

MARIA SIMONA MOROSIN

**PROJECT NPA.
NEURODIDACTICS OF PERFORMING ARTS:
THE IMPACT OF DRAMA TEACHING
ON SECOND LANGUAGE ACQUISITION**



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1. Shifting paradigms

Art, freedom and creativity will change
society faster than politics.

Victor Pinchuk

1. 1. Societal challenges of our time

With only seven words Ukrainian businessman Victor Pinchuk describes our current society, fast and influenced by politics. He proposes a solution for change hinged on art, freedom and creativity. It is worthy of attention that a business expert is advocating artistic freedom as a means for embracing change instead of market strategies, financial and political savvy, clearly suggesting to walk on the untrodden paths of creativity and imagination to solve societal challenges. It also implies that innovation stems from creative processes and that this might be the missing piece in the complex puzzle of our society, a landscape which is fast and ever-changing, but at the same time frozen in old paradigms and resistant to change.

Change brings about movement, the opening of new possibilities, but also the destruction of what was taken for granted before. Change is a constant variable in human life, but what makes the status of our society different from those of the past is the pace at which change is taking place.

We are witnessing bursts of political unrest in many regions of the world due to national and international crisis; economic and social inequality are fuelling mass migrations; democracy is being threatened in countries previously considered a stronghold for freedom. This is happening at a very high speed creating unstable scenarios and making future social outcomes difficult to predict. If on one hand this sense of uncertainty, threat and instability is causing the social divide to become deeper, on the other hand, globalisation and technology is making younger generations be more interdependent and able to share knowledge and experience.

Especially the impact of the rise of artificial intelligence and of the Internet is changing the world in ways that could not be anticipated. Through the World Wide Web, communication happens at a lightning-fast speed; words, images and videos can reach millions of people everywhere in a matter of seconds; social media are changing—sometimes altering—human relationships by providing a continuous flow of contacts, notifications, comments. We have never been far away, yet so connected to each other as today. Knowledge, in the same way, has never been so easy to share. Knowledge and the transferring of knowledge are the focus of education. They have also been impacted by the change of the last decades: educators and teachers are under pressure to confront the undeniable challenges posed by our times and by our “hurried, hypercultural” society (Bergman, 1998). Besides, business, politics and society are looking to educators for solutions. They are asking for innovative solutions.

1. 2. Education: A call for innovation as empowerment

The present study was conducted in different continents (Asia, Oceania, North America and Europe) to research the potentiality for productivity and innovation of a specific teaching methodology, Educational Drama, yet this study provided the opportunity for the exploration and observation of different schooling systems. The map of education that emerges is heterogeneous and diverse. It shows

how education and schooling, together with sustainability and equality, constitute one of the main global challenges nowadays (Cachia *et al.*, 2010; Goldberg, 2009; Sterling, 2001; UNESCO, 2008-2009). Educational systems are undergoing a general transformation that can be described as an involution to old paradigms disguised as “good school reforms”. These national local reforms are essentially reducing funding especially to public schools, cutting resources and basic curricula. With the exception of a few happy islands, like Scandinavia and Canada where politics is committed to social justice, the educational system is globally suffering from a lack of means, supplies, facilities, services, training and good policy makers. Educators are becoming more and more bureaucrats, channeling a lot of energy in filling forms than in continuing education and training. When schools receive fundings for new technological equipment, the expectation to improve teaching and learning through it is high, but many times it remains potential and does not develop because the teaching workforce cannot keep up with the change since training is not always available. Sometimes training is partial and teachers learn how to use the newest cutting edge technology on the go. Although technology, as well as each type of educational resource is an important tool for education, it does not constitute an index of prediction for successful learning.

What makes schools great environments for learning, transformation and innovation at all levels is the quality of teaching. Because the quality of teaching is not always the primary goal of policies, teachers are in need of adequate resources and support in their jobs, in poor and in rich countries alike. As a result of the present situation both teachers and students are dropping out of programs, lowering their performances in a cycle of mediocrity. Especially in the public sector we are witnessing the attribution of value to standardisation over individualisation of learning, to compliance over critical thinking, to conformity over creativity (Anderson, 2012). Yet, the business and politics systems rely on education to promote and develop innovation. What do they mean by *innovation*? As introduced at the

beginning of this discussion, particularly in the private sector, business values the economic aspects of education that bring about innovation in the form of new profitable ideas for the markets. To express it with Orr's words, this model of education fragments society instead of unifying it, emphasises success and careers of few instead of social wellbeing, separates emotions from reason, divides theory from practice (Orr, 2004) and trains people to follow instructions rather than to think critically.

In healthy educational systems, education produces valuable ideas for the success of the country economy, but it also acts as the cradle for developing value in the form of personal development, ethical work, social justice and equal rights. Countries around the world where this educational model prevails invest considerable resources in it, provide educators with the means to continue to educate themselves, link theoretical research with practice, support diversity as a source of innovation and progress, promulgate laws and policies that protect educators and schools at all levels, both in the private and in the public sectors, approve curricula based on critical pedagogies, craft knowledge and applied research. In his study "*Education - an anatomy of the discipline*" presented at the University of Sydney, professor Furlong underlined how innovation in society is strictly linked to innovation in the school system, how the organisation of knowledge in education must undergo a radical change to meet the challenges of today's society. Borrowing Paulo Freire's idea that practice must precede theory and reflection, Furlong outlined that academic knowledge traditions must shift to new integrated knowledge organisation. Education needs a shift in paradigms where knowledge production is the fruit of networking, connection to practice and embodied learning (Furlong, 2013).

This shift of innovation in education is needed at all levels, from where decisions are made to the school community. Educational policy makers must make informed choices and take steps to proactively sustain educational research, to promote networked knowledge production, to empower the workforce of educators. Educational lea-

ders must ensure that educators and teachers are empowered to make decisions to meet the students' needs. Educators and teachers must be prepared to lead this shift towards new ways of teaching that foster the development of knowledge, but also nurture students' human endowments like creative imagination, self-awareness and independent will.

School communities which are already embracing this shift of empowerment experience a sense of agility and openness to change, a sense of intellectual freedom, and a growth of responsibility.

The role of education during these times of shifting paradigms is therefore to embrace change and be ready to mitigate the risks and challenges connected to the digital era by focusing back on the process of learning and consequently on teaching, by expanding interconnected and networked knowledge, and by implementing interdisciplinary educational research linked to practice (Jefferson and Anderson, 2017).

1. 3. The shift in philosophy and cognitive neuroscience research

The implementation of any research is influenced by philosophical models, epistemological variables and personal epistemology (Labbas, 2013). Educational research has experienced a shift in paradigms too due to an underlying change in the philosophical perspective. Philosophy itself had to reopen the discussion about fundamental questions like the nature of mind, thought and abstract concepts, language and learning, because a new tool had become available, able to shed light on the workings of the mind and the functionality of the human brain: imaging technology. Imaging technology was the result of an interdisciplinary effort and synergic work: scientists from different disciplines like mathematics, physics, information technology, mechanics, electrical engineering, robotics and the health sciences cooperated for the common goal of advancing the quality of imaging (Berman *et al.*, 2006; Bandettini, 2012). Consequently, the

use of imaging technology as an investigative tool brought together psychologists, anthropologists, philosophers, linguists, computer scientists and neuroscientists to study the functions of the brain and the mind, which, towards the end of the 1970s, emerged as the interdisciplinary study of *cognitive neurosciences* (Miller, 2003).

Cognitive neurosciences investigate the neural bases of human behaviour by comparing the results from observations in patients with brain injuries, from studies of neural activations during the elaboration of specific tasks in healthy individuals, from computer simulations of brain functionality and from the observation of cognitive functions in child development (Marini, 2016, p. 13). In the last three decades, cognitive neuroscientists have contributed to the advancements in the understanding of the functional and neuroanatomical mechanisms underlying perception, attention, memory, thought, language and motor control. This new interdisciplinary approach to the study of the mind and the brain has triggered a shift in philosophy, which had to rethink its historical tenets and reframe its classical philosophical questions according to the new findings of cognitive science: “The mind is inherently embodied. Thought is mostly unconscious. Abstract concepts are largely metaphorical.” (Lakoff and Johnson, 1999, p. 3).

The dualism of *reason* and *body* was over. The classical view of the human being endowed with a mind capable of reasoning that is separated from the body and its emotions, was abandoned in favour of a theory of the mind that emerges from the functionality of the brain and the body and from our bodily experiences (Damasio, 1994). Cognitive neuroscience studies also showed that higher cognitive functions like thought and language share the same neural mechanisms involved in perception and motor control and that human beings are not always in control of their reasoning, since most of it remains at the unconscious level (Dehaene, 2018). Besides, reason is not separated from emotion: reason, and therefore learning, is emotionally engaged and relies on imagination and metaphorical thinking.

Findings in cognitive neuroscience corroborate the idea that «reason includes not only our capacity for logical inference, but also our ability to conduct inquiry, to solve problems, to evaluate, to criticize, to deliberate about how we should act, and to reach an understanding of ourselves, other people, and the world.» (Lakoff and Johnson, 1999, p. 3-4).

The dualistic concept of the mind/body had influenced education and research for centuries, but this new approach caused educational research to look for new models of instruction and shifted the focus from knowledge transfer to the learner. As with anthropology and psychology, educational research also began to trace connections with the world of neuroscience, understanding that it could not remain uninformed.

Nowadays, educational research has become more interconnected and interdependent. It is making efforts to review and rethink its tenets in consideration of all the other disciplines that try to understand the nature of human behaviour and learning, and to study how we learn in our social and cultural context.

Educational research has established itself as a field of study that now can avail itself of the collaboration with cognitive neurosciences (Rivoltella, 2012) and at the same time cognitive neurosciences are broadening their spectrum of investigation in ways that were unthinkable only twenty years ago.

Neuroscientists are inquiring about concepts that were not considered objects of scientific study, like the problem of what *conscience* and *introspection* are (Dehaene, 2018), or like the nature of *aesthetic appreciation of art* (Changeaux, 2016). Only recently neuroscientists are writing about *creativity* in the brain, *music* and its effect on the mind (Swaab, 2016), about the *art of theatre* and *performing arts* (Calvert, 2016; Kemp, 2012) thus showing that this shift towards common territories of new discovery that was not probable before, is possible. As illustrated in the previous paragraphs, the gap in educational systems that divide research from implementation, theory from practice is still wide, but a growing sense of awareness is spreading

in the scientific and academic community that transformation can happen through networking and through collaboration between different disciplines.

Prompted by the European Horizon 2020 program call for research on innovative language teaching methodologies, the present study places itself in this interdisciplinary background, and stems from the epistemology described above. It investigates second (or foreign) language learning based on educational drama by drawing on educational psychology and cognitive, social, affective neurosciences.

1.4. A role for educational drama in second language acquisition

Characterised by the fast pace of capital flow, labor migration and mobility, global policies and laws, rapid transportation and communication, globalisation has changed every aspect of our social, cultural, economic and political life in a twofold way. On the one hand, this process has developed an unprecedented interconnectedness between countries with the free movement of capitals, ideas and cultures; on the other hand, local and national aspects of economy, politics, law, social life and culture have been altered, sometimes even swept away (Ocampo, 2010; Magu, 2015). The impact of globalisation can be perceived especially at a local level, in the small communities, where cultural boundaries are becoming less distinct. These shifting cultural boundaries open up a shared space in the communities where contrasting feelings prevail: the fear of change, of the unknown, of losing one's identity, and the will to find ethical solutions based on shared values.

This zone of cultural interface constitutes the background in which educational systems operate. They have to come to grips with the effects of globalisation on their local school communities and face the challenges that naturally emerge: the first of these challenges is communication, literacy and language.

School classes have a multiethnic, multicultural and multilingual nature with students who have different levels of literacy and knowledge of the language they use as the language for studying; at the same time teachers' competences in second language education vary so that they are not always able to sustain students whose native language is unknown to them. Every university offers courses that are taught in English, which is now the *lingua franca* of exchange programs and courses offered on-line (MOOCs). English is also the language of research and scientific divulgation, of politics and mobility. In fact, governments are supporting the *internationalisation* of research by funding projects that develop the international transfer of knowledge and value academic mobility: in these exchanges English is used as the global language. This scenario ultimately impacts and questions the adequacy of foreign language education at all levels and requires the development of new perspectives in language teaching that encourage intercultural communicative competences and sustain language learning in complex cultural contexts.

In the last decade, the adaptation of educational systems to the needs of modern society has been at the centre of the European debate on second language education, introducing a new concept for the implementation of curricula based on learners' knowledge, competences and skills (European Commission/EACEA/Eurydice, 2012). The learners' achievements are the focus of language instruction. They are described as the ability to put into action necessary competences and strategies which ensure «full effectiveness in communicative events» (European Commission/EACEA/Eurydice, 2012; p. 11)

To encourage the development of foreign language skills, innovative and creative teaching methodologies must be introduced in the classroom environment, since creative, interactive, dynamic task-based instruction increases the link between motivation to learn, attitude and self-confidence¹.

