



SCIREA Journal of Sociology

<http://www.scirea.org/journal/Sociology>

September 24, 2020

Volume 4, Issue 4, August 2020

THE INTERDEPENDENCE BETWEEN THE EMOTIONAL AND THE COGNITIVE IN LANGUAGE LEARNING

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"Are we born with knowledge and then remember all that we already know?"

Platon

Abstract

The progress in neuroscience demonstrates the interdependence of body and mind, the cognitive and the emotional, language and psyche.

My paper is based on the scientific discoveries made by those linguists and scholars whose contribution to science had not always been duly acknowledged throughout the years as their findings proved to be off the beaten track, often provoking heated debates among their conservative-minded colleagues.

It turns out that every language has a sound frequency bandwidth which allows us to pick up the language our ear is prone to accept.

We improve our language skills while enjoying the process of learning at the same time because in this way we are freed from our fears and psychological inhibitions by using the suggestopedia teaching method.

Keywords: *neuroscience, mirror neurons, hearing, ethnogram, emotional stimulus, peripheral perceptions, suggestive approach, music, art, holistic method, language learning*

Introduction

We live in an age when the need to master at least two foreign languages is obvious. The accession of new technologies represents a revolutionary leap in language learning with the expanded possibilities of the use of multimedia and electronic devices. But these new technologies also help us carry out research on the brain to find ways to improve our abilities.

Neuroscience can help us a lot in this formative mission. We need learning approaches that take into account the interdependence between body and mind, the emotional and the cognitive. Neuroimaging would make it possible to choose the most appropriate approaches to improve our language skills. Ancient discoveries are dusted off and resuscitated. There is compelling evidence that learning, making decisions etc. have their correlates in brain activity.

[11]

The brain and language learning

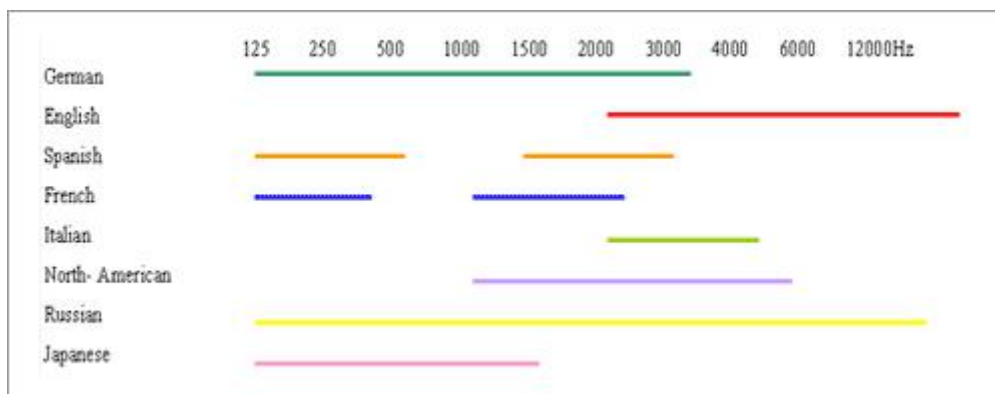
It was Paul Broca, a famous French surgeon, who during the second half of the XIXth century confirmed the existence of a cerebral center of language at the level of the left brain in the lower part of the third frontal convolution: the area of Broca. Ten years later Carl Wernicke, a German neurologist, highlighted another region involved in the understanding of language, called the area of Wernicke. A word that comes from the ears arrives in the auditory area, but to understand this word, the signal must reach the Wernicke area. In the Broca area the word elicits the development of a detailed program for its articulation which is transmitted to the facial area in the motor cortex.

“To hear well”, a precondition for expressing oneself

The methodology of teaching foreign languages is based on a totally wrong postulate, namely that everyone all over the world hears in the same way.

“ Our ability to learn different languages depends on purely physiological factors.” These are the words of Dr. Alfred Tomatis, otolaryngologist, recognized worldwide for his work on hearing-phonation and on the role of the ear in the function of learning.

Our ear can ‘hear’ a certain language, but be deaf to another, i.e. not have access to it if it is in the range of other frequencies that we do not have the physiological ability to perceive. Having the ‘ear’ of our race, we succumb to the study of different foreign languages depending on their phonological characteristics, and to a greater or lesser extent we are refractory in nature to those languages that are far from our curve of listening.



So, the wide open door to language is the ear, which plays a key role in language learning. Hearing includes an 11 octave sound spectrum from 16 Hertz to 16000 Hertz. Dr Alfred Tomatis went even further - he discovered that each language has its own particular frequencies. By using sonographers that are able to break down sound like the prism breaks down the light into a rainbow, he was able to establish specific profiles for each language, called ‘ethnograms’. Every place in the world has its own acoustic resonances.

