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Bilingual aphasia. Adaptation of the Bilingual Aphasia Test (BAT) to Sardinian and study of a clinical case.

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To my parents and brother

To my mentor Dr. Maria Rita Piras

To Dr. Peterpaul Gasser

To my friends Caterina Bagella & Mario Bosincu

Contents

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List of Abbreviations

AD	Alzheimer's disease
BAT	Bilingual Aphasia Test
CL	Central Logudorese
CNS	Central nervous system
CT	Computed tomography
DM	Dorsomedial nucleus
eGp	External globus pallidus
ERPs	Event-related potentials
fMRI	functional Magnetic Resonance Imaging
GABA	Gamma aminobutyric acid
Gltm	Glutamate
iGp	Internal globus pallidus
L1	First language
L2	Second language

LH	Left-handed
LTM	Long-term memory
MCI	Mild cognitive impairment
MMSE	Mini mental state examination
MMSE(AS)	Mini mental state examination (adjusted score)
MMSE(RS)	Mini mental state examination (raw score)
NL	Northern Logudorese
P	Pulvinar
PET	Positron emission tomography
RH	Right-handed
RSA	Rate of school attendance
STM	Short-term memory
VA	Ventral anterior nucleus
VIM	Ventral intermediate nucleus
VL	Ventral lateral nucleus

Abstract

According to the Associazione Italiana Afasici, there are about 150,000 aphasics in Italy, and every year 20,000 new cases. This pathological process is devastating; in fact, they have lost that feature which makes us unique, namely *language*. Since, the first case of aphasia described by the French physician Paul Broca in 1861, science has made great strides.

Many new theories have been proposed and have tried to explain how our brain processes language. Particularly, research on bilinguals has become interesting and important for our understanding of the neuroscientific bases of language.

In this doctoral thesis, we are going to introduce and discuss, with the help of a clinical case study, one of the most plausible theories which tries to explain how our brain processes language.

In addition, we are going to introduce Paradis' Bilingual Aphasia Test, which we have adapted to Sardinian. It is very important that all languages of an aphasic patient are assessed with an equivalent instrument, not a simple translation of a standardized test from another language. The assessment of only one language is not enough, and in the worst case can even cause negative social and/or clinical results. The assessment of both languages through a standardized bilingual test allows us to compare the two languages and to ascertain which one is impaired and which recovers first and best. Based on these results, the clinician together with the patient's family can decide which language should be treated.

1. Introduction

1.1. Bilingualism

The mind is its own place, and in itself
Can make a heaven of hell, a hell of heaven.

John Milton, *Paradise Lost*

The meaning of the word "bilingualism" is more or less clear to everybody, even if there are an infinite number of myths which surround bilingualism and bilinguals. But, in fact, for many people, bilingualism is a rare phenomenon that is found only in bilingual or multilingual countries such as Canada, Switzerland and Belgium. Moreover, it is also believed that bilinguals grow up speaking two or more languages, that they have equal speaking and writing fluency in their languages, that they have accent-less speech, and that they are excellent translators and interpreters. Actually, we know that in reality this is quite different, i.e. bilinguals are seldom equally fluent in both their languages, they often have an accent in one of the spoken languages, and only few bilinguals are good translators and interpreters (cf. Grosjean, 1997).

The main meaning of the word "bilingualism" can change slightly depending on the context in which it is used. In general, it can be said that a human being is considered to be bilingual, if he or she is able to use two or more languages or dialects in his or her everyday live. In the past, various researchers were of the opinion that only those people who spoke two or more major languages perfectly, such as German, English or Spanish, could be considered to be genuine bilinguals. Nevertheless, this idea was very soon abandoned as it turned out to be a simple cultural prejudice. The distinction between "language" and "dialect" is a mere political one, and it is of no value nor interest to linguistic and neurolinguistic research. In addition, the common opinion that bilinguals are only those human beings who are able to master and speak two or more languages *perfectly* has been a further deep-seated bias. This erroneous point of view has probably been imposed by a monolinguistic view of the phenomenon of bilingualism that has been prevalent in language sciences. Therefore, some contemporary scientists, such as for instance the psychologist François Grosjean who works at the Université de Neuchâtel in Switzerland, felt obliged to underline the fact that "bilingual speakers are not two monolinguals in one person", i.e. they are not seen as the sum of two or more complete or incomplete monolinguals but rather as specific and fully competent speakers-hearers who have developed a communicative competence that is equal, but different in nature, to that of monolinguals (cf. Grosjean, 1997). In general, bilinguals are individuals who use different languages in different domains and/or situations, for different reasons and with different interlocutors. In fact, bilinguals use their two languages in a different way or assign different social or emotional functions to them. This is called the "complementary principle". Moreover, they do not necessarily have to develop a perfect competence or knowledge of both languages (cf. Fabbro, 1999; Grosjean, 1997 and Beccaria, 1996).

Above all, bilingualism is a phenomenon which is constantly found in border areas where the borders of a nation do not correspond to its linguistic boundaries. In addition, there are numerous reasons that bring languages into contact and promote bilingualism; the most important among them are migration of various natures, nationalism and federalism, education and culture, trade and commerce and intermarriage. From a sociolinguistic point of view, there are three main forms of bilingualism, i.e. horizontal, vertical, and isolated bilingualism. **Horizontal bilingualism** can be found in a bilingual or monolingual environment where all spoken languages have the same social status, whereas **vertical bilingualism** or "diglossia" is typical of those communities where only one of the spoken languages is considered to be the official one. Amongst other things, the phenomenon of diglossia is characteristic of all dialect-speaking communities. On the contrary, **isolated bilingualism** appears when a person or a restricted number of persons (for example immigrants) who live in a monolingual environment master more than one linguistic code (cf. Beccaria, 1996).