¹ “Measures that are taken to readdress this situation include: support for teaching methods that improve engagement” in European Commission/EACEA/ Eurydice, 2012. *Developing Key Competences at School in Europe: Challenges and Opportunities for Policy*. Eurydice Report. Luxembourg: Publications Office of the European Union. p. 11

Educational drama (also called *drama teaching*, *drama in education* and sometimes *process drama*), focusing on creativity, interaction, improvisation, problem solving, dialogue and performance, meaningful use of space and context (Way, 1967; Heathcote, 1973), represents a valid teaching methodology that can foster learners' engagement and motivation leading to the mastery of a foreign language and to its effective use in the social environment. Educational drama can have a role in the present educational scenario also as a methodology for the enrichment and diversification of teaching strategies that improve teachers' engagement, development and empowerment.

Studying drama teaching with a cognitive perspective is the fundamental element of novelty of this study, given the fact that educational neuroscience has been offering new insights and opening new possibilities of research on key factors of learning, namely attention levels, memory development and consolidation, embodiment and role of emotions. The comprehensive study of cognitive factors involved in learning through performing arts outlined in this project builds on interdisciplinarity (education, neuroscience, performing arts) as a fundamental principle for the innovation of the educational and training systems to match the demands for engaging teaching methods required by the modern learning society and in compliance with the European policy "Europe 2020" on smart growth². It aims at building a theory of experiential, performative second language learning.

² http://ec.europa.eu/europe2020/index_en.htm

2. Learning: Findings and contributions of cognitive neuroscience

2.1. Introduction

This chapter explores the contributions of cognitive neurosciences that help understand what underlying mechanisms constitute learning. It provides the epistemological foundation to the current research and, in particular, a biological account of second language learning through the arts. We want to discuss what is already known about brain functions involved in learning, and what the new contributions of cognitive neuroscience studies on the arts can tell us that is directly and indirectly relevant to drama-based learning.

2.2. Perception, memory, learning and imagination

What is learning? To answer to this question I will refer to the work of Kandel *et al.* (2000 and 2013) who describe learning as «the process by which we acquire knowledge about the world» (p. 1227). Learning cannot be separated from memory because memory and learning are intertwined: «memory is the process by which that knowledge of the world is encoded, stored, and later retrieved» (p. 1227). Notwithstanding the complexity of the task, researchers are refining their understanding of how memories are formed (encoding), how they are retained (consolidation and storage) and how they are recalled (retrieval) (Squire, 1987). These mental processes allow us to acquire, retain, and retrieve information. Encoding refers to the process by which perceptual and sensory information is transformed and entered into the memory system. Storage refers to the consolidation of a new memory so that we can retain information for use later in time. The retrieval phase is the process of recovering information and becoming consciously aware of it.

2.2.1. Short-term or working memory

Memory can be described according to its features in terms of capacity and time: short-term memory has limited capacity and does not last long. It is also called working memory. Instead, long-term memory lasts longer and has a storing capacity which is greater.

Through working memory we are able to store information which is maintained for a limited time as «representations of goal-relevant knowledge» (Kandel *et al.*, 2013, p. 1442). Then, two sub-systems of working memory - the verbal and the visuospatial sub-systems - are coordinated by an executive control processes system, that regulates attentional resources and updates stored representations by selectively transferring them to long-term memory (Kandel *et al.*, 2013, p. 1442). Working memory retains either phonological information or mental images of visual objects and their location in space through rehearsal of that information, for the time we need them: for example, when we consciously rehearse a word or an image.

2.2.2. Long-term memory

Long-term memory has been divided into two main types, explicit memory and implicit memory (Graf and Schacter, 1985) to refer to the type of information remembered: explicit memory refers to semantic and episodic memory (remembering respectively new words and concepts, facts and events), while implicit, or non-declarative memory, refers to different forms of processes that are not conscious, like remembering skills and habits. Explicit memory, also called declarative memory, was defined by Ryle (1949) as the “knowing that”, while procedural memory is the “knowing how”. Later in the 1980s, Baddeley (1986) called declarative memory “conscious recollection” and procedural memory “automatic recollection”. The idea was that how we remember facts and events is different from how we process

and remember how to do things: explicit memory is a conscious process, while implicit memory is mostly unconscious.

2.2.2.1. Explicit memory

Explicit memory involves the four discrete processes outlined before: encoding, storage, consolidation and retrieval. Encoding refers to the process of translating information coming from various resources into a common form that can be linked to existing knowledge and stored. Perception works in this way when the brain translates different types of signals from the environment (photons, air compression waves, molecular concentrations, pressure, texture and temperature) into electrochemical signals carried by the neural cells, the neurons, and combines these bits of information into a memory (Eagleman, 2015). Our sensory organs, (the eyes, the ears, the nose, the mouth and the skin) act as interpreters. They send different streams of sensory data to the brain, which processes them at different speeds: sound is processed faster than visual data, «yet everything seems synchronized» (Eagleman, 2015, p. 51-52). Therefore, perception of reality starts from the streams of sensory data of vision, hearing, touch and taste coming from the outside world but is constructed inside the brain. Eagleman (2015) describes reality as «the result of fancy editing tricks, and a delayed version of it» (p. 42), «a construction of the brain, taking place only inside your head.» (p. 39), «an electrochemical rendition in a dark theatre.» (p. 42).

How does the brain store and consolidate memories in the brain? The storage and consolidation of explicit memories occurs in a distributed fashion in the association cortices of the brain: any form of knowledge is distributed among many brain areas. Through consolidation, temporarily stored memories becomes more durable and can be accessed independently when a specific key, - for example a verbal, visual or other type of sensory clue - triggers the specific memory. A single clue can unlock a whole web of associations. New findings show that the meaning we attribute to an event or object de-

depends on our specific webs of associations, based on the whole history of our life experiences (Eagleman, 2015, p. 35). Explicit memory can be deliberately retrieved since it is a conscious and highly flexible process: multiple pieces of information can be associated under different circumstances. The more a retrieval clue reminds us of how we originally encoded an experience, the more effective the retrieval of the memory will be. Especially with semantic memory - our general knowledge about facts, concepts, the world, objects, words and meanings- a specific cue can recover the associative structure connected to a fact, a concept or a word, whose components are distributed among several brain regions. Besides, the phase of retrieval of explicit memory is similar to encoding: bringing back memories is a constructive process that combines information stored in different areas like in perception.

Sometimes perception is subject to illusion and retrieval is subject to distortion (Loftus, 1976) Explicit memory is in fact not always accurate, but can be susceptible, malleable and fallible due to the fact that sensory perception is not a direct experience of the external world, but it is mediated by the brain; moreover, it is a constructive process influenced by the inner personal knowledge of the world and of our own history. When we retrieve a memory

recall is not an exact copy of the information stored. Past experiences are used in the present as cues that help the brain reconstruct a past event. During recall we use a variety of cognitive strategies, including comparison, inference, shrewd guessing, and supposition, to generate a memory that not only seems coherent to us but it is also consistent with other memories and with our “memory of the memory”. (Kandel *et al.*, 2013, p. 1448)

These new findings shed light on the process of learning, emphasising how learning (and therefore memory) is supported by the multi-modality of the senses, is influenced by our own personal history, by our individual view on the world that surrounds us, by our past experiences that continuously restructure our knowledge. These findings also contribute to the study of imagination.

2.2.2.2. *Imagination*

Imagination plays a fundamental role in drama-based learning, as we will see in the next chapters: many drama-based teaching techniques rely on the use and the development of imagination. Through the imaginative techniques used in drama in education students become able to find solutions to problems and try out different outcomes in a safe environment; imagination is also linked to creativity, or the ability to create new ideas starting from what is already present.

From a cognitive perspective, imagination is the brain's own reality making (Eagleman, 2015, p. 56). It means that the brain is able to generate its own reality even before receiving information from the senses. The cerebral structure responsible for letting us imagine the future is also a very important structure for memory and learning, the *hippocampus*, that not only records what has happened but also assembles a possible image or experience of the future by recombining information from our past.

2.2.2.3. *Implicit memory*

Long-term memory also serves and acts like the common denominator of other cognitive functions: without it, we would need to learn how to speak, how to control movement, how to act every time anew. Instead, once learnt, we automatically know how to speak, how to ride a bicycle or how to play a musical instrument because we use our implicit, or procedural memory. As described in Kandel *et al.* (2013), «implicit memory stores forms of knowledge that are typically acquired without conscious effort and which guide behaviour unconsciously» (p. 1452)

What is important for our later discussion of drama-based learning is that those forms of implicit memory like the learning of habits, the learning of motor, perceptual and cognitive skills, the formation and

expression of conditioned responses emerge gradually through practice and repetition: they are forms of incremental learning that flows from perceiving to thinking and acting, but does not require an individual to be engaged in an act of remembering. When students learn a foreign language through drama-based approaches, which involve learning through movement of the body, or when actors rehearse their part, this kind of memory might be at work and could be supporting learning without conscious awareness, at least in some part. In fact, in the retrieval of implicit memory conscious awareness is not required and the recall of motor skills is more connected to the original conditions under which they were acquired (Kandel *et al.*, p. 1446). Implicit memory also determines many aspects of our individuality, and our sense of personality since we are unaware of most of our mental operations that guide our daily life (p. 1483).

Another form of implicit memory that might be active during learning is priming: it refers to the perception of a word or object that is improved by prior exposure (p. 1445).

To conclude, the two memory systems, explicit and implicit, work together in parallel during learning experiences, so that when we practice extensively, what started as explicit memory formation can be transformed into implicit memory, especially in perceptual and motor skills formation (p. 1485). Learning and memory are connected to other processes that influence the quality of our memories: learning depends on emotions, attention levels, motivation, and processes of repetition.

2.3. Emotions and their role in learning

Affective neuroscience is the branch of cognitive neuroscience that studies emotions and affect, social interaction and communication, the body and cognitive functions to answer questions about human behaviour and experience. Recent studies confirm that emotions and feelings are connected to learning and influence the quality of

memory formation (Immordino-Yang, 2016). For example, Johnston and Olson (2015) describe how the basic emotional systems are now studied in terms of their interaction with cognition, how emotions affect the body and the mind, how they influence thought, judgement, decision making and learning. Before continuing our discussion, it is necessary to distinguish between *emotional states* (or *emotions*) and *feelings*. To do so I will follow LeDoux and Damasio's (2013) description of these concepts. The processes responsible of emotional states (or *emotions*) do not reach the level of conscious awareness most of the time, but are able to lead to *feelings*, which we recognise consciously and are able to report:

Conscious feelings facilitate learning about objects and situations that cause emotional responses. Thus feelings enhance the behavioural significance of emotions and orient the imaginative process necessary for planning future actions. In brief, unconscious emotional states are automatic signals of danger and advantage, whereas conscious feelings, by recruiting cognitive abilities, give us a greater adaptability in responding to dangerous and advantageous situations. Indeed, both emotions and feelings also play a major role in social behaviour, including the formation of moral judgments [...]. » (LeDoux and Damasio in Kandel *et al.*, 2013, p. 1092)

In other words, emotions are survival- related mechanisms, innate or learned, that «coordinate rapid and complex behavioural and bodily responses that ensure an optimal interaction with the stimulating events, thus enhancing survival.» (Johnston and Olson, 2015, p. 309). The amygdala, an almond-shaped structure located close to the hippocampus, is often mentioned as involved in emotional processing and in the encoding and retrieval of emotionally charged experiences (Kandel *et al.*, 2013, p. 1458), which is part of the same brain system that is active and when we feel and appreciate social and intellectual aspects of life. Feelings connected to our social and intellectual life are complex mental reactions that we have to situations, events or concepts, and therefore they are subjective cognitive interpretations of reality and of the embodied reactions connected to them.

Emotions and feelings play a crucial role in learning because they alter our sense of self and purpose: our motivation to learn decreases when we feel disengaged, disappointed, frustrated or bored, while it is heightened when we are engaged, inspired, curious, proud or simply happy to learn something new. Emotions depend on the body chemistry, on the social environment and on the surrounding context, factors that also affect learning. Contrary to the belief that emotions are separate from cognition and that they hinder acquisition, recent research by Immordino-Yang (2016) shows how basilar they are for general learning and for school-based learning. The most important points in her discussion of how emotions and feelings are relevant to learning are the following:

1. Memory, complex thoughts and meaningful decision making, that is, higher cognitive functions, are not possible without emotion because information flows from systems in the brain that process emotions to those involved in the elaboration of higher cognitive functions;
2. «Complex emotional feelings, such as interest, inspiration, indignation and compassion, are active mental constructions — they pertain not to the real physical context (the immediate context that we can see) but to abstract inferences, interpretations, and ideas» (p. 19) so that teachers can help students connect learning to their abstract, subjective emotional experiences transforming a learning situation into a *meaningful* learning experience. Thus, it becomes clear that acknowledging an emotion or feeling that a student or a teacher is having is not the purpose of meaningful teaching: understanding emotional experiences means creating the conditions for students to be aware of the meaning they are creating.

