

Agnieszka Stach, 2020

# Neuroplasticity Of The Tango Brain

talent is overrated

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What do math and tango have in common? Tango old-timers could talk about it for hours. However, I intend to focus on a similarity that is rarely discussed. Have you ever thought about the fact that both these domains are usually associated with talented people of special abilities? It is commonly held that a person is simply born with or without a talent for dance or mathematics. But this is outdated information. It's time for a little update.

I was inspired to write this text by the book [Limitless Mind](#) by Jo Boaler, Professor of Mathematics Education at the Stanford Graduate School of Education, who developed an innovative method of teaching school children math. I was delighted when I found out that the effectiveness of the techniques I use intuitively in teaching tango has been scientifically proven and has a foundation in neurobiology, among other branches of knowledge.

This article will certainly be an inspiration for dancers of Argentine tango. I also hope that this text will encourage you to equip your home library with [Limitless Mind](#) and that you will reach for it as an enthusiast of any discipline, parent or teacher.

## Talent

Jo Boaler begins by outlining the scale of the question of "talent" in education. There is still a strong stereotype among both students and teachers about genetic aptitude to given activities. According to it, mathematics in particular is associated with skills that require innate talent. Boaler's book refutes this myth, points out the weak points of the previous methods of teaching mathematics that consisted in memorizing it, and presents specific solutions to facilitate and accelerate the process of learning math for everyone. All this is

based on foolproof scientific research, with particular emphasis on neuroplasticity of the brain.

*Researchers now know that when people with math anxiety encounter numbers, a fear center in the brain is activated—the same fear center that lights up when people see snakes or spiders. As the fear center of the brain becomes activated, activity in the problem-solving centers of the brain is diminished. It is no wonder that so many people underachieve in mathematics—as soon as people become anxious about it, their brains are compromised. Anxiety in any subject area has a negative impact on the functioning of the brain. [Boaler, 7]*

As a dance teacher, I constantly meet people who are convinced that their rate of development is determined by genes. Sometimes they have complexes about their motor coordination, sometimes about the pace of remembering steps, and most often about musicality. Tango learning is also commonly associated with a long and arduous process, which many people do not undertake (or give up quickly), probably because they are convinced of their lack of abilities. This is where I see a close analogy to mathematical talents and that's why I was bright-eyed and bushy-tailed when I read how Jo Boaler dealt with this stereotype.

## Step I

### Awareness of the adaptive properties of the brain

Every year, neurobiology gathers new evidence of the plasticity of our brains and provides new information about how these changes persist over time. The knowledge of learning methods, which used to come from empirical research, now has a solid foundation in the creation of new neural networks and the activity of individual brain areas.

*Researchers now know that when we learn something, we grow the brain in three ways. One is that a new pathway is formed. Initially the pathway is delicate and fine, but the more deeply you learn an idea, the stronger the pathway becomes. The second is that a pathway that is already there is strengthened, and the third is that a connection is formed between two previously unconnected pathways. [Boaler, 20]*

It follows from this knowledge that the first condition for achieving perfection in any given field is to consciously repeat the relevant activities. Such in-depth practice allows you to strengthen your neural network and create networks of connections. The network of connections will be discussed in more detail in Step 3.

Another condition is the psyche. As it turns out, the very erroneous beliefs about talent or lack of talent, i.e. the unchangeability of the brain, determine slower absorption of knowledge, which has been repeatedly proven in research. It is, therefore, very important that, when we approach the learning of something new, we understand that our alleged "lack of aptitude" is only the result of interests in early childhood, a small number of repetitions in this field, improper preparation of the body, or that it is a manifestation of our own negative beliefs. So it is worth getting on with your beliefs in the first place. If your parents or teachers have been telling you since you were a child that you're not fit for something, dump it and take advantage of modern neurobiology.