According to François Grosjean, over 50% of the world population is bilingual; bilinguals are found in every country of the world, in all classes of society and in all age groups, and they usually acquire their languages at various times during their lives and not just in early childhood (cf. Grosjean, 1997). But due to political and ideological prejudices, bilingual individuals are considered to be only a very limited number. This is also given by the impossibility to define concepts such as language and dialect scientifically. From a neurolinguistic point of view, bilinguals are individuals who master, understand and speak: 1) two languages, 2) two dialects or 3) a language and a dialect, and who can make a sharp distinction between the two linguistic codes during verbal production if they wish to do so. A considerable number of psychological and linguistic studies have made an important distinction between different forms of bilingualism: compact, coordinated, or subordinated bilingualism; early or late bilingualism, or adult learning of a second language (L2); balanced bilingualism or dominant bilingualism. A **compact bilingual** has acquired the two languages simultaneously before his or her sixth year of life, and in particular, they were each spoken by one of the parents. On the contrary, a **coordinated bilingual** is an individual, who has learnt the L2 before puberty within or outside the domestic environment. Whereas, in a **subordinate bilingual** one language is considered to be the mother tongue, and the L2 is used as mediator of the first language (L1), i.e. the speaker thinks of what he wants to express in his L1 first and then translates it into his second one. Some further classifications and definitions have been proposed and made such as **early bilingualism** to refer to the acquisition of the two languages during infancy; **late bilingualism** to indicate a much later acquisition of the L2 than the mother tongue, and **adult learning of a L2** to refer to a subject who has learnt a foreign language at an advanced age. In addition, other definitions such as balanced bilingual and dominant bilingual have been proposed which try to give a correct description of the degree of competence in the two languages. Therefore, a **balanced bilingual** is a person who masters the two languages to the same extent, while a **dominant bilingual** is an individual who is more fluent in one language than in the other. It is important to mention that all these definitions have been very useful, particularly to identify suitable groups of bilinguals for psycholinguistic studies, but unfortunately for the purpose of neurolinguistics they lose their usefulness. For instance, if a bilingual German-English woman moves from Germany to Australia and stays there for 25 years, it is very likely that English becomes her dominant language and German her L2, but if that woman suddenly and unexpectedly decides to go back to Germany, after only six months German might become her dominant language again. Moreover, it must be highlighted that some of these classifications have also been violently denied from a psycholinguistic point of view (cf. Fabbro, 1999). In addition, a bilingual individual seldom gains equal and complete fluency in their languages, because the needs and uses of a language are more or less different. I mean, the specific level of fluency reached in a particular language skill is bound to the effective need for that language and it is domain specific, for instance if reading and writing skills are not required in a particular language, they will obviously not be developed (cf. Fabbro, 1999; Grosjean, 1997 and Beccaria, 1996).

Nowadays, modern psychologists and neurolinguists have made an important distinction between **language acquisition**, which happens naturally in an informal environment with the involvement of implicit memory, and **language learning**, which occurs by means of formal methodologies through learnt and intentionally applied rules (explicit memory). Actually, it seems that separate cerebral structures are involved in these processes, i.e. the emotional system, as well as cortical and subcortical structures are involved in the acquisition processes, while mainly cortical areas play a fundamental role in the learning processes. Besides, it is very well known that the earlier the exposure to the two languages, the easier and more complete the acquisition; but in order to acquire them successfully, the child has to use both of them in daily life. Weak outcomes are gained if the child is taught the L2 for only one hour a week and/or if teaching methods are institutional and based on rules. Nevertheless, a human being can become bilingual at any age, but at a more advanced age, more effort will be necessary to acquire results that are often lower than those reached by children (cf. Fabbro, 1999 and Grosjean).

2. Neurobiological bases of language

2.1. The Central Nervous System: An overview

Nowadays, it is very well known, that the brain is formed by neurofunctional units which are the neural cells or neurons, and by supporting cells which are the glia. According to modern neuroscientists, the human brain contains approximately 10 billion neuronal cells, and every single neuronal cell can influence 1,000-10,000 other neurons. Every neural cell elaborates and transmits information, i.e. it receives information from other neurons, elaborates the obtained information and afterwards transmits it to thousands of other neurons. Moreover, we know that neurons tend to form neuronal groups; some of them are organized into complex systems which are responsible for a specific function in order to attain particular aims, for instance the reflex arcs are among the simplest functions organized by the nervous system. Most of these functional systems, as well as some specific functions are innate, i.e. they are genetically pre-programmed, and therefore they do not need to be learned, while other functions are acquired, that is they are not innate. Without any doubt, the most important characteristic of neurons is that of sending information by means of electrical signals through extension of single cells. The dendrites connect the cell body of a neuron to other neuronal cells through the synapses, whereas the main function of the axon is that of sending information to other structures. In the vicinity of the synapses between the neural cells, electrical impulses release neurotransmitters which modify the electrical activity of a post-synaptic neuron. Different groups of neurons which are connected together form neuronal circuits. These circuits can involve several areas of the nervous system, for instance there are at least four neuronal circuits which are involved in the production of vocalizations, namely the limbic system, the motor cortex, some structures of the midbrain and the pons, and the motoneurons which control the larynx. Another important characteristic of neurons and of the neuronal circuits they form is that of reducing the activation threshold, i.e. the more frequent the activation of a circuit or group of neurons, the lower the quantity of energy needed for its re-activation. This is given by the fact that the contact points which are in charge of the transmission of information between neuronal cells are functionally and structurally changed in accordance with their frequency of activation; that is a neuronal circuit needs a great deal of energy for its activation in the early phases, whereas the use of energy tends to diminish when the same circuit is activated repeatedly. Furthermore, some of the neurons which form a neuronal circuit are inhibitory neuronal cells. These inhibitory neuronal cells are very important, because they inhibit the electrical activity of the neuronal cells with which they are in contact, for instance they are responsible for the synergy in muscle contraction. In conclusion, we can say that neuronal circuits are formed by excitatory and inhibitory mechanisms whose complexity depends on the type of function they sub serve (cf. Fabbro, 1999 and Kandel et al., 2000).

