

## **Web-Based Radio Show**

### **The Mind and the Brain Part I**


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Welcome to our Web-Based Radio Show. This is Dr. Greenspan coming to you again. Today we have a very interesting topic and we are going to call this, “The Mind-Brain Relationship.” The reason why I am bringing it up today is that lots of listeners ask me about whether or not experiences, particularly the right kinds of emotional experiences result in actual changes in the brain too, or whether we just get mental changes alone. This has been a perplexing problem for over 2,000 years. Today I thought I would clarify how experience builds both the healthy mind and healthy brain, but how the experience comes first, the healthy mind comes second, and the healthy brain comes third. Or, in reverse direction, poor experience or the wrong types of experience and problems with the mind can lead to problems with the brain.

Now as my colleague, Stuart Shanker, likes to discuss when we work on our books together, these are problems that have been with us for over 2,000 years trying to solve, and we believe we have some insights – some new insights – that will help us significantly. Some of it comes from our work with children with ASD where we are finding in our research at Professor Shanker’s laboratory, that the right kinds of emotional experience are not only changing the way children feel and talk and behave and experience themselves and others, but also resulting in very favorable changes in the ways their brains function, particularly in the areas of the brain associated with emotions. We have some preliminary pilot data, but we are now doing the same studies on larger groups of children that will be very, very exciting, I think, to share with you and particularly we will be sharing some of that at our November meeting for our Interdisciplinary Council (ICDL).

The way it works is this: First, consider a few basic facts that have been well established, and then we’ll give some examples throughout the developmental sequence that children go through; through the developmental stages of how it works. First the facts. It has been widely shown now in both animal and human studies, but with lots of animal studies, that experience can change the very structure of the brain. For example, with humans, musicians have more neuronal connections in the area of the brain having




to do with the movement of the fingers concerned with their particular instrument. So here we see the effect of practice and doing on a part of the brain. With studies with animals, we have known that for a long time, studies have shown that if you provide certain kinds of experience, you can increase the connections in different parts of the central nervous system or the brain, depending on the kind of experiences you provide. You can even help one part of the brain take over for another where there has been a trauma or a deficit or an injury by providing that extra experience. So the human brain seems to be very “plastic” in the sense that it is open to the effects of experience. In a new work on epigenetic phenomenon, those biological phenomenon that control our genes – turn them on and off and regulate them – fits in with this because they are very experience-dependent. How they work is determined by the experiences we have.

So one fact is that the brain is very plastic and open to experience as it develops. Mother Nature designed it that way so that it could adapt to the environment it found itself in. There are only some of the basics there at birth.

A second fact is that there are different kinds of experience. Deprivation, for example, with human beings will lead to faulty development. Children without language; without the ability to integrate different kinds of experiences – what they see, hear, feel, touch, and how they move – so they will be much more dysfunctional. We see the effects of deprivation from children who grew up in orphanages where there wasn’t any human stimulation. They didn’t develop relationships or the capacity to think or speak; things that require many parts of the mind and brain working together. But we also see stress changing the way the brain works as well as the child’s behavior. So there are lots of experiences on the human side. On the animal studies, we also see this fact that it is certain kinds of experience. If you over stimulate an animal – put it in overcrowded conditions, for example, you will get lots of stress and you get development on the negative side. On the other hand, appropriate nurturing and experiences appropriate to that animal’s development will result in favorable development. We have seen that with human beings as well. So not all experiences are the same, is the second fact.

The third fact is, and this is the most important one, is that in recent years we have discovered what are the most appropriate kinds of experiences to build a healthy mind and a healthy brain. What are the capacities that all human beings need as foundations for healthy functioning? We have outlined this in our stages of functional emotional developmental capacities. The ability to attend, relate, engage in two-way exchange of gestures, particularly emotional gestures with facial expressions, the ability to get into a continuous flow of these gestures in a shared problem solving way where the child takes daddy’s hand to help him find a toy, the ability to then move to using ideas but using them meaningfully and creatively and then to connect ideas in different levels of logical




thinking that we have outlined before and I won't go into again. So I have identified the kinds of milestones and foundations children need to develop and described the kinds of experiences that require it at each of these of these milestones to be mastered.

Next I am going to go into some examples of how it works, why at first we have the experience, then we have the development of the mind, and then we get the development of the brain and why it is not the brain first.

It seems to work in the following way. Just like with musicians, we don't get changes in the neuronal connections and the parts of the brain controlling the fingers until the musician has practiced those finger movements a lot. So it seems like you have to have the experience a great deal before the brain develops the pathway. In other words, it is not genetically wired, it is experience dependent. So the baby needs the experience first and then develops the mental capacity based on that experience, which in turn helps wire the brain. So the brain is the result of the practice. When people sometimes talk about a motor memory and doing sports, this is the same type of phenomenon. You are getting the experience to really wire things and to help things happen. So that is a very, very important factor in all this, and that is the factor that the experience comes first, the mind comes second, and the brain comes third; that you need to practice it before the wiring will take place.