The strongest prejudices related to learning probably concerns age. People of various ages define themselves as those who are no longer fully capable of learning new things. Let's take a closer look at a study conducted twenty years ago on London taxi drivers:

*The extent and focus of the deep training needed by black-cab drivers caught the attention of brain scientists, who decided to study the brains of the black-cab drivers before and after the training. Their research found that, after the intense spatial training, the hippocampus of the cab drivers' brains had grown significantly. This study was significant for many reasons. First, the study was conducted with adults of a range of ages, all of whom showed significant brain growth and change. Second, the area of the brain that grew—the hippocampus—is important for all forms of spatial and mathematical thinking. Researchers also found that when black-cab drivers retired from cab driving, the hippocampus shrank back down again—not from age, but from lack of use. This degree of plasticity of the brain, the amount of change, shocked the scientific world. Brains were literally growing new connections and pathways as the adults studied and learned, and when the pathways were no longer needed, they faded away. [Boaler, 17]*

## Step 2

### Mistakes and learning difficult things

The way I and Tymoteusz Ley teach—especially complete beginners—may be controversial. The scenarios of group classes run in Krakow include difficult coordination exercises in the first six months of learning. Our students train their balance and spiral in turns, as well as strengthen their feet. When practicing in pairs, they are immediately taught to lead from the centre, quickly introduce sacadas and other figures that require skill. The same is true for the material taught during the various editions of our six-day [Tango Challenge](#) seminars. Although we start with the basic elements, we expand them to complex enrosques, off-axis dancing, chains or sequences in couples that at first glance seem completely beyond the reach of an average dancer.

In short, our students are often given tasks that are on the verge of their comprehension and capability to perform. And not always is it pleasant to struggle with your weaknesses. It would be much easier for us and our students to spend a year studying nice sequences that are easy to repeat. Our students would have a nice time in class, and their tango... wouldn't change a bit.

Until now, we have introduced difficult material intuitively, based on our own experience as teachers. Reading *Limitless Mind* gave it a scientific basis. According to studies conducted by Carol Dweck or Jason Moser, every time a student realizes that he or she has made a mistake, synapses responsible for development light up in his or her brain. They used MRI to monitor the brains of the participants in their studies while the latter were solving tests. Later, the resonance images of the subjects taken while they were giving correct and wrong answers were compared. The effect?

*The researchers found that when people made mistakes, brains were more active, producing strengthening and growth, than when people got work correct. Neuroscientists now agree that mistakes positively contribute to the strengthening of neural pathways. [Boaler, 46]*

Boaler indicates Japan and China as examples of an education system that is based on challenging students to speed up the learning process. Teachers there are able to provide wrong theses or even wrong solutions to equations during lessons in order to make their students analyse problems on their own and go back to basic concepts. Unlike their Japanese and Chinese counterparts, American students are given tasks that are broken down to prime factors, and the textbooks and lesson scenarios are geared towards praising even the smallest successes, which do not necessarily require much effort. The result is a lack of real mathematical literacy.

What does that mean for a tango dancer? That when practicing difficult elements or precision in seemingly simple elements our brain will be in constant activity. To put it simply, it is through these difficult exercises that we will make progress. What can be so difficult about tango? For instance, practicing 180- or 360-degree pivots and focusing on different posture elements from the feet to the neck. Remembering very long sequences. Leading your partner without touching, so that you can practice your own balance. Dancing with elimination of habitual elements, i.e. no backward steps, no rebounds or ochos cortados. It is worth having a clever teacher with you who will assess which points of focus will bring the greatest benefits at your current stage of development. How does neurobiology explain the process of creating neural networks when a person is struggling with difficult exercises?

*Our brains function through an interconnected web of nerve fibers (including neurons), and myelin is a form of insulation that wraps around fibers and increases their signal strength, speed, and accuracy. When we revisit an idea or kick a soccer ball, myelin coats the neural pathways involved, optimizing the particular circuits and making our movements and thoughts more fluid and efficient in the future. Myelin is vital to the learning process. Most learning takes time, and myelin aids the process by reinforcing signals and slowly strengthening pathways.*

*(...)*

*So how do we all develop 'super-duper pathways'? This occurs when people are working at the edge of their understanding, making mistake after mistake in difficult circumstances, correcting mistakes, moving on and making more mistakes—constantly pushing themselves with difficult material. [Boaler, 47]*

## **A mistake in tango**

However, while reading this chapter, a certain doubt arose to me. It is easy to determine when a mistake occurs in mathematics because regardless of the method chosen the result must be the same. But what is a mistake in tango? What must happen for our developmental synapses to light up?