The central nervous system (CNS) is composed of four main parts:

I. **Spinal cord**: receives the information from the skin, the joints and the muscular tissue of limbs and trunk. Moreover, it controls the reflexes and the voluntary movements of the muscles of the limbs and trunk.

II. **Brainstem**: is formed by the medulla oblongata, the pons and the midbrain or mesencephalon, and it is very important for the automatic control of respiration and sleep. Moreover, it contains sensorimotor nuclei which control facial movements and sensitivity. In addition, the brainstem and its structures contain small bundles of neural fibres which send information to both cerebral hemispheres, and it also contains motor fibres which connect the cerebral hemispheres to motor neurons which control movement.

III. **Diencephalon**: is formed by the thalamus and hypothalamus. The thalamus is a station of sensory information which controls sleep and attentive and mnestic functions. While the hypothalamus controls several functions which are essential for survival, such as the regulation of body temperature, sexual behaviour and hunger and thirst.

IV. **Cerebral hemispheres**: are formed by the basal ganglia and the cerebral cortex. The cerebral hemispheres play a fundamental role in the organization of the cognitive functions such as emotions, language, writing, reading, music, arithmetic and visual imagination. The two cerebral hemispheres are connected by means of the corpus callosum.

For a better understanding of the cognitive disorders caused by lesions of the cerebral tissue, it is important to mention that in the brain the sensorimotor pathways which connect the neuronal centres to the various parts of the body are crossed. In other words, the right hemisphere gets the stimuli from the left side of the body and controls it, whereas the left hemisphere receives stimuli from the right side of the body and controls it. Another important feature of the human brain is that all somatosensory inputs coming from the whole body surface are represented in an orderly array in the cortex. In other words, the area of the cortex which is responsible to processing information coming from a particular part of the body is not proportional to the mass of the body part, but on the contrary reflects the degree of innervation of that part. Therefore, sensory input from the lips and hands occupies a bigger portion of the cortex than that from the shoulder. Furthermore, output which has its origin in the motor cortex is organized in a similar way, that is the quantity of cortical surface dedicated to a part of the body is bound to the degree of motor control exercised in that part. Therefore, for instance, much of the motor cortex is dedicated to moving muscles of the fingers and the muscles related to speech (cf. Kandel et al., 2000).

2.2. Classical language areas

At the end of the 19th century, clinical studies on epileptic patients by Jackson and on aphasic patients by Freud, Dax, Lichtheim, Broca and Wernicke proved that various linguistic functions were controlled by specific cortical areas.

In 1861 the French surgeon Pierre Paul Broca visited a 51-year-old patient, named Leborgne, at the Bicêtre Infirmary in Paris. Paul Broca noticed that his patient suffered from a severe gangrene to his right leg and that his right limbs were completely paralyzed. Moreover, Broca noticed that Leborgne could only produce a monosyllabic word "tan", even if he understood very well what Broca said. Paul Broca became very interested in Leborgne and decided to study him carefully (cf. Caplan, 1998).

Leborgne lost the ability to speak at the age of 30, nevertheless he was in good health and quite clever. He had good verbal comprehension, but if somebody asked him something or spoke to him, he always replied with the monosyllables "tan tan". Most of the time, he tried to express himself through gestures, but without success. Ten years after he had lost the faculty to speak, Leborgne began to show a gradual weakening of his right arm muscles, and eventually his right arm was completely paralyzed. Furthermore, the right sight of his body was less sensitive than his left side. He could move the muscles of his face and his tongue without any effort. His hearing and his calculation ability were preserved as well.

On the basis of these clinical observations, Paul Broca suspected that the patient was affected by a progressive left hemisphere lesion. The autopsy of Leborgne's brain revealed a large left frontal lesion caused by a cyst; most of the third frontal convolution of the left hemisphere cortex had been completely destroyed by it. Paul Broca presented his clinical case and the results obtained by the postmortem examination of Leborgne's brain at the annual meeting of the Anthropological Society of Paris. In his lecture he affirmed that he had localized a faculty of the human mind in the brain. Moreover, he proposed his hypothesis that the faculty of articulated language was independent of both verbal comprehension and nonverbal communication. In addition, he stated that the faculty of articulated language was localized at the foot of the third frontal convolution. Broca's findings and his hypothesis were sensational and gave origin to numerous discussions among the leading intellectuals and scientists of that period not only in France but also in the rest of the world. After the publication of his first results, Broca continued his research on subjects who had lost the ability to speak and confronted his clinical findings with the results obtained by the postmortem examination. Between 1861 and 1863 he studied eight more aphasic patients, and what he found out was sensational, i.e. they all showed a lesion to the third frontal convolution of the left hemisphere cortex. Broca was aware that according to very general biological law and according to classical theories, i.e. from Aristotle onwards, symmetry has been seen as the highest form of organization, and for that reason, symmetrical organs such as the two cerebral hemispheres must have identical functions. Therefore, he was astonished and perplexed by his findings, and he could hardly believe that the faculty of language, the feature that makes us human beings, was not bilaterally represented in the two cerebral hemispheres. In 1865 after a period of reflection and after having collected further evidence to sustain his theories, he presented his second important hypothesis, namely the fact that "nous parlons avec l'hémisphère gauche", i.e. "we speak with our left hemisphere". That statement by Broca became a milestone in the study of cerebral functions; in fact it proved that in right-handed individuals the linguistic functions are not only localized in a particular cortical area, but are also lateralized in the left hemisphere. Therefore, it can be stated that Paul Broca was the first scientist who proved that right manual preference and language were both controlled by the left hemisphere. After the death of Broca, the cortical area, which is responsible for articulated language was called "Broca's area", and the aphasic syndrome caused by a lesion of that particular area and first described by Broca in his famous work of 1861 was named after him, i.e. "Broca aphasia". The description of the gross neuroanatomy of the language areas, and the clinical classification of aphasias in use today, were the results of the concentrated activity which followed Broca (cf. Caplan, 1998).

