you—you already possess all that within you. As the months pass, driven by the laws of nature, you will ardently desire, with all your being, to develop this potential that you were born with. You will want to walk, talk, explore the world, help others, have friends, quarrel, carry out your own projects. You will want to do all that by yourself, and you're right, because you yourself, through your own explorations, are the one who will transform these initial promises into a unique and strong intelligence. But in this great work to achieve your individual humanity, I will be there to help you. I will be able to recognize the importance of your intelligence and its needs; I will be able to respect it and guide it—firmly when necessary, you can be sure of that. My dearest wish is for you to be able to reveal what you have within you, develop it fully, and illuminate the world with your intelligence and its beauty."

On this road, the experiment at Gennevilliers represents a starting point—not an arrival. People should feel free to retain from this work what seems pertinent to them and forget the rest. Once we have understood the fundamental laws that condition child development, each of us should have trust and confidence that we can find the best practical applications of those laws in accordance with the means that are available to us, taking care not to fall into the trap of dogmatism. We should always be ready to call our knowledge into question in the light of our practical experience, our intuition, and the discoveries of the sciences of

human development. I would like the experiment at Gennevilliers to be an inspiration and not a model. I hope it gives you the encouragement and confidence necessary to carry out your own experiments.

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RESOURCES

On the website of Céline Alvarez and her team, you can find more information on the pedagogical organization of the preschool class at Gennevilliers (www.celinealvarez.org/?locale=en). Particular topics covered include:

- group sessions
- monitoring the children's progress
- schedules
- the teacher's approach
- the class assistant's approach
- organization of the environment/classroom
- the different stages of setup
- the different stages of autonomy
- a list of the materials used
- relations with the parents

You will also find videos on these topics:

- parent testimonials
- photos from the first two years
- instructional activities

NOTES

INTRODUCTION

1 From the 2007 report of the Haut Conseil de l'éducation (High Council on Education).

2 Thus 25 percent of French children were weak in reading, writing, and mathematics, and 15 percent did not even attain basic skill levels in these areas.

3 Mattea Battaglia et Aurélie Collas, "Classement Pisa: La France championne des inégalités scolaires" (PISA Assessment: France Is the Champion of Scholastic Inequality), *Le Monde,* December 3, 2013.

4 More practical information on the website www.celinealvarez.org/?locale=en.

5 Jean Itard is known for his work with Victor, the "wild child of Aveyron."

6 The monitoring of this first year was organized by Agir Pour l'École (Action for Our Schools). The tests were selected by a psychologist and technical expert contracted to the Laboratoire de Psychologie et Neurocognition, which is affiliated with the CNRS (National Center for Scientific Research). The testing was conducted by independent psychologists, and the data was analyzed by the association Agir Pour L'École. For further information, see www.celinealvarez.org/?locale=en,under"Presentations/Results over Three Years."

7 You can watch them at www.celinealvarez.org/?locale=en.

8 The tests for the second year focused on mathematics and reading. The language tests were selected by the researcher Karla Monzalvo, then at UNICOG (Cognitive Neuroimaging Laboratory of the French National Institute of Health and Medical Research), directed by Stanislas Dehaene. These tests were conducted and analyzed by Karla Monzalvo with the assistance of Benoît Charlieux, PhD in cognitive psychology. The mathematics tests were selected by researcher Manuela Piazza, then also at

UNICOG, and were conducted and analyzed by Dr. Benoît Charlieux. For more information, see www.celinealvarez.org/en/results-over-three-years.

9 Stanislas Dehaene decribes these first results in his lecture “Apprentissage de la lecture: Apport des sciences cognitives” (Learning to Read: The Contribution of the Cognitive Sciences). This lecture was given at the Collège de France and is available online.

10 See www.lamaternelledesenfants.wordpress.com.

PART ONE: THE PLASTICITY OF HUMAN INTELLIGENCE

1 Epigenetics (from the ancient Greek *epi*, "above," or "on top of" plus "genetics") is the discipline that studies the molecular mechanisms that modulate the expression of genetic heritage in response to the environment.

2 Sometimes badly translated as "ambience."

1. BRAIN PLASTICITY

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2. THE NATURAL LAWS OF LEARNING

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3. THE GENNEVILLIERS EXAMPLE

1 You can get more detailed impressions of the way we organized classroom space at www.celinealvarez.org/en/reorganise-your-classroom. Also at www.celinealvarez.org/en/the-various-stages-of-implementation.

2 This phenomenon has been called "embodied cognition."

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invited to watch the video “Regroupements” on the website www.celinealvarez.org/?locale=en.

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PART TWO: HOW TO TEACH

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4. REFINING SENSORY PERCEPTIONS

1 S. Dehaene, “Fondements cognitifs des apprentissages scolaires: L’attention et le contrôle exécutif” (Cognitive Foundations of Academic Learning: Attention and Executive Control), course at the Collège de France, January 13, 2015.

2 Pairing of the sixty-three shades requires the use of two “Number 3 color boxes.” This activity is suggested by Maria Montessori in her *Dr. Montessori’s Own Handbook.*

3 More information on group sessions can be found at www.celinealvarez.org/?locale=en.

4 A. N. Meltzoff, P. K. Kuhl, J. Movellan, and T. J. Sejnowski, “Foundations for a New Science of Learning,” *Science* 325, no. 5938 (2009): 284–88, doi:10.1126/science.1175626; Dehaene, “Fondements cognitifs des apprentissages scolaires: L’attention et le contrôle exécutif.”

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7 The exhaustive list of this material is presented on our website at www.celinealvarez.org/?locale=en.