Fifty years ago, counter-espionage radio operators were tasked with picking up messages from the Morse code sent by secret agents on the radio. They flawlessly recognized the nationality of the radio operator who transmitted the Morse message, without mastering its language, even before the content of the message was deciphered. Radio operators are able to recognize language just by the rhythm of dots and dashes. [11]

The specific listening curve of the French language is profiled in the form of two ranges with high points - one located at 250 Hertz in the bass and the other between 1000 and 2000 Hertz.

The French find it hard to speak foreign languages because their language is rich in vowels whereas in most languages consonants are largely predominant. The ear of a Frenchman with a permeability of 1000 - 2000 Hertz has difficulty learning English, which is in the diapason from 2000 to 12000 Hertz. (4 octaves). The Spanish language is in the low waves between 100 and 500 Hertz, Italian between 2000 and 4000 Hertz and the range of German is very wide at 3000 Hertz.

The Slavs have a very wide range of sound frequency (11 octaves) and have a wide open auditory diaphragm, thanks to which they are able to comprehend and reproduce the sound spectra of other languages. That explains the gift for languages possessed by the Slavic populations.

According to Dr Tomatis, language is directly related to neurology and our ability to learn foreign languages is not related to the intellect, but to the physiology of our ear. Modern technologies provide the listener with an opportunity for research, which determines the degree of audibility of the person wishing to study a particular language, its possibilities for perception and reproduction. Depending on the range of audibility and the ethnogram of the language (whether it is rather in the high or low frequencies), it can be determined which language would be more suitable for him or her.

Alfred Tomatis says that we learn a foreign language with a new ear. The voice reproduces only what the ear hears. Hearing well means analyzing sounds and recognizing rhythm and linguistic melody. Speaking poor English for a Frenchman is hearing English and listening to it in the French way. [10] Each of us has a specific hearing. Many people are deaf at frequencies above 2000 Hertz.

These discoveries are professor Tomatis's contribution to physiological linguistics, recognized by the French Academy of Sciences, and known as the 'Tomatis effect'. In 1957 he founded a new science: audio-psycho-phonology. With his unique method he treated children with difficulties in expression, reading, memorizing, learning foreign languages, suffering from a lack of concentration, stuttering, dyslexia and dysgraphia, even autism. He found that we can improve our audibility by inventing an 'electron ear' that filters sounds, providing the missing bandwidth.

Professor Tomatis gives an example of a student who was an excellent at every subject but failed Spanish. After the audiogram and the listening test, it became clear that he had an

Englishman's ear, very open to high frequencies, but unable to catch the frequencies of Spanish.

Dr. Tomatis describes another case: a German came to Paris to improve his French. He spoke his native language as well as English, but had difficulty pronouncing sibilant consonants in French. It turns out that he was an artilleryman in the war and the loud noise has damaged his hearing in the high part of the spectrum, i.e. the sound wave on which these consonants are located.

The case of Enrico Caruso is interesting. It turns out that he owes his singing talent to a special kind of partial deafness caused by an accident, in which, after an operation, he could hardly hear the low frequencies of any sound. This means that he did not hear poor quality sounds which is why it was impossible for him to reproduce them. Thus, he became the greatest voice in the world.

The second stage after listening is reading aloud, which is required by the *resonance* phenomenon of the word that sounds, penetrates the body and awakens the memory. The main mechanisms of mastering a language are acquired by giving the voice a certain intensity, which makes it possible to awaken the processes of its integration into the body. For Dr. Tomatis himself, Parisian French was like a foreign language, and he managed to overcome his southern accent by repeating sentences and words aloud in his bathroom or kitchen, and the acoustics of these tiled rooms managed to 'model' his ear.

'To hear' supposes a passive attitude towards the sound world which surrounds us. We receive sounds and record them without any interpretation by our psyche of the transmitted message. 'Listening' requires the subject's participation, the acceptance or refusal of messages reaching the ear, then the nervous system. After passing through the ear canal, information travels to the brain and passes through the thalamus which reflects the emotional state. It may block the passage of information. [11]

Our entire psychological past is important for the perception and acquisition of a language. If a young child is often exposed to loud noises, screams of parents arguing, high volume TV, the only way for him to save himself is to close his ears to this hostile world. According to Dr. Tomatis, he may remain closed to language, communication and social relations. At school, he may have problems learning languages and develop dyslexia. Dyslexia and dysgraphia are also explained by this different audibility of people. [2]

It is of great importance in school to work to overcome the blocks caused during childhood, to have classes in personal development, as working with psychologists will overcome the traumatic events of childhood and help the student to express his or her potential.