Only nine years after the publication of Broca's second hypothesis, the German neurologist Carl Wernicke published his monograph "The symptom complex of aphasia: a psychological study on a neurological basis", in which he provided a classification of various aphasic syndromes, each of which resulted from lesions in different areas of the brain. He also presented a general model of how language is represented in the brain from which new syndromes could be predicted and tried to explain the way in which voluntary movement and language were organized in the human brain. In his monograph Wernicke described nine clinical cases, but the aphasic syndrome which affected two of them was very different from what Broca had described previously. In fact, in both cases, the patients had substantial difficulties in understanding what was said to them, and in addition, they had difficulties with spoken language in general. They spoke fluently, and the intonation of words and sentences was normal, whereas their utterances were senseless, i.e. instead of saying a particular word, they just said another one which was similar to it in sound or semantics. But sometimes the words they said were so different from the original German words, that Wernicke and the other examiners did not understand what they wanted to say. Such newly formed words, called "neologisms" by Wernicke, did not exist in the German vocabulary, and they did not follow the general rules of German word formation. The postmortem examination of the brain revealed a lesion of the cerebral tissue caused by a cerebral infarction in the region of the first temporal gyrus on the left, occupying approximately the middle third gyrus and extending posteriorly towards the parietal lobe. According to Wernicke, this area of the cerebral cortex had two main characteristics, namely it was an area directly contiguous to the cortical area which receives the final connections of the auditory system, the post-thalamic auditory radiations, and moreover it was neither a primary sensory nor a primary motor area. In fact, in his opinion, this area played an important role in the elaboration and modification of sensory and motor information, and therefore he called it "association" area. As the association area was directly contiguous to the primary auditory cortex, he believed that this area was responsible for understanding spoken language. This was explained by the general hypothesis that the association cortex which is localized around each primary sensory cortex was responsible for the analysis of the sensory signals which were sent to the area of primary sensory cortex. Therefore, subjects who have a lesion in that particular area will have considerable problems in understanding spoken language. According to Wernicke, the area of the first temporal gyrus, which after the publication of his monograph was called Wernicke area, was a memory store for the auditory form of words. This hypothesis seemed very plausible to him as this area was contiguous to the central termination of the auditory pathway. As mentioned previously, Wernicke believed that language was a kind of voluntary movement and so according to him, the sensory and motor centres had to be interconnected by a neuronal pathway. Moreover, he hypothesized that there had to be a flow of information between the auditory representations of words and the representation of motor sequences. Nowadays, we all know that the two major language areas, i.e. Broca's area and Wernicke's area are connected by the arcuate fasciculus. Wernicke developed a neuroanatomical and neurophysiological diagram in which he incorporated his main ideas (c.f. Fig. 1).

Figure 1: Wernicke's diagram. Wernicke's area and Broca's area are marked as "a" and "b" respectively in the temporal and frontal lobes. Input, output, and connecting pathways are indicated in schematic form. (Source: Wernicke, 1874: 19)

In his opinion, language was processed by various centres which are connected through communication pathways. Therefore, he hypothesised the existence of various forms of aphasia depending primarily on the site of the lesion, i.e. he suggested that aphasias caused by lesions of centres had to be different from aphasias caused by lesions of connecting pathways. For instance, a lesion in Wernicke's area leads to both a receptive deficit and an expressive disorder, while a lesion in the pathway between Wernicke's and Broca's area leads to an impairment of repetition. This particular type of aphasia (conduction aphasia) would be studied later on for the first time by the German neurologist Lichtheim.

To sum up, these clinical and anatomo-pathological studies of the late 19th century led to the discovery of the major cortical structures involved in speech and language, i.e. Broca's area (the inferior left frontal gyrus, which contains Brodmann's areas 44 and 45), Wernicke's area (left posterior, superior, and middle temporal cortex; Brodmann's area 22) and arcuate fasciculus (c.f. Fig. 2). Moreover these studies revealed a functional asymmetry for language in the two hemispheres and were the forerunners of modern neuropsychology, neurolinguistics, and cognitive neuroscience (cf. Caplan, 1998).