In my experience, it would appear that in learning tango the process of finding out what kind of movement is understood to be wrong is the most developing. We gain this awareness gradually and the individual stages are difficult to ignore.

What are the steps to achieving a flawless move?

- Understanding through touch and sight what is happening in the teacher's body,
- learning how to scan your body and increase the feeling in subsequent layers of your fascia and muscles,
- the ability of the brain to give commands to relax and activate individual body parts,
- experiencing exactly the movement that the teacher proposes.

For those who prefer a less abstract language, let's discuss an example: a forward step. At first, you see that your teacher can push him- or herself from the floor more intensively than you can and land steadily. You watch him/her from a distance but you also touch his or her body during the step. You analyse with your touch what is happening in his or her chest, pelvis, leg, foot, and you begin to look for that feeling in your own body while doing the same move. When you first try it yourself, you probably don't know if you've copied the teacher correctly. You look in the mirror or you ask, "Is that it?" The teacher will then focus your attention on different parts of your body to make the exercise easier for you, so that you start to feel more intensely which muscles are active and which are relaxed. Once you feel your foot is unstable, you will start "sending a command" to your brain to stabilize the foot, using the tools indicated by the teacher, such as activation of your knee or adductors, lowering your centre of gravity, etc. If everything goes well, from time to time you'll be under the impression that you know "what's going on".

What would then constitute a "mistake" in tango? For example, unsuccessful attempts to achieve specific goals with the tools indicated by the teacher. It is a donkey work if a student doesn't know what the goal is and repeats an exercise thoughtlessly. If he or she doesn't know the purpose of the exercise, they can't define what is wrong either, so the brain is blissfully asleep. In movements that require a lot of coordination, where several conditions have to be met in order to perform them as proposed by the teacher, it will be necessary to focus on one thing at a time.

How to benefit from this? When practicing pivots on your own or sacadas in a couple, in each repetition concentrate on one element only. This could be the position of your head, your sternum, the height at which you focus your eyesight, the tonus of your embrace, the position of your pelvis, your base foot, your free foot, and so on. There are plenty of options. By choosing only one of them for the next ten repetitions, you stimulate your development in the most effective way, and your mind gets a chance to notice what is wrong and what is correct.

*One of the significant characteristics of the highly effective learning described is the presence of mistakes and the role of struggle and error in transforming people from beginners into experts. This is consistent with the brain research showing increased brain activity when people struggle and make mistakes and decreased activity when they get work correct. Unfortunately, most learners think they should always be getting work correct, and many feel that if they make mistakes or struggle, they are not good learners—when this is the very best thing doing. [Boaler, 49]*

## Step 3

### Multidimensional teaching methods

One of the basic tools I and Tymoteusz use as teachers is Gardner's theory of multiple intelligence. This theory distinguishes eight types of intelligence or, in other words, "learning styles". These include linguistic, mathematical and logical intelligences or visual and musical intelligences. These competencies are the ways we think about the world, remember information and learn new things. Usually you have two or three leading intelligences. Very

rarely someone has one or all of them. You can learn what your leading competencies are taking a test. We sometimes give it to our students at Tango Challenge workshops.

As teachers, we find Gardner's theory useful in two ways. First of all, having it in mind during the lesson, we explain things to the group in such a way so as to care of people with different kinds of perception. We speak the language of numbers and vectors (mathematical and logical i.), metaphors (linguistic and visual ii.), referring to the feeling of one's own body (intrapersonal i.), we show the character of a movement with rhythm (musical i.), we exercise with everyone (kinaesthetic i.), we work in groups and we encourage giving mutual feedback (interpersonal i.).

Secondly, awareness of different intelligences is helpful in difficult cases, i.e. when a student is making slower progress than the group. Usually, it turns out that he or she has only one specific highly leading intelligence. A student who is extremely kinaesthetic will hardly ever benefit from the explanations given in the middle of the classroom (usually such a person will not be able to repeat what was said) and will need to dance the movement with the teacher. An extremely mathematical and logical person, on the other hand, will not attempt a new movement until he or she understands its mechanics and the whole sequence.