3. Emotions and feelings, as cognition, take time to develop: they are considered like skills, or organised “patterns of thought and behaviour” (p. 20) that we actively construct gradually over time.
4. Meaningful emotional learning, that is, the ability to understand what has been learnt, is crucial for long-term memory, for the application of the new knowledge to new different situations, and for the building of “personal relevance”. As explained in the next paragraph, being able to reflect on ones’ learning, to set goals and to sustain the effort required for reaching that goal, is fundamental for two additional aspects of learning, namely attention and motivation.

2.4. Attention and motivation

2.4.1. Attention

Craig and Lockhard (1972) studied the mechanisms that contribute to the consolidation of memory: in order for new information (and therefore study material) to be remembered, the phase of encoding must be “deep”, that is, the incoming information must be thorough. By consciously attending to the new information, the new memory can become stable and be integrated with previous knowledge. In addition, Schachter (2001) states that absent-mindedness resulting from lack of attention to immediate experience prevents new memories from being consolidated. Attention is therefore a prerequisite to the development of academic skills (Posner and Rothbart, 2007) that improve with training: practices of attention regulation with a focus on the surrounding context and on specific different aspects of the material taught also improve other abilities such as reading skills and

social interaction. Usually, an individual attends to two kinds of stimuli: external or environmental stimuli —from the surroundings— and internal stimuli —from the individual’s own memory and body. All the information coming to the brain compete for processing resources and create the phenomenon of attention (James, 1950), the process by which neural mechanisms assess and process this competition in order to create a unitary response (Desimone and Duncan, 1995). *Control*, *vigilance* and *selection* (Parasuraman, 1998) are subcategories of attention that allow to maintain a goal-directed behaviour. In learning environments, attention is the result of a «continuous process of evaluation, action and reaction, [...] an ongoing exchange between neurobiology and environment, [...] a process of interaction between learner and environment that depends on competition between behavioural goals, internal and external stimuli, and temporal contexts» (Schumann *et al.*, 2004, p. 144-145). Under certain conditions, an individual might divide her cognitive resources for different and simultaneous tasks, as when a learner follows a lesson (Marini, 2016): she might be taking notes while listening to the teacher talking and while looking at a presentation shown on the screen. In that case, when more than one task must be performed at the same time, the demands to accomplish them might exceed the processing capacity, so that the performance on one or more of these tasks often declines. This form of attention is called “divided attention”. Another form of attention is called “sustained attention” (or vigilance), by which we are able to attend to a task for a long period of time, or as long as it takes to complete a task. In this case the prolonged effort to eliminate distractions coming from the environment or the individual’s body and the focus on the task is what we know as *concentration*. The attentional process overlaps with working memory processes: as with memory, we have seen that attention has different features and subcategories according to the task we are trying to accomplish; it has an intertwined nature and cannot be separated from memory and goal setting. Goal-directed behaviour like learning requires sustained attention and an *intention* to learn.

2.4.2 Motivation

Another important factor must be present for learning to occur and to make initial new memories to become stable: motivation. As Kandel *et al.* (2013) illustrates «this is accomplished by attending to the information and associating it with knowledge that is already well established in memory. Memory encoding also is stronger when one is well motivated to remember.» (p. 1447). Complex brain circuitry is recruited to sustain motivation and deep learning. Especially the brain *reward circuitry* is responsible for promoting and maintaining behaviours that anticipate and procure rewards. The release of the neurotransmitter dopamine deeply influences goal-directed behaviour and facilitates the mechanisms of learning and memory (p. 1113). In his theory of *stimulus appraisal*, Schumann (1997, 2004) describes the mechanisms that underlie the motivation to learn, and in particular language learning, by drawing on his studies about the “value and relevance of stimuli”, the “interactional instinct” and the “mental foraging” processes that are active during learning. In this framework *value* refers to the biological notion of basis for all activities that we engage in: we perceive, move, cognize and feel on the basis of the value of a stimulus. Schumann distinguishes three types of value:

1. *Homeostatic value*: the «biological tendency for an organism to maintain its physiological system within a certain range» (Schumann *et al.*, 2004, p. 24). It refers to the systems in the brain and the body which control respiration, heart rate, body temperature, satiation, eliminatory functions, and sexual drive.

2. *Sociostatic value*: the «inborn tendencies to interact with conspecifics [...] to seek social affiliation». that is also explained as the *interactional instinct*. This form of learning is inevitable in all normal individuals: learning to see, to walk, to attend to faces, to voices and to the dispositions of others are processes that have been selected in evolution due to their importance (value) for survival.
3. *Somatic value*: the «preferences and aversions acquired in the lifetime through experience, socialisation, enculturation and education». In this type of learning, motivation generates mental and motor activity to reach the goal: a “foraging for knowledge”, the type of intrinsic motivation that sustains learning.

According to Schumann, we experience the emotional impact of a stimulus in terms of its relevance to our homeostatic, sociostatic, and somatic value systems. In attributing somatic value to experiences, the emotional relevance of a stimulus is assessed and eventually appraised on the basis of the following factors: novelty, pleasantness, relevance to the individual's goals or needs, ability to cope, and compatibility with the individual's self and social image. A memory of this learning experience is created and used in evaluation of subsequent stimuli that will lead, or will not lead, to the readiness to undertake mental or motor behaviours. As described in the previous paragraph, new studies show that social emotions play an important role in motivation: admiration for another's accomplishments can become an inspiration to do meaningful work too. The implication for learning is that inspiration «heightens conscious awareness and impels us to act purposefully toward our goal» (Immordino-Yang, 2016), thus changing the perception of self and that of others. Through socially motivating emotions like admiration and gratitude individuals engage in activities that are beneficial for themselves and for society.

2.5. Processes of repetition

Motivation and intention also sustain the process of *repetition*, which is necessary to establish learning both in motor and in linguistic skills. Kimble (1961) defined learning in terms of a permanent change in behaviour which occurs as a result of practice. Repetition and practice are important for the consolidation phase of memory formation: «new perceptual, motor and cognitive abilities are learnt through repetition: with practice performance becomes more accurate and faster, and these improvements generalize to learning novel information. Skill learning moves from a cognitive stage, where knowledge is represented explicitly and the learner must pay a great deal of attention to performance, to an autonomous stage, where the skill can be executed without much conscious attention.» (Kandel *et al.*, p. 1453). Repetition plays a crucial role in learning (Morosin, 2008), in the formation of new memories, as well as in the building and the restructuring of knowledge because it constitutes the rehearsal necessary for working memory to translate sensory information into explicit long-term memory. On the other hand, repetition is needed when trying to learn a new motor skill: the more we practice, the more refined and autonomous the motor skill will be because the memory that was formed initially and that was supported by a conscious effort becomes automatic and supported by procedural memory.

2.6. Streams of consciousness

As described in the section dedicated to emotions and memory, most of the activities that constitute learning occurs underneath the level of consciousness: we do not have a conscious thought about every piece of information that enters our perception, nor are we aware of how a word or a movement is selected and produced. Our

conscious awareness does not experience anything about the workings of the brain in action: we sometimes are likely to not even notice what act we have just performed, like when we drive while thinking about something else, or when we perform daily routines (Eagleman, 2015). At the same time, it is remarkable how the brain is able to make us aware of the fact that “we are aware”: by holding the mirror of *introspection* we are able to see ourselves and some of the conscious processes that lead to cognition.

2.6.1. Introspection, metacognition, embodied cognition

The study of consciousness and introspection have been long neglected by neuroscientists. It has received attention only recently, and many contributions are shedding light on this phenomenon (Dehaene and Naccache, 2001). Consciousness is divided into three main categories that overlap with attention and perception: *vigilance*, *selective attention* and *conscious access*. *Vigilance* in this case refers to the state of being awake; *selective attention* is the unconscious process of concentrating mental resources only on one or a small subset of perceived incoming information; *conscious access* is «the entry of some of the attended information into a second post-perceptual stage of cognitive processing which makes it durable, available to many additional cognitive processes, and reportable to others. It relates to the transitive use of the word “consciousness” in everyday language (as when we say “The driver was conscious of the red light”))» (Dehaene, 2013, p. 3).

Dehaene (2013) gives two more definitions of consciousness that are relevant to learning, especially learning through a drama-based approach: *self-consciousness* and *recursive consciousness*.

1. *Self-consciousness* refers specifically to «the capacity to represent our body and its limits; the separation of our actions from those of others (agency); and the formation of a “point of view” on the external world. [...] self-consciousness arises from a combination of brain circuits specializing in the representation of different aspects of

our selves (sensory maps of the body, vestibular signals of head stability, programming of intentional movements, etc)» (p. 4). Another way of describing this knowledge of the body about its position and movements is *proprioception*.

2. *Recursive consciousness* is also called *metacognition* and refers to «the capacity to “know oneself”, i.e. to introspect and obtain information about one’s own mental processes. Such information is called “meta-cognitive” because it provides a higher-order representation of the content, value or quality of some other information represented elsewhere in the system. We rely on metacognition when we evaluate our confidence in a past decision, or when we realize that we do not remember something.» (p. 4)

This study of different streams of consciousness and introspection is relevant because it begins to show how *subjectivity* and *individuality* emerge from a complex network of interaction between parts of the brain and the body, how introspection and metacognition can give voice to our mental processes, at least those that we perceive as conscious. In learning, introspective verbal reports will not be a means to understand how the mind works while it learns, but they can help establish new memory. In fact, in his study about unconscious and conscious states of mind, Dehaene (2013) underlies the importance of conscious re-elaboration of information: «The quality of the extracted information, its durable maintenance and its flexible use in multiple tasks are drastically enhanced on conscious relative to non-conscious trials» (p. 9).

Dehaene and his colleagues (Dehaene & Naccache, 2001) also proposed an interesting theory called Global Neuronal Workspace (GNW) that accounts for unconscious and conscious processing and that could also explain the concept of *embodied cognition*. GNW theory assumes that:

1. Unconscious stimuli are processed via automatised pathways (“encapsulated processors”) in sub-cortical parts of the brain;
2. In addition to these processors for non-conscious processing, the brain broadcasts a subset of the available information globally via

long-distance axons neurons, so that it can be consciously processed as a memory, an evaluation, a verbal report, an intentional action or plan, usually in the cortical areas of the brain: this organisation allows for a more efficient processing and for verbal reporting because information is thus “flexibly shared by many cortical processors” including those responsible for language. (Dehaene, 2013, p. 11-12)

If the same mechanism is active for long-distance neurons that project to the body through the spinal cord and the nerves, it might explain the concept of *embodied cognition* discussed in the next chapter, the theory of learning that occurs through the body, with the body.

GNW theory also explains how *conscious access* to information, supported by a distributed network of neurons (the Global Neuronal Workspace), leads not only to *durability* in time but also to *individuality* since exposure to the same stimulus may reach the level of consciousness in one person, but not in another, making the experience (and therefore learning) unique and personal.

2.6.2. Idleness

Idleness refers to a state of inactivity, when one is not engaged in work. It is a state of rest when we are doing nothing and typically not attending to our surroundings. Sometimes students are not engaging in activities that require attention and goal-directed concentration, they seem to be daydreaming, or they are so absorbed in their thoughts that they ignore everything going on around them. Is this time useless? Often during a drama-based lesson students are invited to take some time for introspection to reflect about their actions, their choices, their emotions and their learning experience. What happens in the brain when we reflect? How does this type of activities impact learning? Attention to the inner psychological self was studied by Immordino-Yang (2016). She researched the state of idleness of the brain, called a “default mode” (DM), connected to internally focused psychological mental processes during tasks like mindfulness exerci-

ses, reflection, recalling of personal memories, imagining future experiences, feeling emotions about social situations and constructing moral judgments (p. 44). She collected findings that show that people with stronger activation during DM time —so when they are resting— are able to get higher scores on cognitive abilities like creative and divergent thinking, reading comprehension and memory retrieval. These findings also showed that attention to the outer world is related to introspection and social processing, as well as to abstract, symbolic thought. During tasks that involve reflection and inwardly directed attention, the brain networks responsible for DM are active, while during goal-directed tasks, the networks that sustain focused attention are engaged: the brain switches between these two activities. Training introspection has shown to improve sustained attention (p. 48), which is required in learning a foreign language.

3. Neuroscience of second language acquisition and performing arts: shared pathways

3.1. Second language learning and performing arts

Learning a second language requires the brain to become a specialist in something for which it has no specialisation: it is a process that needs to be deeply sustained for a long time, sometimes for several years. The processes involved in learning described in the previous chapter, all contribute to the successful learning of a foreign language: the intrinsic motivation to learn a new language facilitates the recruitment of attentive resources and sustains the prolonged effort required to achieve accuracy and fluency; through multi-modal learning new linguistic knowledge is consolidated in a distributed way so that memories become well established; by implementing routines and reiterating practice, the rules of the new language become ingrained and automatic. Emotions play a crucial role and determine our motivation to learn, while embodying practices and moments of reflection contribute to the development of the interactive and social cultural aspects of language (Morosin, 2008). Learning a foreign language becomes a pleasant activity when the hedonic system in the brain is activated and perceives the learning experience in aesthetic terms, that is “the beauty of learning”. Recent studies in the neurosciences of performing arts have shown that many of the processes outlined before play a crucial role also in successful actor training. In addition, neuroscience research has started to examine the functionality of the brain when it engages in performative and artistic activities, thus proposing contributions that make clear the connection between the arts and learning, and especially the role of performance in learning. The next paragraphs will illustrate these findings. Firstly, I will describe cognitive factors involved in second language acquisition, secondly, I will present the findings from neuroscience of actor training that can be relevant for educational drama.