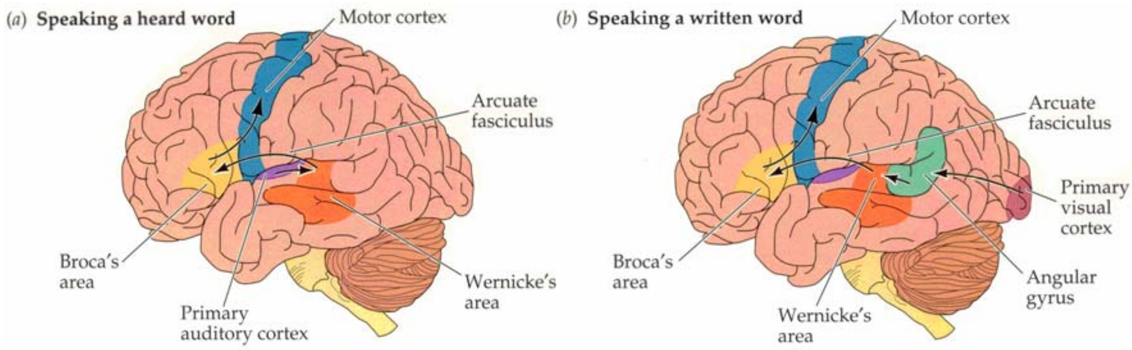


Figure 2: Language-related areas in the human brain according to the Wernicke-Geschwind Model. (A highly simplified view of the primary language areas of the brain are indicated in this lateral view of the left hemisphere. Broca's area is adjacent to the region of the motor cortex (precentral gyrus) that controls the movements of facial expression, articulation, and phonation. Wernicke's area lies in the posterior superior temporal lobe near the primary auditory cortex (superior temporal gyrus). Wernicke's and Broca's area are joined by a bidirectional pathway, the arcuate fasciculus. These regions are part of a complex network of areas that all contribute to normal language processing.)

2.3. Modern neurolinguistics

The great amount of data obtained from anatomo-clinical observations and collected from the 19th century onwards by physicians and neurophysiologists led to the elaboration of precise cortical maps which provided an exact anatomical localization of sensorimotor functions. At the beginning, these results regarded only elementary sensory and motor functions, but as a matter of fact, they also influenced the growth of knowledge concerning the cerebral organization of speech and language and that of the other cognitive functions. On the one hand, these results theorized that speech and language as well as the other cognitive functions were localized in particular cortical areas, too, and on the other hand, they gave origin to a theoretical framework useful for studying speech and language and the other cognitive functions. From the 19th century on, most of the scientists had started to classify the then known aphasic syndromes in terms of sensory or motor deficits. But the tight collaboration between linguists, psycholinguists and neurolinguists facilitated the discovery of the inner complexity of language, and therefore this classification method of the aphasic syndromes was abandoned. Nowadays, scientists use those models which view both language and brain in hierarchical terms. In fact, behaviour is considered to be the result of the functioning of successive levels of the nervous system and not, as traditionally believed the result of complex behaviours which took their origin from simple components. Moreover, it is believed that language which is a particular form of behaviour is the result of the operation of both the nervous system and the psyche (cf. Cacciari, 2001).

For more then a century, the classical connectionist model (e.g. the Wernicke's connectionist model) and then the neo-connectionist model (e.g. Geschwind's connectionist model) were based on the distinction between expressive and receptive disorders of speech and language, and they did not take into consideration other methods of interpretation and classification. As a matter of fact, they were not the right models to explain the complexity of aphasic syndromes as, according to modern neuroscientists, there was an imbalance between the complexities of the cognitive instruments which were related to the anatomo-functional organization of the brain and the roughness of the concepts which were related to the inner organization of the linguistic code (cf. Cacciari, 2001).

The concept of hemispheric dominance, originally proposed by Jackson in 1868, had remained unchanged until the 1960s, but afterwards it was progressively substituted by the concept of hemispheric specialisation. According to this concept, there is an alternating shift of dominance between the two cerebral hemispheres, and this depends mainly on the cognitive function in question. The review of the classical theory of hemispheric dominance led to the following conclusions:

1. The two hemispheres are asymmetric from a structural point of view and not symmetric as previously believed.

2. Even the brains of other mammals are asymmetric from an anatomical and functional point of view; therefore this characteristic is not species-specific to human beings.
3. Even if the two cerebral hemispheres are different from a functional point of view, there is no dominance of one hemisphere over the other. With regard to elementary sensory and motor functions, the two cerebral hemispheres are completely equivalent.
4. Generally, manual dominance is not a certain indicator of the hemispheric dominance. In most left-handed individuals the organization of cortical functions is not inverted compared with that of right-handed individuals, but indeed it is quite similar. Clinical reports regarding aphasic patients had revealed that in 61% of left-handed individuals the linguistic functions are localized in the left hemisphere and that only in 20% of the cases they are bilaterally represented.

In the last few decades, the attention of most scientists has moved from the idea of finding the exact anatomical localization of language to the attempt to understand the relationship between language and the different functions of the nervous system. Instead of regarding Broca's and Wernicke's area as the main cortical language areas, they can be seen as areas which are intensively used for speech and language (cf. Cacciari, 2001).

According to the most common neuroscientific and neuropsychological models, in all right-handed individuals verbal abilities and the ability to do fine movements are concentrated in the left cerebral hemisphere. The left hemisphere is the part of the brain in which symbolic and analytical processes are elaborated, therefore this hemisphere is also responsible for the elaboration of language. Since the left hemisphere contains prevalently those areas which are involved in speech and language, it seems that it plays an important role not only in the elaboration of speech and language, but also in the elaboration of all those cognitive functions which are implicitly mediated by language. In the past, it was believed that the right hemisphere did not play an important function in the elaboration of language, as according to many neuroscientists, it was not implicated in the elaboration of symbolic representations. But nowadays, it seems that the right hemisphere is even more important in the elaboration of spatial and perceptive tasks than the left hemisphere. As shown in table 1, there are abilities which are bound to one cortical hemisphere rather than to the other hemisphere.

Left-hemisphere dominance	General functions	Right-hemisphere dominance
Words Letters	**VISION**	Geometric patterns Faces Emotional expression
Language sounds	**AUDITION**	Nonlanguage sounds Music
	TOUCH	Tactual patterns Braille
Complex movement	**MOVEMENT**	Movement in spatial patterns
Verbal memory	**MEMORY**	Nonverbal memory
Speech Reading Writing Arithmetic	**LANGUAGE**	Emotional content
	SPATIAL ABILITY	Geometry Direction Distance Mental rotation of shapes

Table 1: Cognitive abilities, which are more, lateralized in the two cerebral hemispheres.