Let's take an example from the very beginning of life where babies are just learning to look and listen, and see how this occurs. Newborn baby begins turning to mommy's face, listening to her voice, looking at her big smile, and is attracted by the pleasurable sound and the pleasurable smile. If the sound is aversive – too high, too grumbly, or too irritated, the baby won't look and listen as much, and we won't see that coordination of movement – looking and listening and eventually leading to a big smile. By 3-4 months of age the baby is now smiling at mommy and looking and listening, and then by 8 months the baby is actually smiling, looking, and listening and beginning to interact with different facial expressions and different emotional gestures back-and-forth and we see nice, what we call “reciprocal back-and-forth interactions” between the baby and the mommy.

So what do all of these experiences mean? The baby is developing mental capacities, initially to look and listen and to experience pleasure all at the same time and to move along with it. That is a mental capacity – to coordinate the senses with movement with emotions and pleasure. As the baby practices this and does it many times, the pathways in the brain that connect emotional areas of the brain with movement areas, with what the baby sees and what the baby hears begins connecting up together. We see, then, the wiring occurring. Now this hasn't been documented with hard research




yet, but the research on, again, musicians with adults and animal studies suggests strongly that you have to practice and do something many times before the brain develops the wiring to support it. So in other words, you would think the brain is there and enables you to do it and you've got it. But as musician studies show, just playing the piano once or twice won't develop those areas of the brain – not until you have really mastered it, then you seem to get it wired and you can do it anytime and anyplace. We are assuming that's what people mean by body memory – when a great athlete practices it over and over again until they have it.

Well, all abilities seem to have this quality of practice leading to changes in the way the neuronal structures of the brain work. So at the beginning at birth, there are certainly potentials there – potential to learn, then experience happens like the looking, listening, experiencing pleasure of mother's voice and coordinating that with pleasure, and then after you get the coordination of the looking and the listening and the pleasure and then you add onto it the big smile, you recruit more areas of the brain as a result of new mental capacities and how to experience intimacy. Then as you get back-and-forth emotional signaling, as you practice that a lot, you bring in the frontal areas of the brain involving planning and sequencing. As you get into what we call shared social problem solving, the fourth stage where the child or toddler is in a continuous flow of back-and-forth interactions with caregivers and taking mommy by the hand to the refrigerator to get the favorite food or daddy by the hand to go find the favorite toy, now you are getting more of the frontal lobes involved. But again, until you have practiced this a lot, so you have an enticing daddy who is offering his hand to little Susie or Johnny to take it and find something, you're not going to have the practice necessary to wire those connections that are needed.

Then as we bring in use of ideas and words through creative pretend play, we are bringing in more of the cortical functions. So we are taking the emotional centers of the brain having to do with limbic areas and the hippocampus probably to some degree in terms of memory, and those are getting connected up to the frontal lobes and the cortex, and we see some of this happening, to some degree. Equally importantly, with children who have been deprived, we don't see these connections. With children, who for biological reasons find it hard to get involved in these experiences – children with autism – we are seeing a lack of connections between different parts of the brain; more than the lack of development of any one part of the brain.


So the sequence appears to be experience first, but it has to be the right kind of experience like a pleasurable voice with mommy, the big smiles fostering intimacy, the responding to the baby's emotional signals with emotional signals back to get back-and-forth signaling, the offering of social problem solving and the working with the child as a



social partner with strong shared emotions of pleasure and mastery, and the involvement with creative pretending to get creativity cooking. So nothing happens for nothing, you get everything with practice, and as you practice it, and as you move forward with that practice, you begin getting better and better development and more and more development. What we mean by the fact that experience is one, the mental capacities that result from that experience is two, or the mind, and then three, the wiring of the brain. When we get to logical thinking, it's the same thing. If you don't have a parent who asks the child "Why do you want to go outside?" we don't have as good of a logical thinker as with a child whose parents ask him why he wants to go outside. If they just say yes or no, we don't get as much logic as a child learning to explain, "I want to go outside because I want to play" or "...because I want to go on the swing" or "...because I want to do this or that."

Later with multi-causal thinking and gray area thinking where a child can discuss things subtly, each time the child is practicing that ability, we are getting new mental capacities for sure, and that if you practice it leads to, most likely, new wiring in terms of areas of the brain. Again, there isn't that hard research data showing that connection from the mind to the brain, but there are enough elements of research – little pieces – that are very suggestive of this overall model that we are discussing. As we get to more abstract thinking and higher levels of logical thinking, we are bringing in higher levels of cortical functioning. But we are connecting those to the other areas of the brain – the looking, the listening, the emotions, and the feelings. We get the brain working as one strong orchestra, very smoothly.