There are many examples of diverse competencies and they are one of the more exciting aspects of our work. We are constantly "learning new people" and even after months of teaching them we discover something new about them. Many times during the lesson we exchange with Tymoteusz information such as: "It turned out that Barbara is a physicist—when I explained her the vectors in the movement, she immediately grasped the centrifugal force", "Now I know what is going on with Mathew; you have to practice all the moves with him both as a leader and follower because he's kinaesthetic. Now he's leading perfectly from his centre."

However, the chapter on the multidimensionality of teaching methods in *Limitless Mind* has given me a new perspective on this issue, one that I haven't realised before:

*In 2013 research scientists Joonkoo Park and Elizabeth Brannon reported on a study in which they found that different areas of the brain were involved when people worked with symbols, such as numbers, than when they worked with visual and*

*spatial information, such as an array of dots. The researchers also found that mathematics learning and performance were optimized when these two areas of the brain were communicating with each other. We can learn mathematical ideas through numbers, but we can also learn them through words, visuals, models, algorithms, tables, and graphs; from moving and touching; and from other representations. But when we learn by using two or more of these means and the different areas of the brain responsible for each communicate with each other, the learning experience is maximized. [Boaler, 95]*

When I read this chapter, I understood that we should actually strive to give everyone the opportunity to analyse the movements taught in several ways. Not because everyone has a different intelligence, but also because such work is faster and more effective due to the way our brains work. It should also be largely self or group work and not knowledge presented by the teacher. Now we consciously create lesson scenarios in which students in groups analyse movements and describe them with numbers, graphics, metaphors or music. I am really glad that the high effectiveness of such teaching is now confirmed by studies on brain neuroplasticity.

When discussing the topic of multidimensionality of teaching, Jo Boaler readdresses the myth of innate talent. It turns out that the visual approach to solving problems was characteristic to mathematical and musical geniuses. She refers to Einstein, who struggled with transferring his theories into the language the numbers, while in his head he developed them chiefly graphically. Scientists had the opportunity to examine the brains of living people who had done extraordinary things. They discovered that the brains of people who are trailblazers in their fields are different from the brains of other people in that they have more active connections between different brain areas, more communication between the two hemispheres of the brain, and more flexibility in their thinking. The brain communication that is a characteristic of the brains of “trailblazers” is not something they are born with; it is something they develop through learning.

I imagine that when you read this section you may find that I am writing about the obvious. Today, everyone talks of a multidisciplinary approach to solving problems. The question is whether you used this approach to learn tango? Does your teacher actually present the subjects taught from different perspectives when teaching the technique of step, precision,

relaxation, quality of movement or musical interpretation? When you practice tango, do you activate different areas of the brain at the same time?

## Step 4

### Team work not only in the office

We are often asked whether it is better to attend private or group lessons. Honestly, a combination of the two works best because each of these two forms gives you completely different benefits. In short, the main advantage of private lessons is the individual curriculum adapted to the student's conditions, needs, and interests, and the opportunity to learn kinaesthetically, i.e. through frequent physical contact with the teacher. Group lessons, in turn, offer a whole plethora of attractions and benefits of intensified self-work in a couple and collaborating with others in the group—if the teacher knows how to use this potential. However, my experience shows that many teachers treat group classes as budget versions of private lessons, where teaching methods remain the same and teachers' time and attention is shared among their students. And such a way of working is, unfortunately, an underutilisation of the group's potential. Boaler confirms this observation:

*Neuroscientists also know the importance of collaboration. Research shows that when people collaborate, the medial orbitofrontal cortex and the frontoparietal network are activated, the latter of which aids in the development of executive functions. Neuroscientists refer to these different brain areas as the “social brain.” When we collaborate, our brains are charged with the complex task of making sense of another’s thinking and learning to interact. Social cognition is the topic of much current neuroscientific investigation. [Boaler, 157]*

How to implement this knowledge in group lessons? The cooperation mentioned above should start before the lesson, before the teacher appears. "What did we do last time?", "Will you show me how you do it?", "Are you guys losing your balance here?", "Can we switch couples and dance this last sequence?" The habit of repeating the material from the previous classes together is a great way to activate the brain and actually the essence of how students in a group can learn from each other. It doesn't matter if you're well prepared and so

you help your colleagues or you haven't been to the class lately and you have to learn everything from scratch. Either way you learn to analyse your body and the new movements, and, as Boaler observed, to put two and two together when listening to other people.