3.2. Schumann's theory of second language learning

Many theories describe how languages are learnt, but for the purposes of our study I will draw on Schumann's (2004) theory of second language acquisition because it represents one of the first neurobiological accounts of foreign language learning. His work was developed together with a team of neuroscientists at UCLA two decades ago: nowadays, findings in neuroscience are validating at least some aspects of this theory.

3.2.1. Motivation

Based on the concept of stimulus-appraisal described in paragraph 2.4.2., this view of learning considers second language acquisition as the result of a motivation to act and to learn, the achievement resulting from a form of "mental foraging" that may involve the same neural circuits that are used for foraging to feed or to mate. Thus, the mechanism that subserves motivation may operate on motor neural networks since it is considered as a cognitive process that may be seen as a higher order function of motor processes. The structures of the brain involved in motivation are usually recruited also during emotional processing, like the *amygdala* and the *limbic system*, and during motor control, like the *basal ganglia* and the *brainstem*. The possible phases for the activation of motivation loops in the brain would be divided into the following steps:

1. Limbic system (amygdala) and orbitofrontal cortex are activated: the goal for learning is generated based on the positive appraisal.
2. The amygdala and the orbitofrontal cortex project to the basal ganglia: a motor area in the midbrain that seems to hold the goal over time and modulate its intensity.

3. There is activation of the motor nuclei of the brainstem: here motivation generates motor activity to reach the goal: "foraging for knowledge".

If the learner perceives that the situation is rewarding, *dopamine*, a neurotransmitter, is released in the basal ganglia: this positive signal is detected by another sub-cortical structure of the brain, the *striatum*. This circuit works like a chain of reinforcers and leads to learning.

4. *Acetylcholine*, another neurotransmitter, is released and distributed in the *cortex*, where refined and complex processing occurs: it facilitates synaptic formation and strengthening to encode the relevant linguistic information.

To translate into learning, the first initial motivational state must channel attention resources to the input received and this is accomplished during the phase of sustained or focused attention.

3.2.2. Attention

Gaining the audience's attention is the teacher's and the performer's main goal: from this point of view, the two professions share several aspects. Many factors determine the quality and type of learner's or the audience's attention, that can be summarised in two main categories: the person's internal and external environment. The internal environment corresponds to the homeostatic needs as well as personal history and goals; in the classroom, learners' attention might also be influenced by academic history, preferences for instructional methods and learning styles (Skehan, 1998). Instead, the external environmental factors influencing attention levels might be the classroom environment, the surroundings outside the classroom, the interactions between teacher and learner and the relationship between all

these aspects. Attention emerges as a process of continuous evaluation, action and reaction to human behaviour and cannot be described as a single neurobiological phenomenon. As described in the previous chapter, attention is inextricably linked to perception and working memory processes, influenced by emotion and motivation, and involved in both declarative and procedural memory formation, that is, it is involved in the learning of cognitive, motor skills and knowledge.

In language learning the interaction between learner and environment depends on the competition between goals, internal and external input and their temporal context (Schuchert, 2004). Attentive behaviour is therefore created as a complex negotiation and it requires activation of different neurobiological structures according to the type of task or state of mind. In this paragraph we focus on *sustained attention*, given the fact that it is this kind of visual and acoustic attentive behaviour that creates the state of concentration necessary for remembering new linguistic material. According to Iacoboni (2000) the areas of the brain that are active in this attention process are networks in the *frontal* and *parietal sensorimotor regions* —dedicated to motor planning— influenced and connected to areas of the *dorsolateral prefrontal cortex*, which is the site of elaboration of behavioural and task goals. These areas also project to the *anterior cingulate cortex*, a region of the brain which is part of the mechanism that modulates motivation, or mental and motor activity for learning.

This description of attentional processes shows that no clear boundaries between perception, action and cognition are present, but that sustained attention and learning is the result of the interaction between the internal and external environments, the outworld and the inner world of the organism, the body and the mind. Sustained attention leads to proficiency and accuracy in language learning.

A factor that fosters sustained attention and the consequent process of memory formation and consolidation is the presentation of multi-modal, multi-sensory input.

3.2.3. Perception and Multi-modal learning

We tend to think that in order to learn a foreign language exposure to linguistic input might be enough to lead to language learning, but recent studies of the last two decades show the importance of learning through all the senses, that is, learning in a multi-modal way (Lightbown and Spada, 1999; Gardner, 1999; Torresan, 2008; Morosin, 2011). Language teaching should therefore be based not only on visual and linguistic presentation of new material, but also involve experience of the language through the other senses of touch, smell and taste. Learning through the senses opens up a world of new knowledge that is discovered by the learner at many different levels: the unconscious level of emotion and perception, and the conscious experience of motivation, attention and cognition. Although we describe these processes as divided from one another, it is clear by now that they are fluid and interconnected in reality. Scientists are changing the way they think about cognition (Kandel *et al.*, 2013) because the imaging technologies available today let them see how information in the brain is sent from one area to another through pathways that connect more than two areas, and especially for memory, they have discovered how declarative and procedural memory (both important for language learning) are *distributed*. *Distributed memory* means that the brain stores different traits or aspects of the same experience, event or object in different areas, so that the concept or representation of that experience is redundant and can be accessed by different channels: it might be a visual, auditory clue or a scent, a movement, a gesture that activates the memory. This is relevant for our discussion of language learning because it supports the idea that learning can be improved when all the senses and the body are involved in the learning experience. Therefore, planning foreign language classes based on the sense of smell and taste -like when we engage in cooking a traditional recipe-, or based on touch and movement -like when we explore cultural concepts through drama exercises that in-

volve movement of the body, might lead to the formation of that learning memory in a distributed fashion, that is, not only a memory based on what we have heard from the teacher and seen on the board, but a memory which has other features attached, like the sensation of tasting a new food combination, or the emotion connected to a dramatic representation of a story.

3.3. Shared pathways

Researching about ways to make the linguistic input accessible from different sensory channels brought to the study of performative techniques to teach a foreign language: actually when learners engage in artistic and performative learning, the exchange between the external and internal environment becomes richer and more intense, the input can be accessed from different sensory channels, which leads us to think that the learning resulting from this type of learning experience might be consolidated in a stabler way. The performative techniques to which we refer, are specifically thought for the school environment and do not refer to dramatic acting in front of an audience, instead they refer to the corpus of theatrical exercises that can be employed in a classroom to teach different subjects. For a description of performative technique in educational drama, please refer to chapter 4. Drama-based techniques can be a valid pedagogical tool to foster multi-sensory and multi-modal learning: they are designed to modulate learning through the mind and the body, sometimes involving all the sense, and specifically focusing on movement of the body to produce symbolic meaning. But cognitive studies of these aspects of educational drama are missing. So far, the only resources available on this topic, are the work of experts who are neuroscientists and also theatre artists, like Susana Bloch (2008) and Dorys Calvert (2016), interested in bridging the gap between theatre studies and neuroscience and focusing especially on the affective neuroscience of the actor's work, which therefore are not specifically de-

scribing performing arts in the school settings, but that shed light on aspects of learning that might be active during drama-based language learning too, like the role of emotions and feelings, the formation of procedural memory, the process of embodiment of learning and that of aesthetic engagement.

3.3.1. Emotions

Emotions are at the basis of all our behaviours: they modulate our reasoning, they motivate us to take actions, they support or repress our creative processes, and they sustain learning. They lie at the bottom of every mental activity due to the neuroanatomical configuration of the brain structures involved in emotional processing: the *hypothalamus*, the *brainstem* and the *lymbic system* are sub-cortical regions in the brain that modulate emotions (Damasio, 2010) by projecting to many other areas involved in cognition.

Calvert (2016) describes how the findings in affective neuroscience are beginning to illustrate the role of emotions in the actor's work: her studies are relevant for our discussion of how emotions influence learning when adopting drama-based techniques, because students, as actors, might undergo the same processes when engaged in performative activities. She underlies the importance of the emotional dimension in acting, which permeates every aspect of the artist's work, from her scenic presence (*présence scénique*) to her physicality (*organicité de l'acteur*), from the interpersonal relationships to the quality and intensity of communication (p. 361). Emotions give a natural, vital and physical character to performing arts, that can turn it into a transformative experience both for the actor and the audience.

Performative practices and their emotional transformative power were described by Boal (1990) as a *therapy* involving mind and body, able to modify the individual's sense of being. Contrasting with Boal's view, Orioli (2010) does not see theatre as a therapy, but

says that theatrical practices may constitute a means for extricating and healing blocked emotions. In fact, although performative practices can become a therapeutical means for personal emotional balance and can be used in medical contexts to heal psychological and psychiatric disorders, it must be noted that in school environments performative practices have a healthy and positive influence on learning and eventually lead to personal transformation when emotional states are regulated and when they contribute to problem solving. This occurs when the brain circuit for pleasure and reward is activated, when empathy is mediated and when reflection is used to acknowledge emotions.

The circuitry in the brain dedicated to pleasure and reward is linked to the processing of negative and positive emotions: we avoid, if possible, feeling pain, fear and disgust, while we engage in activities that are rewarding, and that make us feel happy or worth. This mechanism is active when we perceive an experience as being good for us, so that we want to repeat it. In the brain dopamine is released, the neurotransmitter responsible for the state of happiness. Calvert (2016) discusses the theatrical experience as a source of multiple forms of pleasure and well being, a theory already advanced by Pradier (1990) who proposed that a performance might stimulate the reward system of the brain «through complex sensorial processes as well as by means of imagination and emotional excitation.» (p. 92). Thus, a performative practice, being experienced at the theatre or in the context of performative pedagogies, might trigger the activation of the reward system, which is also connected to the motivation mechanism described in the previous paragraphs, and linked to the system that modulates empathy.

Decety (2003) explains *empathy* as a psychological phenomenon involving the ability of representing and feeling others' emotions and to adopt the others' perspective while maintaining a sense of individuality (p. 85), a mental simulation of the others' subjective perspective. In fact, social neuroscience tells us that, although the brain has been studied in isolation so far, many neural networks are dedicated

to social interaction, to monitoring others' communication and intentions, and to read their emotions based on subtle facial, auditory and sensory cues. Eagleman (2015) describes empathy as a form of "mirroring": he studied a group of people looking at pictures of other people smiling, frowning or expressing pain and found out that the subjects in the experiment «were automatically using their own facial muscles to copy the expressions they were seeing» (p. 155), thus trying to put ourselves in the other's shoes seems to be an unconscious process that, first of all, informs us of what the other is likely feeling. Empathy activates areas of the brain working in concert, like the *mirror neurons* of the *frontal and parietal cortex* (Iacoboni *et al.*, 2005; Iacoboni, Kaplan, Wilson, 2007), but also areas dedicated to the emotional experience of pain. Empathy allows us to simulate what it is like to be in a given situation, to better predict what another person is going to do next. We can feel his/her happiness, joy and pride, and as Immordino-Yang (2016) explained, feel admiration and be inspired to do the same, to imitate good examples; but in case of painful situations, this might lead to a negative memory of the experience. Our brains are wired in a way that simulation of emotions activates the same regions that are active during the real experience, especially those areas that process pain: the brain uses the same networks in experiencing pain or in seeing someone in pain (Eagleman, 2015, p. 158).

How is it possible for a person to identify with a character that actually does not exist (think of a character in a play or a novel) and feel his/her emotions? This question is also linked to the issue of the reception of the audience and the relationship between actor and audience: is it possible to manipulate the audience's emotional responses? During theatre performances, the manipulation of some aspects of staging might enhance the probability of triggering real emotions in the spectators. For example, the rapport between the actor and the spectator, the physical closeness between the two, the general sensory stimulation through the use of music, silence, lights, sounds and different movements contribute to the emerging of emotions, as well

as the quality of the actor's psychological engagement, her physical presence, and the coherence (or not) between the dramatic text and her emotional expression (Calvert, 2016, p. 367). However, as proposed by Dehaene's (2013) discussion, individuality emerges also in the triggering and processing of emotions, so that the actor's emotional expression might not be enough to trigger the same emotion in the spectator. Moreover, although empathy may arise, the emotional reaction of the spectator might be unique, due to the unique configuration of internal and external factors like memory, perception and past emotions, or personal history and experience, momentary homeostasis and their interaction with the outer environment.

In the same way, the students' response to a performative activity is the result of their unique way of processing emotions, that cannot be foreseen, but can be mediated.