So as we were discussing, we get the sequence where we have experience building mental capacities or the mind, and as we practice, as those experiences occur over and over again, and as we respond to those experiences with our new mental capacities, we build the brain structures that support it. We trace this through the first stage of what we call "regulation and interest in the world" where the baby is just learning to look, listen and move all coordinated by that emotion of pleasure to the second stage where they develop intimacy and add deeper levels of feeling to the equation, to the third level where they are developing the ability to sequence and get into back-and-forth emotional signaling where they are recruiting not just the areas of the brain that have to do with looking, listening, feeling, and moving, but now with sequencing, planning, anticipating, and initiating. Often we think of those as involved with the frontal lobes and the prefrontal cortex to again to shared social problem solving involving the use of words and ideas but mostly more elaborate functioning of the frontal lobes together with the desire, intent, having to do with our emotions and the emotional



centers of the brain, and the beginning recruiting of some of the cortical areas. Then to higher levels of cortical areas being recruited as we learn to use ideas.

Again, the experience that we have with others – the baby with their caregiver, for example – the baby initiating more and more of that experience leading to the mental capacities and as it occurs in various subtle variations over and over in many different form of baby taking mommy by the hand or daddy by the hand to open the door or find the toy or get a favorite food; as that occurs, we see that the brain is getting to support this more and more through the effective practice through effects of what we sometimes call “body memory” and sports.

Now you may ask the important question, “Well how can a person do something if their brain structure isn’t there to support it?” Again, the brain is a phenomenal organism, or part of the human organism, that has enormous potential. It starts off life with certain fundamentals. The fundamentals have to do with basic abilities to perceive, to look, to listen, very basic movements like turning, engage in basic rhythmic activities, but it is also born with the potential to grow. Mother Nature invested that potential to grow with the need for the right kinds of experiences. So experience, then, fosters that growth. But that experience again, has a number of steps to it. The caregiver makes the experience available like by having the pleasurable voice. Then, secondly, the baby or later the toddler participates in that experience – initially reacting, but then taking over and initiating. As the baby, toddler, or young child goes from reacting to initiating, the mental capacity is forming. We are taking it over and becoming charge of it. So that is an important second step from the ability to react, to participate, to share in it, and then to initiate in it. So we see the child going over and grabbing the mommy’s hand to go to the door to help them open it, or the child offering the logical explanation, “I want to go outside because...” without even waiting for the question. Or the adult initiating a logical argument because it is something they want. As the initiative factor takes over; as the child or the adult who is initiating more and more and therefore doing many variations on it, the brain capacities form to support that. So again, you say how does the child react or participate in the experience or initiate without their brain capacity to support it? That is because the brain has the potential to learn, it has the potential to develop, and in a sense, to use an analogy, let’s look at a plant growing. We fertilize the plant and water the plant, but the plant doesn’t grow until we provide the essential nutrients, but it has the potential to grow. Similarly, the mind has the potential to grow to form these connections that we need, but it doesn’t do it until we provide the experiences, until the mind starts using its new mental capacities and then we see the brain coming in, to, in a sense, form the architecture for these capacities that gives it some stability and provide a platform for the next level of capacities.



So in a sense, it is the brain's potential that enables the mind to lead the way. Mother Nature was very tricky in this way – making us experience-dependent. This insight, that experience leads to development of the mind, which in turn leads to development of the brain, it is this basic paradigm, and the second facet of it is that desire and emotions are the architect for both the mind and the brain because the baby has to experience pleasure in the mother's voice; pleasure in the intimacy of that deep smile, engagement, and attachment; pleasure of the emotional signaling; pleasure in the emotional problem solving, joint pleasure in creative pretending and the mastery of logical thinking. So there are emotions orchestrating all the way, not just pleasurable but all kinds of emotions that we talked about in our book, *The First Idea: How Symbols, Language, and Intelligence Evolve from Our Early Primate Ancestors to Modern Humans*, orchestrating this all along the pathway.

This insight has led to our DIR®/Floortime™ Model when working with children with autistic spectrum disorders where we have shown that for those children who don't have severe neurological impairments, many are able to develop high levels of empathy and abstract thinking and relationships and sense of humor that were thought to be way beyond the capacity of children with autistic spectrum disorders – impossible for them to develop. Our studies are now suggesting that the emotional areas of the brain change too when these children develop these capacities. Some of the older adolescents we had tested with brain imaging studies and we are finding that these brain imaging studies are showing that the emotional areas of the brain are functioning in ways thought unlikely for children with ASD and they are very similar to children who never had challenges who are often called neurotypical children.

So this is all very exciting confirmation of the basic model of the basic theory that we have been advocating. I thought I would discuss this today because it comes up a great deal. It also comes up when we think of the choice of what kind of intervention to use. That is why we advocate interventions that build healthy foundations for development, not just interventions that will alter behavior or make a child compliant or just have a child repeat what they hear. We want to build those healthy foundations, however long it takes us. Children with more severe neurological restrictions may take longer. They may not get to all the higher level capacities but they may still establish the foundations for warmth, relatedness, and some basic communication, and other children go all the way up to abstract thinking and higher levels of empathy and high levels of academic skills.

So where a child will end up as an adult – only the child and the adult can determine that. We look for each person to redefine and keep redefining their own potential. We don't predict ahead, we let the child's growth be the determiner.



Thank you for joining us today and we will talk about this more in future shows.