Especially important for educational purposes is the analysis of fear and stress, which shows how they, for instance, reduce analytical capacity, and vice versa how positive emotions open doors within the brain. [1]

The immense role of teacher behavior

“Two interlocutors face to face are like two pianos, installed in the same room; if you press the pedals of the first, the second immediately starts to vibrate.” According to Helmholtz’s law (the law of resonance), if we lift the piano lid and sing the tone *la* against the strings, for example, although the air strings of the tone touch all the piano strings, only the piano strings of tone *la* will vibrate. [9] This resonance illustrates the discovery in 1996 by Giacomo Rizzolati, a neurologist at the University of Parma, of mirror neurons.

The theory of mirror neurons could be the origin of a major scientific revolution. The different brain areas activated by these mirror neurons enable us to grasp the intention by contextualizing the action. Beyond gestural intention, mirror neurons enable us to discern thought from action. [1]. When we see others performing an action, our mirror neurons are activated and we feel as if we were performing the action or having this feeling. This means that empathy also has its correlates in the brain. [11]

The mirror neurons prove the great importance of what the teacher feels and radiates. If the teacher loves the subject he teaches, it is passed on to the students. If the teacher believes in the abilities of his students and respects them, they are calm and trust him, which creates an atmosphere for easy assimilation of the information. Learners unconsciously imitate everything they see, hear and feel.

Professor Tokuhamo-Espinoza, director of the Institute for Teaching and Learning at the University of San Francisco, says teachers need to show confidence in students' abilities. Their confidence and enthusiasm in teaching their subject will be ‘contagious’. ‘Social contagion’ is based on the system of mirror neurons in the brain, in which people accept the emotional state of others. [8]

The empathy of the teacher is expressed in the ease and naturalness of communication, very close to normal communication. There is no dominant edifying error correction which would lead to blocks and stress for the learner. The teacher only repeats correctly, most often in another context, the wrongly pronounced word or grammatically incorrect sentence, and in a natural tone.

“In the learning situation”, mentioned at the neuroeducation symposium in 2014, F. Héraud, professor of neurophysiology, gestures and words activate these mirror zones and if there is an inconsistency, the brain perceives it. These are the suggestive signals, called ‘weak signals’ by Professor Georgui Lozanov, a Bulgarian physiologist and neuropsychologist. These signals betray the real feelings that the interlocutor is not able to hide.

If the teacher's smile is fake, it will be felt because serenity and goodwill cannot be imitated. The zygomatic muscles (‘zigomaticus’) which act in the smile are under a double control: conscious and unconscious. The orbicularis muscles (“orbicularis”) – the muscles by the eyes, are only under unconscious control and cannot be activated by force of will to imitate a sincere smile. [6] We can smile with our lips but the eyes betray us.

When there is a contradiction between what we hear and what the body says, the neural circuit that is formed is the same as in case of a threat. On a deeper level, we have felt insincerity.

"People can't think creatively, they can't work with others when neural pathways are activated in their brains, processing the “threat signal”. ... A neural response of the ‘threat’ type is caused by any lack of emotional spontaneity, by any attempt of the interlocutor to cover up what he feels. " [6]

As a neurologist and psychologist, Professor Gueorgui Lozanov has carried out very extensive research on how the brain works during learning. In the 80s, he gave the world a new learning approach – ‘suggestopedia’.

In a process where the student is confronted with the acquisition of something new, he needs support, understanding, love. Through the suggestopedic approach, a very fine bond is created between the teacher and the student. The teacher emanates sympathy, total acceptance, while the student enjoys an atmosphere of trust. Progressively, he breaks his ‘protective shell’ and overcomes his fear by forgetting the embarrassment of making mistakes or becoming ridiculous and dares to speak.

Memorization depends on emotions

The atmosphere of security and confidence creates a receptive mental disposition in the student which will call upon the untapped reserves of the brain. The didactic approach must take into account the very close links between the emotional and cognitive aspect of the student. Good memorization depends on our emotions. Dr Lozanov's pioneering work raises awareness of the importance of the emotional dimension. The American educator Carl Rogers agrees with the opinion of the Bulgarian suggestologist. A relationship of trust and mutual respect must be established, which requires from the teacher theoretical knowledge in psychology but also the possibility of establishing and maintaining positive contact. [7]

In the brain, the amygdala is a very important element whose role is to regulate emotions. It has the shape of a small almond (*amygdalum* in Latin and *amadula* in lower Latin) located in the center of the brain. Along with the hypothalamus, the amygdala is the main source of chemicals in the brain which controls several hormones. Experiences show that our emotionally charged experiences stimulate the hormonal system and the brain and help to affirm memories.