To avoid the negative emotional reactions to pain, it is important to always acknowledge emotions through reflection, in training and especially in school settings. Actually, as it will be described in the next chapter, performative pedagogies sometimes risk to trigger painful emotions connected to personal experiences so that, in these cases, it might become a dangerous practice for the students involved if the teacher is not able to detect the situation and propose a time for reflection on the work done up to that moment and on the different emotions that have arisen. In order to do so, the teacher must introduce a metacognitive process of "stepping out" (or *distancing*) of the role assumed before, where students go back to their reality and identity, and distinguish between the emotions felt as the character that they were playing and those pertaining to their personal sphere.

3.3.2. Procedural memory and embodiment

In theatre training, the synergy of forces that keep our balance stable when we move, that continuously monitor our posture and our movements in relations to the space is described with the concept of

body schema. Introduced by Gallagher (1986), the body schema emerges as the result of the orchestration of unconscious sensory-motor networks that «constantly regulate posture and movement - a system of motor-sensory capacities that function below the threshold of awareness, and without the necessity of perceptual monitoring» (Gallagher in De Preester and Knockaert, 2005, p. 234). Therefore, it is a mechanism that does not require our attention to function, so that we can concentrate on other activities, but that intervenes and modulates our way of occupying space. In other words, it is the way the body knows itself and knows the world that surrounds it. The concept of body schema is also linked to the concept of *embodied knowledge*. Also called *tacit knowledge* or *thinking in action*, it includes not only the motor control dimension, but also cognition through the integration with perceptive and memory schemas. It is another way of conceptualising the tacit and hidden workings of the brain described by Dehaene (2013, 2018) as *embodied cognition*, the automatic system sustained by the Global Neuronal Workspace and linked to procedural memory. The studies on body schemas and embodied cognition illustrate that cognition is deeply connected to the sensory-motor system, to the body in action, which learns about itself and the world through its own movements and actions. The more we engage in practice with repetitions of routines, the more refined the actions will be both on the unconscious and conscious level. As seen in the previous chapter, practice and repetition lead to consolidation of procedural memory as *experience*, *accuracy* and *fluency*. For the actor, experience can mean to be able to choose the best option during improvisation without directing conscious attention to it because she has a large repertoire of actions she rehearsed many time before (Sofia, 2013). For language learners, accuracy and fluency can be the direct result of extensive practice with the new language to the point that, for example, certain grammatical rules become available without conscious retrieval.

Embodied cognition was also discussed by Johnson (1987) in terms of “structures of our bodily experience” that become abstract

meanings and patterns of inference, that is, «human bodily movement, manipulation of objects, and perceptual interactions involve recurring patterns without which our experience would be chaotic and incomprehensible. I call these “image schemata,” because they function primarily as abstract structure of images» (p. xix). Thus, Johnson emphasises the role of the body in meaning and in reason, and the embodied origins of imaginative structures of understanding that emerge «from our experience as bodily organisms functioning in interaction with an environment» (p. xvi). Recent neuroscience research by Eagleman (2015) shows that indeed the body is *in* the mind. His findings corroborate discoveries made on procedural memory: a) practice makes skills become “high wired”, automatic and unconscious so that we lose conscious access to the skill (*expertise*); b) expertise changes the structure of the brain so that what is sometimes referred to as “muscle memory” is in fact in the brain (p. 88).

3.3.3. Aesthetic Engagement

Neuroaesthetics is the interdisciplinary branch of cognitive neuroscience interested in the study of the neural bases of aesthetic engagement. Aesthetic experiences involve the appraisal of elements in our environment, like objects and people, artefacts and works of art, spaces and events.

The underpinnings of the aesthetic experience are found in the areas of the brain dedicated to perception, emotion, declarative semantic memory, attention, and decision-making. Since in our discussion so far, we have not mentioned the faculty of decision-making, it is worth to know that when we take decisions about voluntary actions, one of the areas involved in this process, that is also relevant to motivation, is the orbitofrontal cortex, which is active when the brain is engaged in evaluation and interpretation of experiences, among which are also aesthetic experiences.

Recent evidence shows that aesthetic experiences emerge from the interaction between a “triad of neural systems” in the brain (Chatterjee and Vartanian, 2014): 1. the sensory–motor mechanisms in the brain connected to 2. the networks that process emotions and appraisal, and that are intertwined with 3. meaning and knowledge neural systems (Skov and Vartanian, 2009). Hence, aesthetic engagement is the result of the distributed activity in the brain, which is not limited to the right hemisphere -previously thought to be the “artistic hemisphere”-, but which is modulated by the triad of neural systems described before. Since neuroaesthetics is still an emerging discipline, most of the findings available so far, describe aspects of the aesthetic engagement with visual art. However, due to the interactive nature of the neural areas involved and because performative activities share many features with the visual arts, like the concept of painting composition and the use of space, or the expression of meaning through the execution of body movements and face expressions, the following aspects of aesthetic engagement in the visual arts (Chatterjee and Vartanian, 2014) can be relevant for performing arts too:

1. The human gaze is attracted by the human figure, the other’s gaze (or eyes), the hands, and the movement of the body to analyse the other’s behaviour and to respond to that presence (Zeki and Lamb, 1994; Zeki, 1999). In addition to attending to faces, bodies and landscapes, through the visual system, the brain is able to discern elements like luminance, color, and motion.

2. Dynamic paintings and scenes evoke a sense of movement and activates visual motion areas (Thakral *et al.*, 2012) in individuals; portraits activate the *fusiform gyrus*, an area dedicated to detection and recognition of the face, while landscape paintings trigger activation in the the *parahippocampal gyrus* (the region adjacent to the hippocampus), responsible for processing of space information

(Kawabata and Zeki, 2004; Yue *et al.*, 2007). Perceptual areas adjacent to these regions might also be involved in the evaluation and appraisal of specific elements of visual art. Actually, research by Biederman and Vessel (2006) showed that there was a stronger activations in the visual areas dedicated to elaboration of “interpretable information”, thus indicating that experiencing aesthetic pleasure might be the result of distributed activity between structures dedicated to specific stimuli (like motion, faces or landscape in a scene) and the emotion-evaluation systems in the brain.

3. Freedberg and Gallese (2007), Umiltà *et al.* (2012) describe in their articles that the pleasure we feel during an aesthetic experience, deriving from the activation in the sensory-motor cortex, linked to activation in the appraisal-reward system structures — like the anterior cingulate and the striatum, which are usually engaged even when we are not consciously thinking or evaluating an input— constitutes a form of empathetic embodied response to visual art. The same regions of the brain respond to other forms of pleasure like music and architectural spaces (Ishizu and Zeki, 2011; Vartanian *et al.*, 2013)

4. Another important point in this discussion is the contribution that a population of specific neurons, called the mirror neuron system (Gallese *et al.*, 1996), might give to the emerging of aesthetic experiences. These neurons are found in the motor and sensory cortex of the brain and they extend from one area to the other: they are active when we execute or perceive actions.

Studies found that this sensory-motor system is activated when we look at works of art that depict actions, when we observe and try to understand the artistic gestures represented.

A recent study by Gallese (2017) corroborates the idea that vision, which plays a relevant role in aesthetic experience, is multimodal, since it «encompasses the activation of motor, somatosensory, and emotion-related brain networks» (p. 5). In addition, the motor system is also multimodal, in the sense that motor neurons control action but also respond to visual, tactile, and auditory stimuli: they not only control our movements, but also «map the space around us, the objects at hand in that very same space and the actions of others, thus defining and shaping their representational content in motor terms». The motor system also responds to tactile and visual stimuli within the body's peripersonal space (or the space surrounding the body), and to auditory stimuli also originating from the same peripersonal space. Thus, different sensory channels (both visual and auditory) of the same motor action activate the very motor neurons normally causing it. This occurs during the execution of an action, but also when observing another person's performance of the action, so that the action of others is mapped on the observer's motor representation. Gallese describes these processes by presenting them as a unifying concept that is fundamental for the understanding of aesthetic engagement, that is, the process by which the brain creates bodily memories and imaginative association in response to works of art based on the mirror neurons system (MMs), or *embodied simulation*. In his words:

These results radically change our understanding of the role of bodily actions and the cortical motor system. The cortical motor system is not just a mere muscle controller. It is an integral part of our cognitive system (Gallese, Rochat, Cossu, & Sinigaglia, 2009) because its neurofunctional architecture not only structures action execution but also action perception, imitation, and imagination by means of neural connections to motor effectors and/or other sensory cortical areas. [...] The multiple MMs present in our brain, thanks to the "intentional attunement" they generate, allow us to recognize others as other selves, allowing basic forms of in-

tersubjective communication and mutual implicit understanding (Gallese, 2014a). Embodied simulation provides a unified theoretical framework for all of these phenomena. It proposes that our social interactions become meaningful by means of reusing our own mental states or processes in functionally attributing them to others. In this context, simulation is conceived of as a non-conscious, pre-reflective functional mechanism of the brain-body system, whose function is to model objects, agents, and events. This mechanism can be triggered during our interactions with others, and is plastically modulated by contextual and cognitive factors as well as ones related to personal identity.

Embodied simulation is also triggered during the experience of spatiality around our body and during the contemplation of objects. The functional architecture of embodied simulation seems to constitute a basic characteristic of our brain, making possible our rich and diversified experiences of space, objects, and other individuals; it is also the basis for our capacity to empathize. Altogether these results suggest that empathy, or at the very least many of its bodily qualities, might be underpinned by embodied simulation mechanisms. According to my proposal, empathy is the outcome of the natural tendency to experience our interpersonal relations first and foremost at the implicit level of intercorporeality (p. 11).

Therefore, Gallese's study of embodied simulation in relation to aesthetic experience shows how emotions and feelings on one hand, and sensory-motor mechanisms on the other hand, are triggered in the brain at the same time when we engage with art, thus emphasising the interconnection and multimodality of the aesthetic experience. His study also provides additional evidence that, although aesthetic experiences involve symbolic and abstract processing that we might think as external to the body or as solely a work of the mind, aesthetic experiences start in fact in the body. To conclude, engaging in an aesthetic experience means to deal with emotions, meaning and presence (Gumbrecht, 2004), which starts from our bodily dimension and exists because of our physicality. As seen in the previous paragraphs dedicated to the neuroscience of language learning, findings in neuroaesthetics begin to highlight how mechanisms in the brain that process different aspects of cognition, are in fact connected and working in synergy, and how cognition derives from the interaction of our body with the surrounding world, even when we engage in abstract activities like appreciating art. These studies and findings are

important for our discussion because they shed light on what might be happening in the brain of a learner engaged in performative activities, since many of the techniques used in educational drama involve dealing with “emotions, meaning and presence”, as well as the enacting of scenes and the manipulation of space and other elements in the environment, so that learners create and become part of a “living painting in progress”.

4. Drama in Education and process drama

True theatre begins with the body.
Every individual does not make theatre, but is theatre and he/she discovers it
by working on his/her body. School has forgotten the body.
Remo Rostagno (2017)³

This chapter opens with a citation from an interview to an Italian playwright, Remo Rostagno, who was also a pioneer in the development of a form of educational drama for the youth during the 1970s in Turin, Italy, called *animazione* (animation) and later *teatro ragazzi* (youth theatre) (Rostagno and Pellegrini, 1978; Puppa, 1975; Puppa, 2001a, 2001b). Following the societal changes of those years, Rostagno started to experiment with drama education in the schools introducing theatrical and drama activities designed for students and for the school environment, and later bringing these performances outside of the classroom to meet the local community. It was a new way of introducing experimental drama to children and teenagers, that worked with different languages of communication and suited the imaginarieness typical of children. This movement that united school and drama started in France: it was there that the meaning of *animation* was explained in a document written by the Maison de la Culture of Grenoble (Casini Ropa, 1976), studied by Presotto (2004), that distinguished three forms:

1. classical animation: all the activities implemented with the aim of fostering the encounter, the comprehension and the communication between an audience and a cultural and/or artistic event;

³Excerpt taken from an interview published on the website educazioneaperta.it:
« Il vero teatro parte dal corpo. Ogni individuo è teatro, non fa teatro e lo scopre lavorando sul proprio corpo. La scuola si è dimenticata del corpo» original Italian text translated by M.S. Morosin.

2. research animation: the relationship established during the preparation of a cultural product between whom intends to realise it and the recipient;

3. creative animation: or the stimulating action that develops in a group to promote inventive and creative abilities in the group itself (p. 5).

In Italy, the third aspect of animation has been developed in youth theatre, with theatre companies specialising in theatre for the youth and dedicating their work to students, but working within the school community for the limited time of a course or workshop. In other words, drama still has not been introduced in the curriculum as a methodology or as a subject like in other countries of Europe and the world. In this study I refer to performative pedagogies that also developed during the 1970s and that are called by the field community as *drama teaching*, *drama in education* or *educational drama*, emphasising the educational purposes of these pedagogies. They include embodied approaches to learning that engage the students' creative and imaginative abilities, as well as their bodily presence in the classroom, but that are not always intended for an external audience. They constitute a body of dramatic forms used in school settings as pedagogical methods and as curricular or elective subjects.