If our students come up at the beginning of the lesson and say: "I was absent recently. Would you show me what you did in the classes?", it is obvious we will reply, "find a couple who know how to do that movement and ask them for help." Nobody gets offended. Such a person may just smile to themselves because they realize that they could have guessed such an answer.

How else to use the group's potential in the classroom? Together with Tymoteusz we have developed many exercises based on activating students who, without the teacher's help, have to teach their colleagues a given move, analyse something in their bodies or create something of their own. The discussion of this kind of exercises is itself a material for a manual for teachers.

I'll just add a final observation that two people, that is a couple, are a team too. Treat your partner as a... partner. Ask him or her for feedback, compare different concepts in words, and your brains will become more active and will absorb tango knowledge faster.

### **Joint ups and downs**

One of the downsides of private lessons is the inability to compare your pace of development to others. Imagine you've been struggling with some kind movement during private lessons for two months now, and you're starting to get tired of the idea of having no talent for tango whatsoever. The teacher assures you that you are developing at a normal pace but you subconsciously assume that they are saying this out of pity or to keep you coming to the lessons. At this point, paradoxically, the praise and support that the group members could give you would be more credible and you would be free to focus on what is important. We have been through such situations many times with our students. As Boaler writes,

*Part of the reason students give up on learning is because they find it difficult and think they are alone in their struggle. An important change takes place when students*

*work together and discover that everybody finds some or all of the work difficult. This is a critical moment for students, and one that helps them know that for everyone learning is a process and that obstacles are common. [Boaler, 155]*

Many people get goose bumps when they hear about team work. This is understandable because their experiences of this type often boil down to putting up with the company of toxic personalities and lacking faith in the effectiveness of such cooperation. In her book, Boaler suggests specific techniques that help convince such people to work in groups on their own terms.

## Step 5

### Combining different concepts singlehandedly

Together with Tymoteusz, I am very lucky to teach the same dancers for years. There are couples who have been with us for a really long time. It is a great compliment in the face of the fact that we teach in Krakow, which has many really great instructors and dancers. Why the loyalty? Maybe because, apart from learning from us, we encourage them to try other techniques. Some of our students go to workshops with other maestros, others regularly attend classes at another tango school. As Boaler observed,

*“Another reason that students’ learning pathways change is because they receive an opportunity to connect ideas. Connecting with another person’s idea both requires and develops a higher level of understanding.”*

Following this way of thinking, we created the [Tango Challenge workshop](#), where two couples of teachers teach the same topics concurrently. As you can guess, they teach each thing differently. For six days, participants go through "brainwashing". It happens that one day they learn to walk pushing off from the ground with their toes, and the next day—with their heel. One day they initiate the movement from the pelvis, the next—from the sternum. Why? Because comparing concepts at the right time of learning extremely aids and accelerates development. And as for us, the teachers, instead of being jealous of the competition, we discuss differences and similarities with real curiosity during the classes. A

teacher who is convinced of the value of the knowledge he or she passes on will never be possessive.

## Step 6

### Heel tips in shoes and positive thinking

In her book, Jo Boaler devotes a whole chapter to the question of beliefs about one's abilities and how they influence the learning process. She cites one experiment after another, which shows that people with a positive attitude to their work or development are healthier and make faster progress in learning. The relationship between self-esteem and effective learning is so obvious to me that I did not initially plan to raise this issue here. However, I believe there is one aspect of this question worthy of attention. Who is actually responsible for an adult learner's positive attitude to learning? The teacher or the student? Can positive thinking about oneself in the learning process be developed on one's own?

It happens to me that I spend half the time that I have with a person during a lesson convincing them that they have the same aptitude to learn as everyone else. Actually, I'm convincing such a person that he or she is normal. I believe this conversation is necessary once or twice. Unfortunately, however, many people return to this point every time they encounter a challenge.

Timothy Galloway's fantastic book *The Inner Game of Tennis* tells us how to silence the inner voice that tells us "it's not for me", "I won't make it anyway". I recommend it to all my students who unnecessarily waste time on negative beliefs about themselves. Don't let the title fool you, the reading is extremely useful not only for tennis players but also for musicians, dancers, and everyone else in the process of learning new skills.