But in fact, even the right hemisphere plays a rather important role in the elaboration of those processes which are bound to speech and language, and it accomplishes various important tasks which are related to particular linguistic aspects both during childhood and adulthood. In particular, the right hemisphere is important for communicative and emotional prosody, such as stress, timing and intonation, and for figurative aspects of language. In addition, that hemisphere plays a role in the pragmatics and semantics of language, but above all in the semantics of narrative aspects and symbolic representations of language and not in that of single words (cf. Cacciari, 2001).

The manifold of results which were accumulated in the last thirty years of neuroscientific research suggest that the right hemisphere participates actively in the elaboration of language, and moreover they suggest that the elaboration of language happens in a more distributed way in the two hemispheres. So, according to this, the two hemispheres work together, and they elaborate the entire incoming linguistic information.

Further studies proved that the cortical regions involved in the processing of speech and language go far beyond the two classical language areas of Broca and Wernicke. In fact, almost the entire neocortex of the left hemisphere is involved in these processes, including the temporal, the parietal, the prefrontal and the frontal lobe. Therefore, this wide distribution suggests that language is not only localized in Broca's and Wernicke's area, even if clinical reports sometimes seem to prove the contrary. Complex cognitive activities such as speech and language are the result of a continuous interaction between a large number of different cortical regions localized in the two cerebral hemispheres which are connected through neuronal pathways. The elaboration of language is based on a hierarchical organization. Furthermore, the classical language areas are not unitary modules, but on the contrary, they are complex areas arranged in clusters, and every cluster is formed by different functional components (cf. Cacciari, 2001).

Nowadays, most neuroscientists believe that cognitive functions such as speech and language are distributed among different cortical regions in both hemispheres. Without doubt, the classical model derived from the work of Broca, Wernicke, Lichtheim and Geschwind has been very useful as an heuristic model which stimulates research and as a clinical model which guides diagnosis. Nevertheless, according to most modern neuroscientists, undoubtedly the classical model is empirical wrong. In fact, it cannot justify the range of aphasic syndromes, and its linguistic foundations are impoverished and conceptually underspecified. Furthermore, the classical model is anatomically underspecified, i.e. its anatomical affirmations are not true any more. It has become clear, that Broca's aphasia is not caused by a mere damage to Broca's area, Wernicke's aphasia is not caused by simple damage to Wernicke's area and conduction aphasia is not caused by only damage to the arcuate fasciculus. Moreover, conduction aphasia is no longer classified as a disconnection syndrome. And it is scientifically proved, that the classical speech-related regions are not homogeneous from an anatomical or functional point of view (cf. Poeppel & Hickok, 2004).

2.4. Subcortical structures and language

The cortico-centric view of language is supplemented by models that additionally propose language-related functions for subcortical structures. It is indeed believed that subcortical structures control not only the initiation of the motor behaviour and cognitive functions, but that they also support these functions In addition, it seems that subcortical structures are also involved in the regulation of emotional systems and memory. It has been proposed that linguistic processing might be organized in parallel to non-linguistic operations coded in cortico-striato-pallido-thalamo-cortical circuitries. The subcortical structures are connected to the cerebral cortex and to the neuronal structures of the brainstem, as well, and are divided into two major groups: the basal ganglia and the thalamus. The basal ganglia are formed by three nuclei: the caudate nucleus, the putamen, and the globus pallidus, whereas, the thalamus is formed by a set of nuclei, only the most important of which are involved in some language functions. They are: the ventral anterior nucleus (VA), the ventral lateral nucleus (VL), the dorsomedial nucleus (DM) and the pulvinar (P). Neuroscientists found out that the basal ganglia and the thalamus form several neuronal circuits which activate and control functions that until very recently were believed to be only typical functions of the cortex. The frontal, parietal, and temporal lobes send excitatory information to two nuclei of the basal ganglia, i.e. to the caudate nucleus and to the putamen. In addition, these two nuclei receive information from the substantia nigra. The caudate nucleus and the putamen inhibit the globus pallidus, whereas the globus pallidus inhibits the activity of some thalamic nuclei, that is the VA, the VL and the DM. But when they are activated through the inhibition of the globus pallidus, these nuclei excite the frontal lobe which is involved in the organization as well as in the planning of motor and cognitive behaviour patterns (cf. Fig. 3) (c.f. Fabbro, 1999).