As seen in the previous chapters, the body and its interactions with the surroundings enables learning in a multimodal fashion: it is fundamental for learning even when we do not directly engage it in learning activities, therefore the question that arises naturally when thinking about educational drama is whether drama-based teaching techniques, or drama teaching, can improve the learning experience, and how it can become a pedagogical tool for developing creative and innovative thinking, especially in language education. The following paragraphs will try to answer to these questions.

4.1. Educational drama as performative pedagogy: a brief history of *process drama*

During the 1970s, dramatic techniques used for actors' training are introduced in the schools in England, inspired by the pedagogy proposed by Freire (1970) who believed in the potential of performative methodologies for creativity and the development of critical thinking in students. He valued the personal contribution that every learner could bring to her learning community, so he developed dramatic techniques to foster personal growth.

Educational drama, with the contributions of Slade (1955), Way (1967), later became known as *process drama*. Based especially on the work of Dorothy Heathcote (1973, 1984), process drama is an artistic form of theatrical techniques, where students and teacher in role work together. As the name itself conveys, the aim of this performative teaching and learning methodology is not a performance, but the process itself, a participatory form of storytelling that includes moments of reflection on the story, on the action, on the subject being taught.

Thus, although it shares features and techniques with other forms of theatre by which it was influenced -like the Theatre of the Oppressed (Boal, 1990) and Forum Theatre- process drama does not aim to find solutions to conflicts, nor is it intended as a therapeutical tool; it shares the principle of improvisation, but it differentiates itself from Moreno's psychodrama (1975) and from Dufeu's Linguistic Psychodramaturgy (1998). Besides, during its development as a performative pedagogy, process drama teachers and supporters moved from disconnected dramatic activities and games to a form of sensory-aesthetic process with well defined teaching objectives (Piazzoli, 2011). Nowadays, process drama can be described as a performative teaching/learning project that develops following a precise framework and creates a sense of dramatic completion.

4.2. Language learning through process drama

Piazzoli (2011), working with students learning foreign language, describes process drama as a dramatic process which starts with a pre-text with didactic aim and unfolds with the participation of both the teacher and the students in the roles of authors, actors and producers (p. 439). Taking turns and alternating roles has the advantage of eliminating the classical hierarchic role of teacher/learner, so that all the members in the group focus on two main objectives: the learning process and the making of a story. During process drama lessons or workshops the pre-text —an image, a scene from a video, a song, a text— becomes the starting point of a performative experience which is created in synergy around the development of a story: the teacher becomes part of the story by taking on the role of a character, guiding the students through the steps that will lead to the conclusion of the dramatic experience. The students too will have a role and will engage in improvisation and dramatisation of the story co-creating the narrative.

They take on a new identity that allows them to see things from a new perspective, to practice critical thinking because, for a while, they are not students, but experts who can express themselves and help their classmates find solutions or adopt strategies that they suggest. They work, and are able to express their opinions, in a safe environment because no external audience is usually present: they become the audience when they switch role from actors to spectators judging the main character or their course of actions, or when they take on collective roles. Being able to talk and enact a scene or a part of a story in front of the class does not involve the fear of being judged: consequently, students feel safe and protected since the new distribution of roles does not threatens their somatic value (see p. 25), they feel worth and motivated to try.

Therefore, during process drama the new group dynamics allow for a type of experiential learning based on gradual discovery of new knowledge. In language classes, this discovery is usually an intercultural exploration of possibilities: by dedicating time to enactment and

performing, observation and reflection on the process, students learn to approach a topic from different points of view, developing empathy and acquiring intercultural competence in communication.

The new content is also acquired in an authentic and multimodal way. Students need to use language to communicate with each other in order to express their opinion as the new characters: although they are part of a fictional story, once they enter their role, communication becomes authentic because it is functional to the development of the story. Through improvisation, students try out their linguistic abilities developing also pragmatic competences, since the situation requires authentic expression leaving very little time to think about the utterance to use, so that they are unconsciously using spontaneous speech.

4.3. Process drama and embodied learning

Process drama is a type of performative methodology where the body functions as a learning system and learning occurs in multi-sensory ways. Students engaged in process drama activities explore the world through enactment and performance. Learning through enactment entails nurturing the shared pathways in the brain that connect emotions, motion and cognition. Therefore, we could describe learning through performative strategies as a process that enables students to understand, to construct knowledge, to express cultural and social values, to solve problems and adopt new perspectives, but we need to add that enacting also means to engage sensation and perception, to feel emotions and empathy, all of which is possible through our body. Process drama constitutes an opportunity for students to understand meaning by observing their classmates' embodied experiences and by living their own. This learning process involves the creation of meaning because we attend to the linguistic, auditory and visual input, but also feel the emotions evoked by the content of the story in which we actively participate, the environment surrounding us (both real and imaginary), the interaction with the other students,

and, eventually, the subtle pleasure of being part of an aesthetic experience that encompasses all these elements.

4.3.1. *Metaxis*

Another aspect worth noticing is the use of reflection in process drama: usually a process drama unit can be divided into three main parts (*initial*, *experiential* and *reflexive phase*) intertwined with time dedicated to reflection. Students reflect on the unfolding process, on the contents, but also on their real emotions and on the emotions felt as they were embodying a role or a character. This process of metacognition, called *metaxis*, refers to the ability to reflect on being the actor and the spectator at the same time. Through reflection we are also able to acknowledge and to give voice to our thoughts, that is, through voice we embody cognition. These aspects of learning are sometimes neglected during traditional school classes because learning is not mediated or constructed with the body: as described by Renk (1993), process drama provides opportunities to engage learners in constructing learning through an embodied experience which is facilitated by explanation, or language. Therefore, referring to the initial quote from Rostagno (2017), we need to bring back the body in school, and, especially in drama education as well as in educational drama, the body and how it works in learning should be at the centre of discussion.

4.4. Ten process drama conventions and strategies

This paragraph will explore some of the strategies based on the work of Heathcote used in process drama. Although a direct link cannot be traced between a drama activity and the workings of the brain, we can at least try to connect the type of actions described to a possible feature of learning processing: all conventions reported show how students can empathise, connect through action and movement, and construct meaning through their body. Through reflection and meta-analysis, process drama strategies provide the opportunity to experiment what it means to be another person, to safely express emotions and to distance oneself from the negative sometimes painful memories that might surface. In language classes based on drama activities, students also have the opportunity to talk about emotions together while using the target language in a significant way. These performative techniques also develop pragmatics in the second language because students can also read body language, that is, non-verbal messages: meaning is enacted and portrayed; gesture, posture, position in the space, actions and movements, gaze and facial expressions, all contribute to adding meaning to the verbal expressions.

By using drama strategies, teachers can tap into the students' cognitive, affective and aesthetic systems, enhancing attention levels, improving motivation to sustain learning, and they can very likely increase the chance that new content is learned because it is perceived by different sensory channels and processed in a distributed and redundant manner.

According to the teacher's educational goal and the students' familiarity with the dramatic technique or the language level, teachers can integrate some of the following conventions in their lessons, or plan a complete process drama experience (Anderson, 2012).

4.4.1. Teacher/student in role

This convention is Heathcote's most renowned and used technique in process drama, and it refers to the role that the teacher or the student play. According to the pre-text chosen, the teacher usually holds an object that symbolises her role and guides the students by providing the dramatic context, by facilitating improvisations, and by creating or describing an initial conflict or dramatic tension. She will then challenge the students' thinking, involve them in the development and creation of a narrative. When this role is given to a student, he or she is then responsible for the narrative, but all actions are mediated by the teacher. Both the teacher and the student can step in and out of their role.

4.4.2 The mantle of the expert

The mantle of the expert is also called *poetics of the expert*, and it refers to a particular approach to the strategy of the teacher in role, when students become the experts in a field, while the teacher has a less important role, or is not as expert as they are and therefore needs them to solve a conflict, or to find possible solutions to a task established with the pre-text at the beginning of the process drama. The teacher usually proposes activities that encourage the students and motivate them as experts, by exploring the situation through the use of imagination. Students and teacher interact as themselves, or imagine to communicate as the experts and the person who needs them; they enact activities that would be typical of the experts (Heathcote and Bolton, 1995)

4.4.3. Choral Speaking

In this technique, more than one student speak together in unison, thus emphasising the voice of a character by amplifying his or her thoughts or voice.

4.4.4. Collective role or voice

When students in couples or in groups enact a role in unison or express a character's words together, thus directing listening attention to one character, providing different points of view and mutual support.

4.4.5. Conscience or decision alley

Also called *thought tunnel*, this technique involves the students dividing into two lines and facing each other. A student, who plays a character in a moment of conflict or decision making, passes in the middle, between the lines and listens for the suggestions, declarations or thoughts spoken by the students in the lines, who represent contrasting thoughts in the mind, and conflicting suggestions. When the student exits the alley she takes her decision. With the conscience alley technique, students are able to argue and expose their thoughts about an issue in a balanced way, evaluating the others' thoughts and the positive and negative aspects of decision making; they also use persuading language (Image 1).

4.4.6. Freeze frame and tableaux

This convention provides a moment for observation and reflection because the action is stopped and students create a still scene like a video frame. The teacher usually call "freeze" or a group of students decide to halt the action to focus on a particular moment in the drama. By holding the scene, students can observe and think about the meaning they are creating or observing. This frame can be re-created later in the drama to reinforce a point of discussion or a perspective. It can also serve as a new starting point in the development of the

narrative, when students can predict the possible course of actions, or ask the students in the frame to change their disposition to enact a different meaning (Image 2).

In the *tableau* convention, students are not engaged in a previous action, but stop to create a still image, or tableau, where they depict a relevant scene of the drama with their bodies and form a composition that resembles a picture or painting. Through the tableau they convey an idea or a meaning mediated only by the body, while the other classmates can verbalise the experience and say what the meaning might be.

4.4.7. Improvisation

Students are in role and act and speak spontaneously without any previous rehearsal or script. This involves being present in the scene and giving a timely response. Improvisation can develop dramatic tension and engagement with the scene, to play a credible role and defending that character's perspective.

4.4.8. Hot-seating

When using this convention, a student who is in role sits in a chair positioned in a particular place, or that is different from others, and that becomes a hot-seat. The students sitting there plays a character that can be asked questions for a while. Only the student on the hot-seat is in role, so that the other students can ask questions to the character as being themselves. Through this technique we learn about a character's information or perspective, while all students are given a chance to interact with the character.

4.4.9. Mirroring and multi-sensory visualisation

Sometimes at the beginning of a process drama workshop or during the reflection phase, a teacher might ask the students to close their eyes and imagine objects, scenes, and people. By guiding the visualisation with cues that do not provide details to a context, learners are able to create their own images or they can imagine what it is like to move as a certain animal, object or character.

Sometimes the pre-text for a visualisation can be a text like a poem, an extract from a play or a novel, so that students are guided in creating a personal context beginning from the same point of view, that they can eventually share later.

Another technique connected to visualisation but happening with open eyes is mirroring (Image 3). This convention adds the sensory perception of oneself and the other when the teacher asks to mirror the other's movements, or to imagine you are the mirror following the other's expressions, actions, or words. This dramatic technique might trigger the mirror neurons region of the brain because we not only engage in observing and predicting what the next movement will be, but also unconsciously read the other's intentions. It is an important technique to enhance sensory reflection and creativity.

4.4.10. Role on the wall

This convention is usually used at the beginning of a process drama workshop because it helps define the main character of the story. The teacher traces the silhouette of the character without defining his or her traits: it is just the drawing of a big body, a form to fill with information received by the students, who, taking turns, describe the character. This technique is useful to fix on the wall information that can be read later on during the drama, to compare information from different students, and to generate discussion. It is also very useful in language teaching at beginner's level because it provides the opportunity to engage with simple words like colours, parts of the body, professions, nationalities, and simple emotions, which is usually in the syllabus of the first few beginning language lessons.



Image 1. The conscience alley. © Maria Simona Morosin



Image 2: A freeze frame during process drama. © Maria Simona Morosin



image 3: Mirroring and visualisation. © Maria Simona Morosin

5. Inside the process

This chapter explores a process drama workshop conducted by Piazzoli (2014) in the framework of a language teaching education course based on the short film “Buongiorno” by Melo Prino⁴. It provides an example of how a process drama workshop is planned and how it unfolds following a main question: in this case the question is about the nature of our personality, and the tabu of mental illness in Italy. The objective of the process drama is to experience the work of psychology and to be able to communicate in Italian at an advanced level. In fact, this workshop was thought for students in their advanced course of studies in Italian language (level B-C of the CEFR⁵). The process drama will explore how a team of psychologists from the Italian Association of Psychology responds to an emergency: a teacher has been found in a catatonic state in a lift, in Milan. It’s about this teacher’s mental health, and about ways to help him out of the lift, to bring him back to a healthy emotional state of mind. The following paragraphs describe the main parts of this process drama, the techniques used to understand and create meaning, and the strategies to enhance communication in Italian as a second

⁴ “Buongiorno”, the short film by Melo Prino: <https://www.youtube.com/watch?v=OBj-ljxoHo>

⁵ Common European Framework of Reference for Languages (CEFR)

language. For each phase, an explanation of the cognitive processing that might be active during each important passage is included.