8 Dyslexia International—Sharing Expertise. This is a very interesting online training that presents the same general method we describe in this book as the most effective means of helping dyslexic children learn to read. www.dyslexia-international.org.

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10 Piazza, "Le goût des nombres et comment l'acquérir."

11 All these activities will be available as videos online at www.celinealvarez.org/?locale=en.

12 Dehaene, "Fondements cognitifs de l'apprentissage des mathématiques"; Piazza, "Le goût des nombres et comment l'acquérir"; S. Dehaene, *La Bosse des maths* (The Flair for Math) (Paris: Odile Jacob 2010).

7. BEGINNING TO READ AND WRITE

1 S. Dehaene, "Fondements cognitifs des apprentissages scolaires: Fondements cognitifs de la lecture" (Cognitive Foundations of Academic Learning: Cognitive Foundations of Reading), course at the Collège de France, February 24, 2015 (the course is available online); S. Dehaene, G. Dehaene-Lambertz, E. Gentaz, C. Huron, and L. Sprenger-Charolles, *Apprendre à lire: Des sciences cognitives à la salle de classe* (Learning to Read: The Cognitive Sciences in the Classroom) (Paris: Odile Jacob, 2011).

2 Ibid.

3 The MRIs done on the children in our class who were readers show that their reading circuits were in place at least a year ahead of the norm. These first results were presented in the following lecture given at the Collège de France: S. Dehaene, "L'apport de sciences cognitives à l'école: quelle formation pour les enseignants?" (The Contribution of the Cognitive Sciences: How Should Teachers be Trained?), November 13, 2014.

4 The examples of words given by the author are in French, but the translator has supplied equivalent English-language examples throughout this chapter.

5 Dyslexia International—Sharing Expertise, at www.dyslexia-

international.org; S. Dehaene et al., *Apprendre à lire*.

6 The testing for this first year was organized by the association Agir Pour L'école (Action for Schools). The tests were selected by a psychologist and technical expert from the Laboratory of Psychology and Neurocognition, which is affiliated with the National Center for Scientific Research (CNRS). The testing itself was carried out by independent psychologists. Agir Pour L'école analyzed the results. For more information, see www.celinealvarez.org/en/results-over-three-years.

7 The tests for the second year focused on mathematics and reading. The language tests were selected by the researcher Karla Monzalvo, then at UNICOG (Cognitive Neuroimaging Laboratory of the French National Institute of Health and Medical Research), directed by Stanislas Dehaene. These tests were conducted and analyzed by Karla Monzalvo with the assistance of Benoît Charlieux, PhD in cognitive psychology. The mathematics tests were selected by researcher Manuela Piazza, then also at UNICOG. The mathematics tests were conducted and analyzed by Dr. Benoît Charlieux. For more information, see https://www.celinealvarez.org/en/results-over-three-years.

8 Stanislas Dehaene describes these first results in his lecture entitled "Fondements cognitifs de la lecture" (Cognitive Foundations of Reading), a part of his 2015 course at the Collège de France entitled "Fondements cognitifs des apprentissages scolaires" (Cognitive Foundations of Academic Learning), already cited.

9 Videos showing the presentation of language activities will be put online at www.celinealvarez.org/?locale=en.

10 A digraph is two letters that encode one sound.

11 Dyslexia International—Sharing Expertise. www.dyslexia-international.org.

12 The video is available on the website.

13 This video is available at www.celinealvarez.org/?locale=en.

14 A phonetic word is a word all of whose letters are pronounced, like the words in the Spanish language. One letter equals one sound—there are no "traps."

15 If these reading activities interest you and you would like to know more about them, you can find them presented and explained on our website

with videos of the children working on them. You can also download the files of these activities.

16 Videos of this are available at www.celinealvarez.org/?locale=en.

PART THREE: DEVELOPING FOUNDATIONAL INTELLIGENCE 8. THE PERIODS OF SENSITIVITY

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3 J. Mehler, G. Lambertz, P. W. Juszyk, and C. Amiel-Tison, “Discrimination de la langue maternelle par le nouveau-né” (Discrimination of the Mother Tongue by the Newborn), Reports of the Académie des sciences, series 3, *Sciences de la vie*, 303, no. 15 (1986): 637–40.

9. THE EXECUTIVE SKILLS

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2 Ibid.

3 I refer you to her warm and inspiring lectures on the internet, in particular: A. Diamond, “Turning Some Ideas on Their Head,” TEDx, 2014; and “Cultivating the Mind,” a lecture given as part of the international conference “HeartMind 2013.”

4 W. Mischel, E. B. Ebbesen, and A. Raskoff Zeiss, “Cognitive and Attentional Mechanisms in Delay of Gratification,” *Journal of Personality and Social Psychology* 21, no. 2 (1972): 204–18.

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10. PROMOTING DAY-TO-DAY AUTONOMY

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13, 2015.

2 Maria Montessori, *The Secret of Childhood* (New York: Ballantine, 1982): 44.

3 Teachers, if you would like to learn more about an approach based on the autonomy of the children, I invite you to visit my website www.celinealvarez.org/?locale=en.

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11. GREATER FREEDOM

1 J. E. Barker, A. D. Semenov, L. Michaelson, L. S. Provan, H. R. Snyder, and Y. Munakata, "Less-Structured Time in Children's Daily Lives Predicts Self-Directed Executive Functioning," *Frontiers in Psychology* 5, no. 593 (2014): 1–16.

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12. PROTECTING CHILDREN FROM TOXIC STRESS

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13. COMING BACK TO OURSELVES

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PART FOUR: THE SECRET IS LOVE

14. THE POWER OF BONDING

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15. ENCOURAGING THE EXPRESSION OF INNATE SOCIAL TENDENCIES

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CONCLUSION

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