In fact, I know people who, before they start an exercise, say, "I never make it right anyway" or "This is my weakest spot", etc. It is really sad to watch people cut their own wings. It's like practicing tango technique in shoes with heel tips worn aslant, when the instability of the shoe must be corrected by the whole body at every step. Such a dancer loses swiftness and lightness, and their body needs to make up for the unevenness of the worn heel tips instead of remembering the right movement.

I know that changing self-assessment to positive is a serious life process. I just want to point out that tango can be more helpful here than you might think. In tango, everyone begins at a

completely different place. Some people have fit bodies but poor concentration, others lead a sedentary lifestyle but feel the music fantastically, still others love to meditate in couples but lack the determination in the movements they propose. The only thing that matters in the learning process is not the "level" we are at (whatever that means), but whether we have made progress in relation to ourselves a month ago. The only measure for self-complacency should be tenacity in the pursuit of change.

## **Talent and the learning curve**

Now that we know that whining about one's lack of talent is harmful, we should ask if the feeling of being a talented dancer helps one learn dancing tango? Unfortunately, that usually brings trouble too.

Contrary to appearances, apart from the first short stage of learning, where there are clear differences in the rate of learning, we all have the same difficulties in the development process as the others. The so-called "learning curve" is governed by the same laws, regardless of age, experience or someone's belief in talent. For self-confident beginners learning starts with a rapid growth, then a small decrease in skills and finally a long lack of progress. After the crisis, or plateau, the cycle starts again—we have another leap in development, then a decline and flattening.

Due to the specificity of tango, which requires high authenticity of body movement and connection with a partner, people with dance experience often face very unpleasant difficulties in tango after the first leap forward. When it comes to the deterioration in skills and the plateau, which is frustrating by nature, angst in dancers is much more intense than in others.

Tango is cunning because from a distance it looks trivial for a professional dancer. Since it seems that the movements do not require a lot of physical fitness, after a few months you can master all there is to learn, right? Stories of ballerinas, salseros or ballroom dance instructors realizing that, for a year, they have to forget everything they used to present on the dance floor, make both teachers and students' blood run cold. Many such dancers give up tango after three months. Those who have clenched their teeth and survived the process are usually professional tango instructors today.

This is also my personal story. Since I was ten, I trained ballroom dancing. I have learned many dances in my life that came with great ease, so coming to Argentine tango lessons, I decided to apply to the advanced group... Fortunately, I was accepted to the course for beginners. The first period of learning went by swimmingly. I was convinced of my talent so I was making progress faster than

others, and I danced a lot at milongas, confusing my attractiveness with the attractiveness of my dance.

It took me six months to find out that tango is merciless to everyone. Thanks to the right teachers it turned out that I have a stiff frame, I don't feel the flow of energy through my body, I don't follow, and of course, in every move I make, a strange habitual styling appears. As soon as I realized it, I was really broken. After several unsuccessful attempts to change my technique, I started to think that my body is not suitable for dancing tango. Since all the other dances were so easy for me, I'm obviously not suited for tango... Sounds familiar?

### **What attitude will aid your development as a dancer?**

The only conviction that will give positive results in learning tango is the conviction about the development and plasticity of the brain at every stage of your life. If you necessarily want to have a talent for something, then let it be the ability to adapt and to build both on successes and mistakes. Instead of thinking of yourself as talented, think, "challenges make me happy".

In moments of weakness, remind yourself of the learning curve, that is of the fact that if you train intensively and consciously, the lack of progress is a sign of great change. During the plateau period, the mind is reworking all the material you have been working on during the decline and stagnation period. The jump that occurs later is the result of all your previous efforts and the work done by the unconscious mind during the plateau.

Furthermore, look for teachers who are passionate about developing their tango teaching methodology and give you the feeling that your training is planned and goal-oriented. If you don't have access to such instructors, look for what makes you grow during your own practice by way of trial and error. Pose questions and ask them to both local teachers and instructors during occasional workshops. Take notes, draw, record films of yourself—do anything that will help you understand your movement better.

Take advantage of the opportunity to talk to your partner. Analyse sequences, compare techniques, look for real comfort in the embrace, watch shows on YouTube together. If you have friends who dance, practice together in a larger group. Work out common ways to give yourselves a feedback that will develop and comfort you. Don't stop your quest.