5.1. Introduction and warm up

5.1.1. *Silence and breathing meditation*

In this workshop, Piazzoli started with a brief silence meditation, where the students focused their attention on the rhythm of their breath, and on the surrounding noises. It is important to notice that not all process drama practitioners include these activities at the beginning of their workshop, instead they might start with the initial phase described later in this chapter. But including this type of meditative stage fosters the ability to concentrate on proprioception, as this provides a moment for introspection and for the development of awareness: of breathing and of perception of one's own body and its subtle movements during breathing. The brain probably enters also a state of idleness, as described in the previous chapters.

5.1.2. *Warm-up improvisation*

Then, the warm-up started with improvisations about the students' favourite colours: the students moved around the classroom and, upon encountering their classmates, they exchanged information about their favourite colour, first in a slow pace, and then accelerating. This type of activity was not decided before, but improvised to involve movement and some sharing of information between participants, who did not know each other. This improvised activity also contributed to the creation of a form of dramatic tension called the *tension of surprise*, when students do not know what is coming next as in this case, or when circumstances in the process drama change unexpectedly. It creates an emotional shock and, therefore, triggers an emotional response.

5.1.3. Exploration of space

The third activity in the warm-up phase was the exploration of space. Standing, students quietly observed what was in the classroom for about thirty seconds. They stretched. They walked around the room and, first, moved to their best spots, then to the places they liked the least. Finally, they talked to their classmates about their preferences. In this activity the exploration of the body in space continues adding the dimension of the “outer” world, that is, the world of objects, people, spaces, landscapes, lights and sounds surrounding the student and integrating the emotions and conscious feelings connected to experiencing the space. This activity provides the opportunity to observe a greater space, the classroom, the actions of the others and their preferences. Students unconsciously begin to observe the others’ reactions and emotions, the first step in the building of empathy. From a cognitive point of view, observation is fundamental for sustaining attention, while the task of expressing a preference for a particular space might trigger the networks in the brain dedicated to aesthetic engagement, since they are engaged in thinking about what they like and where they best like to be.

5.1.4. Body stretching and voice training

Another activity that Piazzoli likes to include in her warm-up phase is body stretching and voice training: students pronounced a brief sentence like “Tell me” stretching their bodies, noticing how their voice changes with the movements of the body, and how emotions can alter the pronunciation of the very same sentence. By interpreting emotions, voice allows us to express infinite possibilities. Once again, through this activity, we tap into the world of emotions and link them to our body as a means of expression: by acknowledging the differences in the voice and in the body while expressing a fee-

ling, students become aware of *emotional embodiment*, that they can use later during other dramatic activities.

5.2. The initial phase

After the warm-up phase, the process drama begins: all activities are coordinated by the teacher who becomes the co-artist in the making of this artistic process of narrative creation. The main focus will be on the dramatic process, not on the final result: starting from a pre-text, in this case the short film, the students will cooperate in the construction of a story observing how it develops as creators and as spectators of their work, no other audience is involved.

Process drama, as the name suggests, is about *the process* and not about the results. This means that the ultimate goal is not the production of a play for an audience, but the reflection on the work and the language used; furthermore, in process drama, it is not necessary to reach a conclusion, the ending can be open.

5.2.1. The didactic structure

A process drama workshop, or lesson, starts with a pre-text and unfolds following a didactic structure proposed by the teacher who acts as a guide and co-creator, but who does not provide a script. The instructor organises the process drama with techniques suited to the exploration of the content and meaning proposed by the pre-text, therefore, there is a line that unites the whole. Activities are not independent from one another, but they are linked. However, they leave room for improvisation, and for open discussion during reflection times. because of this structure a process drama workshop can extend from one hour to more, and the techniques used, like episodes in a series, forward the narration, the understanding and making of meaning.

5.2.2. *The pre-text*

The pre-text constitutes the starting point of the process drama, or the canvas, the didactic structure that introduces the theme that will be developed by all the parties involved. It can be a painting, visual arts, an image, a word, a text, a poem and therefore it takes many forms. In “Buongiorno”, the pre-text is the short film showing a man waking up one morning and not knowing who he really is.

The students watched the short film once, discussing their emotions, sharing their thoughts about the atmosphere in the scene shown. The second time, they watched it again, this time describing in couples what might be happening in a detailed way. Finally, after the third viewing, students formulated open questions about the episode. In this case students were fluent in the second language and could relate about the facts with a large vocabulary choice; in case of students just beginning to learn a foreign language, a different pre-text would be chosen, to enable learners to start communicating using the words they already know for their proficiency level. This activity starts the communication process to share authentic content. In fact, we are not talking for the sake of repeating a text or to exercise a linguistic aspect, but we are involved in sharing opinions about a story. Like gossiping about an unclear situation, this type of activity makes emotions emerge, together with the sense of curiosity that makes the process continue because we want to know whether our suppositions are true and how the story goes on.

5.2.3. *Role on the wall*

The teacher finally introduces the character and says that he is a foreign language teacher working in an Italian school. She draws a simple silhouette on the black board, and all participants write a piece of information about him, like his age, his personality, what kind

of teacher he is, his habits, his preferences. This activity is very important for the development of vocabulary: while students engage in the description of the character, they are also using the second language (L2) for communicating with their classmates. Brainstorming is essential in this technique and, as Saxton and Miller (2013) write, it anticipates how drama works because all ideas are accepted:

Brainstorming words and phrases is designed to model subtly how drama works — to hold back and constrain our natural tendency to create “the narrative”; we are not yet ready to draw conclusions (in this case, to define a character). The instructional language acknowledges contradiction and ambiguity as present and welcome while, at the same time, enabling and encouraging the social nature of the work by accepting all ideas. (p. 120)

5.2.4. Narration

The focal part that starts the real creation of this process drama is the narration. Piazzoli (2014) introduced the content by narrating the known facts about this teacher:

Yesterday, Mister (name given by the students, that we will call X) was expected to come to school for his lesson, but he did not show up. His students waited for him, but he never arrived. Then they talked to the head of school, who tried to call him at home and at his mobile phone, but he did not answer. When his neighbour saw him go out in the morning, he seemed a little *weird*... even the students at school said that recently he acted *really* weird. He has not come to school today either, so early this morning, the head of school denounced his disappearance. It's a delicate situation. (p.1)

This technique develops the sense of mystery and suspense called the *tension of mystery* and refers to the fact that not knowing completely what is happening creates a sense of pleasure and willingness to engage in action and intellectual activities to know the truth. In this

case motivation networks in the brain might be active together with sustained levels of attention.

5.2.5. Students and teacher in role, the mantle of the expert

At this point of the narration, students are ready to enter their role as a team of psychologists working for the Italian Association of Psychology (AIP): they are given a file to complete with their new names and expertise. The teacher also enters the role of the coordinator of this association: she introduces herself after the students. This is the technique used by Heathcote and called the *mantle of the expert*. As seen in the previous chapter, students now shift in perspective and adopt the new character's view of the world.

The role of the expert emerges as the response of the inner self to the new situation by adopting another person's identity traits and features: this process requires an understanding of the new role, of the others' intentions and actions as described in the theory of the mirror neurons system. Embodying a new role might activate the neural networks responsible for the empathic response in the new role.

5.2.6. Hot seat

The final part of the initial phase is dedicated to the hot seat technique, when students in small groups talk about their new identity and introduce each other telling their place of origin.

Seating on a special chair, one by one, they answer to questions and write their new names on badges. The teacher introduces herself as the coordinator. Now the experiential part begins. As with the other activities, hot seat is a technique to foster authentic dialogue, although everybody is talking about their new fictional role.

5.3. The experiential part

The core of process drama is the phase when students experience the narrative and contribute to develop it. In this process drama, Piazzoli took the role of the coordinator of AIP, and started the improvisation by thanking all of the students for their answer to her call. She summarised the events introducing what is called the *tension of the task*, that is, another type of tension that creates the general dramatic tension of the piece. To do so, she told the group of experts:

I called you because we found a strange individual and we do not know how to handle the situation. His last words have been “Today I am not very communicative”. He then started to tremble and became catatonic. He has been found sitting in a corner of the lift in his building, he refuses to talk and to go back to his apartment. My first question is “what does it mean for a language teacher to say “Today I am not very communicative” ? (p. 2).

The students were given an empty document to fill with plans of action to make the teacher move from the lift.

In this activity, writing becomes the focus of language teaching, but this task is also considered as a significant task, since there is a real aim, that is finding out a way to solve the problem of the teacher in the lift. Students exercise their role and expertise; they are unconsciously forced to think as experts and to write as psychologists would do, or at least they try this new task. By living this situation in the first person and by feeling the responsibility connected to the task a dramatic tension, the tension of the task, is created. This tension fades as soon as the task is completed, or the aim is reached. Even during this technique, aesthetic engagement networks might be processing the experience.

5.3.1. Collective Role

Now students walk around the classroom and imagine the character's thoughts. In this case, students thought of a word or a brief sentence that the teacher in the lift says, and that expresses his situation. Every word is said by all participants in unison, achieving the effect of a powerful choir. Once again this activity activates networks of mirroring neurons and embodied cognition: students engage in shared thoughts, and then try to act them out together. This requires synchronisation, and the tacit knowledge of starting to talk at the same time: their bodies and their voices become one, emphasising and amplifying the message.

5.3.2. *Tableau vivant*

With this technique, the students take their plans of action to remove the teacher from the lift, and to take him to the clinic without further emotional and physical traumas, and embody them in a still painting. The coordinator says she will be back in an hour to be updated about the situation. So, the experts discuss in groups how to build this tableau vivant and they enact their suggestion in groups, while the others observe. This technique uses the body as a means of representation and communication with no use of words. Once all the groups have shown their tableau, each one describes the scenes in words. Participants in the groups are given the possibility to say how they feel about their participation in the scene, and what they are thinking: in this way every student has the opportunity to compare thoughts and visions and develop the ability to look at the event from different perspectives. This activity is centred on learning through embodiment and through all the senses. It also triggers the appreciation networks active during aesthetic engagement since the tableau vivant is indeed as a work of art, as a painting.

5.3.3. *The interview, the mirror and the tension of relationships*

At this point in the process drama Piazzoli introduced another form of tension to revive the unfolding of the narrative: the tension of relationships.

This type of dramatic tension is created through the exploration of conflicts between characters, their moments of difference in the way they relate to each other. Some character might change their attitude during the events, some might remain stable and based on conflict. To achieve this tension, Piazzoli divided the participants in couples and assigned the task of interviewing new characters, like the teacher's parents, students, wife or son. Therefore, students entered a new role and engaged in this communication for a few minutes. After that, she showed a letter written by the teacher beginning with "Dear psychologist..." explaining the wish of the teacher to come out of the lift. A sense of relief followed these activities, but Piazzoli did not continue to add information, instead she engaged the students in another form of technique, the mirror, where the students mirror each other's behaviour: one student is the mirror and follows exactly what the other does; sometimes the mirror rebels too, and the reflection must follow. This is a form of warm up before the following activity that introduces a surprise.

5.3.4. The rumor mill, the 3D card and creative writing

To further develop the experiential phase of this process drama, Piazzoli proposed three more activities to enhance communication and use of conditional language. First, she created a scene who shocked the students by entering again in her role as a coordinator and changing the atmosphere of the group by adding new suspense:

- the coordinator enters the room after her break to get prepared and interview the patient: she collects insights from the experts and is ready to leave to bring the patient there.

- she leaves the classroom and enters after a few minutes with a pajamas in her hands and says: “The subject has disappeared! He has left only his pajamas behind!”

The students in the role of experts are now shocked by this news, so they enter a new collective role and express the teacher’s thoughts about escaping trying to entering in his mind processes. To do so they walk around the room talking and then stop in a still image for a few seconds.

In this case it is interesting to notice how the performative technique allows to embody the mind so that thoughts seems to be there, moving in the room, represented by the students’ bodies in action.

After this collective brainstorming session, the coordinator calls the experts to meet after the lunch break and discuss further the event. Another technique is now used to promote dialogue with a different register: the rumour mill.

This is a very interesting technique that involves using the space for moving around in two circles, with the pajamas in the centre and all students facing each other. They move in circle and then they stop to talk about what might have happened. During this activity music from the short film is played to give a rhythm to the gossiping. It is followed by a group discussion about the rumours collected. The rumour mill is usually a very entertaining activity that allows students to be creative and express invention. It cheers up the mood and prepares the participants to the last activities.

After the rumour mill, our workshop continued with a 3D card, or a form of still image constructed around the main character. In this case the coordinator announces that the teacher has been found and is now here. So the students form groups and act the new roles in a new scene which adds another perspective to the ones they explored before.