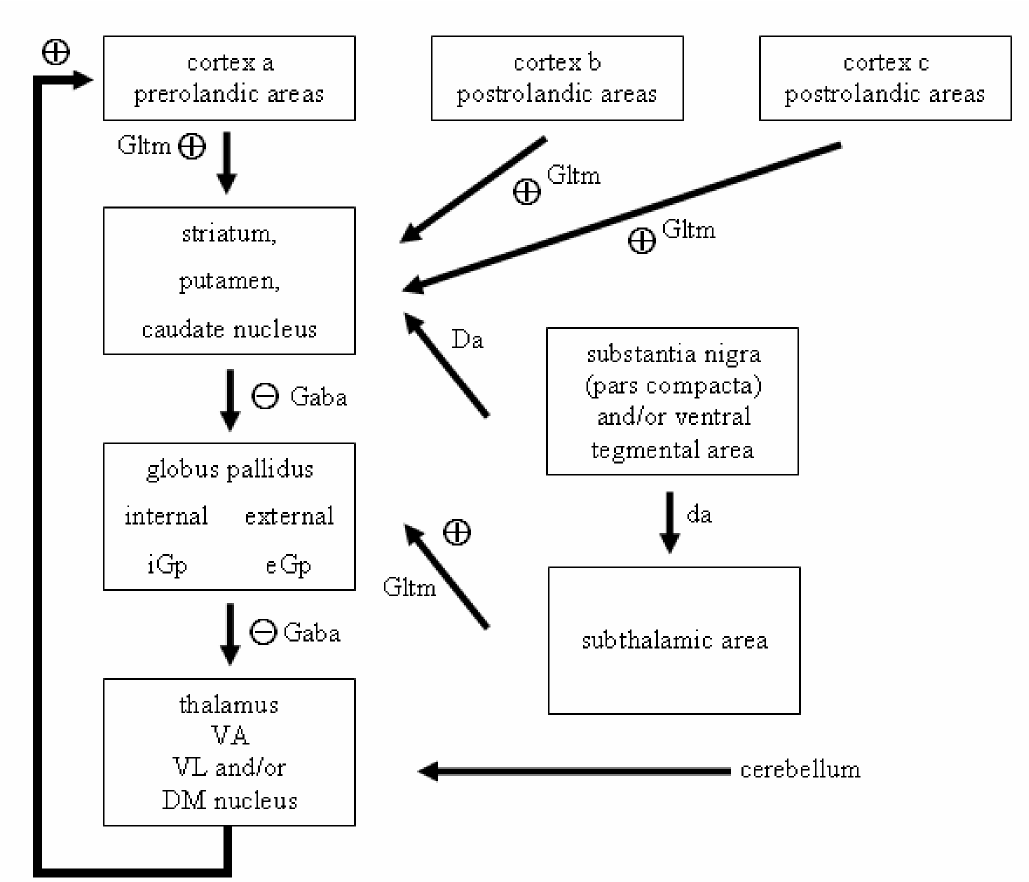


Figure 3: <u>Basic structures of the cortico-striato-pallido-thalamo-cortical loop</u> (adapted from Fabbro, 1999).

In the 1990s, two scientists identified the two major neuronal circuits of the basal ganglia which are involved in the regulation of movement and language:

I. The cortico-striato-thalamo-cortical loop, also known as the direct pathway or inner putamen-pallidus pathway, collects and elaborates the information coming from all cortical lobes. A characteristic of this pathway is that it has an excitatory influence on the frontal lobe (positive feedback).

II. The cortico-striato-subthalamo-thalamo-cortical loop, also known as the indirect pathway or outer putamen-pallidus-pathway, has an inhibitory function, namely it inhibits the frontal lobe (negative feedback). All those motor or psyche schemes which are in direct competition with movement or cognitive action are suppressed.

Various pioneering studies, in particular those on patients with vascular or surgical lesions in the basal ganglia and the thalamus of the left hemisphere, have revealed that these structures play a role in language organization.

Lesions in the basal ganglia of the left hemisphere cause the following language disorders:

1) non-fluent aphasia with a general reduction in spontaneous speech;
2) voice disorders, such as foreign accent syndrome;
3) presence of semantic and verbal paraphasiae, which normally are found only in fluent aphasias;
4) signs of echolalia and perseverations;
5) in general, repetition and comprehension are not affected;
6) writing disorders.

Whereas, lesions to the thalamus of the left hemisphere cause the following language disorders:

1) verbal expression is altered, speech is fluent and the patient is affected by a severe anomia, while comprehension is in general less compromised;
2) verbal, semantic and neologistic paraphasiae;
3) mild comprehension deficit, whereas repetition is spared;
4) disorders in reading, writing, arithmetic, and long-term verbal memory.

The analog-to-memory concept, which is summarized in the "declarative/ procedural model" states that the basal ganglia process rule-based grammatical operations in an implicit way, while explicit semantic recovery is assigned to temporo-thalamic networks. Other neuroscientists have proposed a "lexical selection model" according to which, the basal ganglia combine context-bound phonological word representations in fronto-cortical areas with appropriate lexical information coming from temporo-parietal areas. The basal ganglia in combination with the thalamus also trigger the cortex for language production. Furthermore, it was seen that subcortical-electrical stimulation during neurosurgery sometimes induces patients to speak involuntarily. This suggests that only specific structures of the basal ganglia and of the thalamus are implicated in verbal expression; and it moreover it suggests that the cortex has the function to regulate the final phases of the language production process as soon as verbal expression is activated. These neurophysiological experiments have revealed that the subcortical structures which actively involved in word and sentence production are the head of the nucleus caudatus and the most anterior nuclei of the thalamus. As a matter of fact, electrical stimulation of the head of the nucleus caudatus leads patients, who are awake during neurosurgery, to produce sentences which have nothing to do with the experimental or clinical procedure. In addition, electrical stimulation of the most anterior left thalamic nuclei leads the subjects to a strong desire to speak, but the uttered words or sentences are totally out of the given context. Important to mention is that there is a high concentration of noradrenaline in the left thalamus. From a biochemical point of view, this neurotransmitter is very similar to caffeine and cocaine which increase the desire to speak and make the conversation more fluent and lucid (cf. Fabbro, 1999).

In 1990s, the neuropsychologist Bruce Crosson proposed his theory of subcortical elaboration of language which is based on five systems. The "selective engagement model" by Crosson, which seems to be very useful for clinical and cognitive research, has been widely accepted by the leading neuroscientists, and therefore I will briefly explain it as follows (cf. Fig.4) (cf. Fabbro, 1999).

1. The first activating system is a neuronal circuit which triggers a subject's verbal activity. The activation of the cerebral cortex is provoked through the activation of some neuronal structures of the reticular substance of the

brainstem, of the intrathalamic nuclei of the thalamus and of the cingulated cortex.