The interdependence between our cognitive abilities and our emotions has already been scientifically proven in the book *Emotional brain* by Joseph Ledoux, a famous neuroscientist at the Center for Neural Research at New York University. With his research he unequivocally proved that the connections between emotional brain centers (amygdala) and the cognitive system (neocortex) are strong and any emotion like threats, anxiety and fear can generate a kind of static tension and sabotage the prefrontal lobe's efforts to maintain working memory. [4]

The brain does not pick up isolated stimuli. There are always elements of the mood and state of mind of the receiver that stick to the main stimulus. It is through these additional factors that the brain can fix information in long-term memory. These additional stimuli are referred by Georgui Lozanov as peripheral perceptions. [5] These perceptions include the double plan of communication : intonation, rhythm, atmosphere, all associations, codes and symbols which have an informative and reprogramming effect.

The teaching aids are developed according to the theory of the whole learning process.

But the holistic method is quite difficult because the structure of the lesson must make it possible to locate the elements in the whole and to distinguish the whole in the element like a hologram image or the atom in relation to the cosmos.

At the same time, pronunciation, vocabulary and grammar remain in the background of perception. They are however assimilated when the professor knows how to direct the attention of the students onto it, for a few moments, then very quickly return to the matter at hand. Grammar is taught in a deductive way, without putting too much emphasis on theory. As early as 1695, John Locke said: "Let me be given as an example a single language that we can learn or speak properly based on grammar rules... If you have to teach the grammar of a language, you have to teach it to someone who already speaks the language." [10]

The use of art in learning

Teaching should not be linear. The teacher also avoids having to repeat. It is a boring exercise that additionally suggests that memory is poor. One of the precious qualities of a good suggestopedagogue is his talent for creating different situations which make it possible to use specific material, in various forms which avoid any monotony.

The vibrating nature of teaching helps to avoid the monotony of automatic repetition. [5] Usually the suggestopedic lesson begins and ends with a song. It is as if everyone is celebrating together, not learning. Singing in a choir inspires and creates a special atmosphere of 'co-operation'. It is like an orchestra playing in harmony. Diversity, laughter, humor and play are important supporting elements throughout the learning process. Something interesting and different is happening at every moment. The learners acquire the astonishment of children and their enthusiasm springs from the original aspiration to discover something new, to experience something unusual. Regardless of age, learners are transformed into people with a youthful spirit and aspiration.

According to G. Lozanov the material to be retained must be accompanied by well-selected classical works of art. That favours hypermnesia - the increase in memory capacity.

The teaching approach that Georgui Lozanov proposes is a communicative method that awakens and releases the potential 'hidden' reserves of our brain by calling on all types of intelligence: the seven types of intelligence are stimulated according to Gardner's theory of 1985: linguistic, logical-mathematical, visual-spatial, body-kinetic, musical, interpersonal (the ability to understand the expectations, motivations and desires of other people) and intrapersonal (the ability to understand oneself and one's own feelings and motivation). [3] In traditional training the linguistic and logical-mathematical types are most commonly used.

A study conducted at the University of Edinburgh by Karen Ludke shows that singing increases the capacity of memory. He experimented with participants who listened to a series

of words, then repeated them for 15 minutes - some by reciting them in the traditional way, others by singing. They were then subjected to a test to note the words that were retained. The adults who chose to sing, remembered twice as many words as their peers - a result that also applies in the long term.

Alzheimer patients who are unable to learn anything can remember melodies and learn songs.

Music influences the brain's ability to learn. It leads to a widening of the cortical areas devoted to hearing and movement. Certain musical works have a relaxing, regenerating power and can help with concentration and improve performance and abilities. The 'Mozart effect' is also used by Dr. Alfred Tomatis, and through Mozart's music and special sound filtering he trains and strengthens the ear muscles and thus helps to learn languages faster, improve performance, treat dyslexia, autism and even problems in motility. [2]

“Memory is built by learning and it persists thanks to it. These two processes are so closely linked that memory is subject to the same influencing factors as learning. Thus the memorization of an event or of a piece of information is likely to be improved by a strong emotional state, a remarkable context, the motivation and the attention paid by the individual to what must be mastered”. [1]

In his study *The human emotionality in the behavioral sciences* Prof. Paunov draws the conclusion that the development of neuroscience shows the importance of human emotionality and its interaction with cognitive processes in a revolutionary new light, which highlight the need to update the approaches to the human personality in all areas. [6]

Neuroscience is really opening up new trails for improving education. In the cognitive domain all questions refer to the functioning of the brain. Anything is possible if we believe in the unlimited capacities of the human brain and overcome the barriers that come from our psychological blocks, preconceived ideas, conditioning and limitations of societal norms.

The good news is that neuroscientists have clearly shown that the brain displays plasticity as a result of the creation and strengthening of neural connections throughout life. Emotions 'sculpt' the neural tissue. It is clear how important it is to adopt a holistic approach, which takes into account the close links between physical and intellectual well-being, emotional and cognitive aspects, the analytical mind and creative capacities.

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