When this performative exercise is completed, the last activity before the final reflective phase is the writing of a report for the head of school with suggestions on how to behave with this teacher, or the

writing of a letter from the teacher taking on his role. This phase is the creative writing phase.

5.4. The reflective phase

“Buongiorno”, the process drama conducted by Piazzoli, ended with a reflection part. At the end of the workshop, she engaged the students in a discussion about several topics relating to the process they had been part of. This final phase of reflection evaluates in a personal way the experience of learning: she asked the students about their favourite moment, their most difficult moment, the moment in which they were surprised by their ability in doing a task, or by a new emotion. The reflective phase investigates the contribution of the students as human beings: after all, making theatre involves dealing with the human condition and human emotions.

In the scaffolding of this process drama for language learning there was also time to reflect about language: the use of different registers, of specific and sectorial language; grammar and vocabulary were also discussed between activities and pragmatics was explored in an authentic and significant way. As seen in the previous chapters, reflecting on one’s own process of learning helps with establishing durable memories, because we focus on some elements with dedicated attention supported by emotions.

At this point of our discussion, considering all the cognitive processes involved in learning through a performative methodology like process drama, it is necessary to reflect on the intrinsic value of drama for collaborative and innovative learning and to recognise the beneficial potential of integrating these techniques in the curriculum. Not only is process drama a methodology that engages the learner as a whole, but also, through the cognitive perspective adopted here, it becomes clear that adding performance to learning can only foster the ultimate result, which is the growth of learners in their intellec-

tual, emotional and social dimensions, fostering the ways in which the brain likes to learn about the world.

6. Conclusions

6.1. A cognitive perspective on process drama: a summary

This study investigates the contributions of neuroscience that can provide insight into the workings of the brain when we engage in the learning of a foreign language through performing arts, in particular process drama. This performative methodology can be considered as a pedagogical tool for the implementation of learning activities that develop the complete dimension of a learner, which is constituted by her intellectual ability and her embodied learning potential. It is through the body and *with* the body that we know ourselves and experience the world around us. It is through the body and the intricate connections between different neural networks that we are able to understand the others and their intentions, and to communicate with them. Recent findings in affective neuroscience have shown the crucial role of networks supporting emotions not only for sustaining attention and motivation processes, but also for the formation of declarative and procedural memory, which, in language learning, translates into knowing semantic content and being able to speak fluently and accurately. Emotions are also at the core of evaluation and appraisal of beauty and pleasure in aesthetic experiences of works of art, a process that might be active during process drama activities and that involves “the body in space” and multi-sensory input —like process drama activities interspersed with reflection phases, or the dra-

ma conventions that focus on image compositions like the *freeze frame* or the *tableau*.

To respond to the initial question of how the educational system can foster innovative, creative, and critical thinking in students to make them better citizens and thinkers, I propose that the direction the school system should take is that of further inquiring and studying drama for educational purposes, and incorporating performative pedagogy in the curriculum as well as in the teacher training programs, at least partially. In fact, the study of process drama provided evidence of how it can develop authentic and significant dialogue among participants, even if the context is fictional. It has shown how this fictional context can function as a training gym to test one's capacity for understanding not only meaning, but also social and interpersonal relationships through the development of empathy.

With the enactment of different roles, and by using a variety of voices, students learn how to choose different registers, how to communicate with their bodies and how to express and acknowledge emotions and feelings, taking on also different perspectives. It is through this process of identifying with someone else that students train their creativity and become flexible thinkers: they encounter many perspectives and develop the capacity to think "out of the box" or to consider difficult tasks from various angles, finding innovative solutions. In language learning it is relevant to acknowledge one's own origins and to be open to consideration of intercultural differences: through drama techniques that promote listening and observing the other's behaviour, reaction, response, attitude or choice, students become better observers and are more respectful of the others and of themselves.

Drama allows to be present in the story-making and be an active part of the *learning process*, especially in process drama, when roles are distributed and everyone is responsible for a piece of the drama in progress.

6.2. Drama for inclusion

O'Connor (2013) argues that process drama can also act as a critical pedagogy. Influenced by the work of Freire, who valued performative pedagogies as empowering tools for students to challenge the dominant ideology and to promote a more democratic social environment, process drama can offer

an antidote to an education system that replicates social inequality and creates an unthinking consumer class. It is, therefore, also interested in replacing the rehearsal room with an active engaged curriculum that enables children to question, challenge and remake their reality (p. 127).

So, the first way to apply performative pedagogies remains the school as a potential stage for the exploration of social issues and the discovery of possible solutions to make more empathic choices.

For example, although a lot is said on the news and in the classroom about social integration and acceptance of the others in times of immigration like those we are living nowadays, students still cannot always grasp the meaning of what it really means to be an immigrant, or a war refugee emigrating to a new country: by enacting this situation, by taking different roles and trying the effects of the different emotions connected to inequality or injustice, students experience learning about these issues in a significant way.

They become able to understand others, to “negotiate difference” and to develop «an empathetic and compassionate approach to conflict» (O'Connor, 2013, p. 133).

The potentiality of performative pedagogies, and especially of process drama, could also be exploited in the school systems as a means for inclusion of learners with physical and intellectual disabilities who can be part of the making of their reality in a protected environment. Because of the alternating use of different communication channels and because of the integration of the body as a means for learning, students with disabilities can participate and find the way that best suits their capacity of expression: for example, if they cannot express a meaning through speech, they can use their body lan-

guage or choose to express themselves through a channel of communication other than only writing and speaking.

The need to encourage inclusive learning opportunities is felt also in contexts where social and health rehabilitation is the focus of intervention. For example, in detention and rehabilitation centres performative techniques offer a flexible approach to the discussion of delicate social issues and provide the opportunity to try out the consequences and the results of previous actions in a fictitious protected environment where inmates can reflect upon the process and learn about the world. In this sense, process drama develops in the tradition of Brecht's theatre theory called *Lehrstück*, a form of learning by «observing and participating in the narrative before them. The participation takes the form of ongoing criticism of causes and effects of selected human predicaments» (Errington, 1992, p. 44).

To conclude, although the main aim of this study was to investigate the cognitive factors of drama-based learning, the literature about the social and psychological effects of drama and of performative pedagogies for educational purposes has opened a new window on future research about how to apply these pedagogies so that they can become a tool for inclusion. To say it with O'Connor's words, the study of process drama indicates that it is not only a productive pedagogy in terms of intellectual creativity and innovation, but also a "pedagogy of hope", to engage students and special communities in the making of a possible more empathetic and just society.

6.3. Future research

The future of research in performative pedagogies can be manifold. Drama-based pedagogies should be a field of ongoing enquiry from different perspectives, because of their versatile application in more than one context and because different constituting factors can be analysed. In this study I looked at cognitive factors that might be involved in performative learning and that can be a topic of enquiry from a psychological and scientific point of view. Future research on

cognitive aspects could develop as neuroimaging studies of the role of emotions in the learning through performative pedagogies, or how embodied cognition is represented in the brain in students who learned through drama techniques.

A particularly interesting study could stem from the present research to investigate how a new foreign language is represented in the brain when students are exposed to input taught through performative pedagogies, in contrast to students who learn with a classic approach to language instruction. In this respect, the first step is to review the current literature on the learning and representation of a foreign language in the brain and to replicate the experiment by altering only the variable of the teaching method, thus comparing how a classic approach in comparison with a performative approach differ in their neural representation. First, this type of neuroimaging experiment will always be challenging because of the variety of factors involved and because of the multi-sensory nature of performance. As described in the previous chapters, many of the processes involved in learning are under the conscious level of perception and are active in concert with other conscious processes: being able to detect which process is active is a challenge that requires skilful experiment planning by a team of experts in the neurosciences, in neuroimaging techniques, in foreign language and, of course, in drama-based learning, and occurring only with shared participation of all parties. Second, due to the costs of the neuroimaging procedure, gathering funds to be able to run a large scale experiment which would provide powerful statistical results, becomes complex: involving more participants also involves an increased effort in terms of expenses and time.

However, recent interdisciplinary studies suggest (Immordino-Yang, 2016), that it is possible to consider new research possibilities in this multi-disciplinary field, at the crossroads of the Sciences and the Humanities. In particular, the implications of the research on the cognitive factors involved in the arts—and in learning through performative arts— can indeed lead to thinking differently about in-

struction, and help develop professional skills that can be applied in teaching and learning environments, as well as in contexts of rehabilitation or special needs. It can foster a further use of creativity and innovation also in this type of neglected environments.

Appendix A : Second Language Learning in the brain

Cognitive Process	Brain Regions Involved
Motivation	Orbito-frontal Cortex Amygdala Striatum Substantia Nigra Pars Compacta Ventral Tegmental Area
Attention	Dorsolateral-Prefrontal Cortex Parietal Cortex Anterior Cingulate
Declarative Memory Memory Consolidation	Hippocampus Neocortex (Cortex involved in cognitive higher-order functions)
Procedural Memory	Striatum Globus Pallidus Thalamus Motor Cortex

Appendix B: Regions of the brain

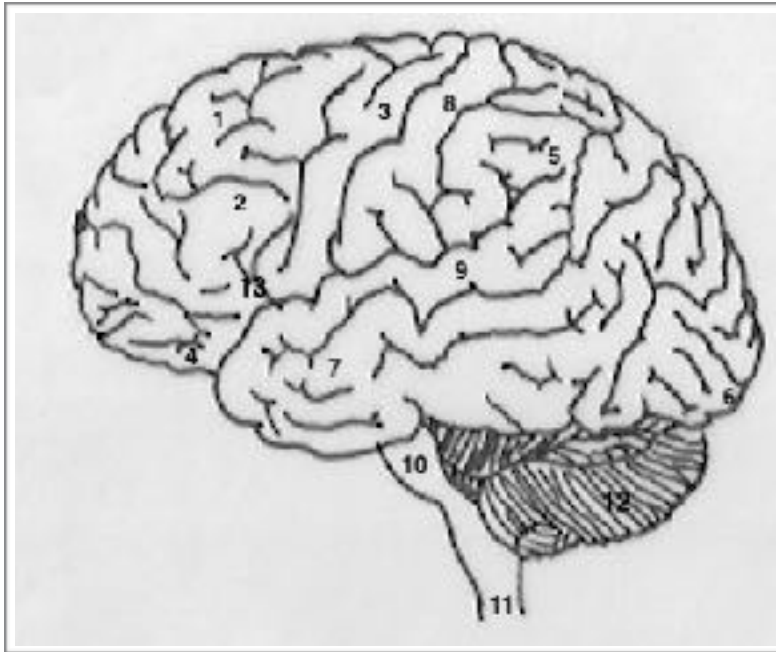
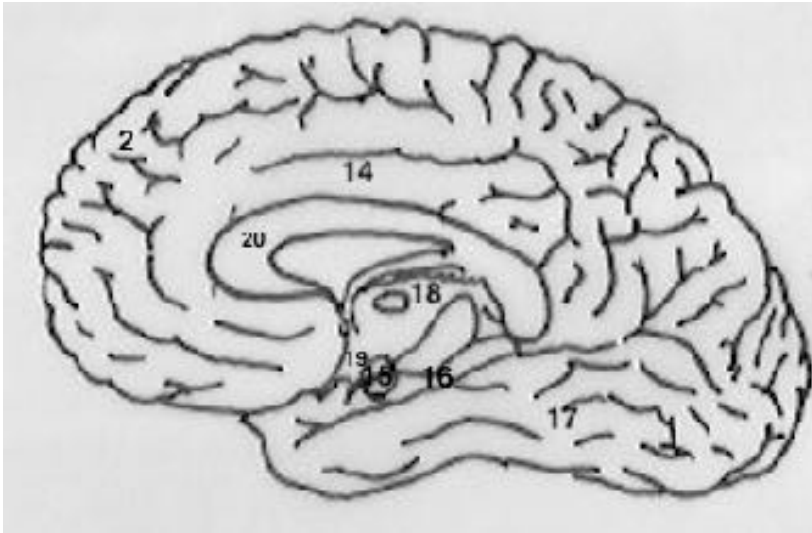


Image 4: Regions of the brain 1. © Maria Simona Morosin

1. Dorsolateral Prefrontal Cortex
2. Prefrontal Cortex
3. Primary Motor Cortex
4. Orbitofrontal Cortex
5. Parietal Cortex
6. Visual Cortex
7. Temporal Cortex
8. Primary Sensory Cortex
9. Auditory Cortex
10. Brainstem
11. Spinal Cord
12. Cerebellum



13. Broca's Speech Area
Image 5: Regions of the brain 2. © Maria Simona Morosin

- 14. Cingulate Cortex
- 15. Amigdala
- 16. Hippocampus
- 17. Fusiform Gyrus
- 18. Thalamus
- 19. Hypothalamus
- 20. Corpus Callosum



Image 6: Regions of the brain 3. © Maria Simona Morosin. The dashes refer to nuclei hidden deep in the brain.

- 21. Globus Pallidus (part of Striatum)
- 22. Substantia Nigra Pars Compacta (SNc) and Ventral Tegmental Area (VTA)
- 23. Nucleus Accumbens

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