2. As soon as the frontal cortex is activated, some areas of the frontal lobe control the formation of language segments. In other words, this system, which is formed by a neuronal circuit involving the frontal cortical areas, the pulvinar and the left posterior cortical areas, controls the semantic acceptability of the newly formed language segments.
3. As soon as the examination of the language segment has been concluded and its semantic correctness has been proved, the controlling system releases the language segment from the assessment stage and connects it to the system which deals with expression. As soon as the latter process has been concluded, the areas of the anterior and of the posterior cortex are activated. Subsequently, the head of the nucleus caudatus is activated by the anterior and posterior cortex, while the nucleus caudatus inhibits the globus pallidus. Furthermore, the inhibition of the globus pallidus activates the thalamic VA nucleus, which in turn activates the areas anterior to Broca's area. These areas are responsible for the production of the phonemic sequences which in turn form words and sentences.
4. Afterwards, the motor programme which is responsible for the production of the phonemic sequences is activated, so as to carry out the evaluation of phonemic acceptability. This system is established by a neuronal circuit engaging Broca's area in the frontal lobe, Wernicke's area in the temporal lobe and the arcuate fasciculus.
5. As soon as the assessment of the phonemic sequence has been concluded and its phonemic correctness has been proved, the phonemes are sent to the circuit which activates the real phonemic production. This circuit is formed by the phonemic temporal cortex (Wernicke's area) and by the phonemic frontal cortex (Broca's area) which synergically activate the putamen. The putamen inhibits the globus pallidus and the inhibition of the globus pallidus activates the VL nucleus of the thalamus. In conclusion, the VL nucleus of

the thalamus activates the cortex, which is in charge of carrying out the vocal tract movements correctly in order to produce language sounds.

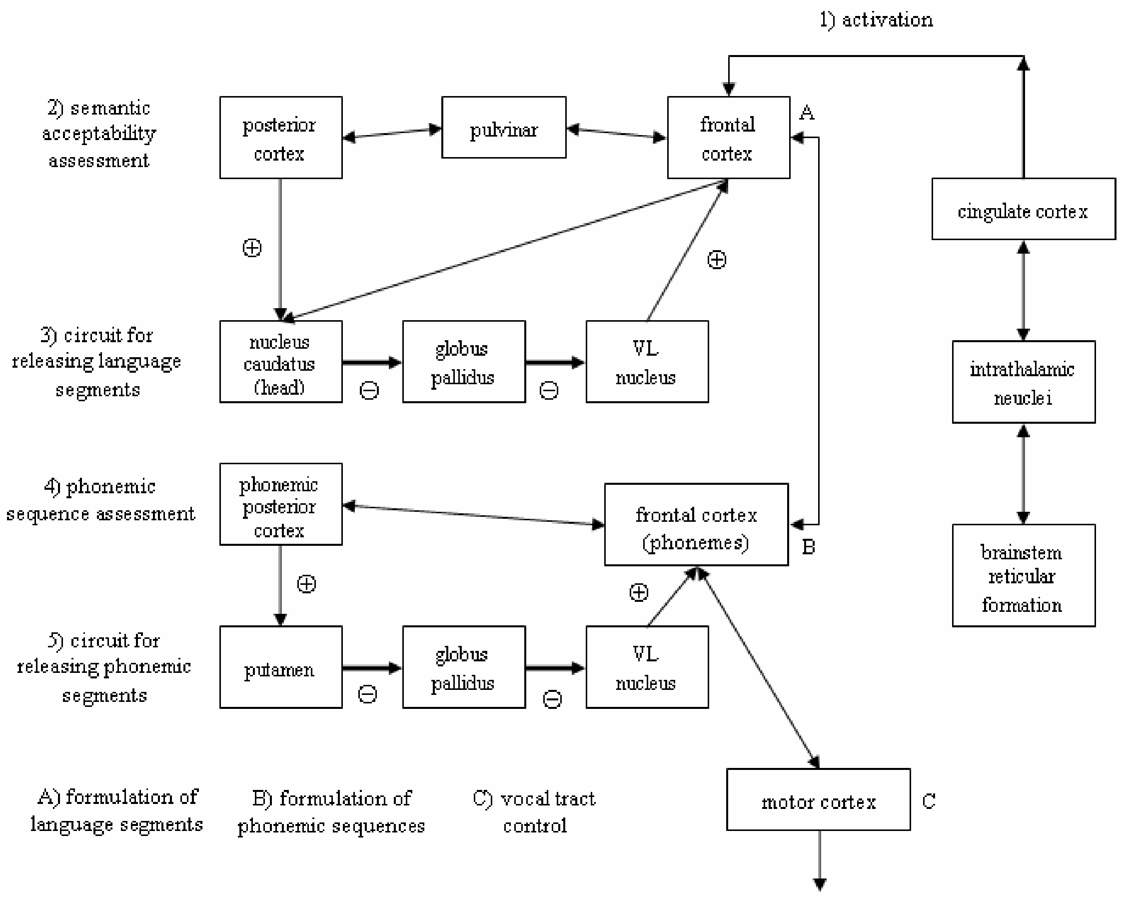


Figure 4: Model of subcortical functions of language (adapted from Fabbro, 1999).

It seems that according to the neurophysiological findings of Michael Wahl's research group (c.f. Michael Wahl et al., 2008), syntactic and semantic language processing largely engages cortico-thalamic networks and, contrary to former suggestions, does not use a basal ganglia network. Above all, they found that the violation of syntactic and semantic phrase attributes provoked event-related potentials (ERPs) in recordings from the VIM (ventral intermediate nucleus) of the thalamus, but not in recordings from contiguous basal ganglia structures. These neurophysiological findings agree with the most important notions of the selective engagement model which hypothesize that cortico-thalamic circuits are engaged in syntactic and semantic language processing. In conclusion, these significant results suggest a radical revision of current language models (cf. Fabbro, 1999).

2.5. Cerebellum and language

In 1917 the neurologist Gordon Holmes described a new form of language disorder caused by cerebellar lesions. The patients described in his clinical report had significant speech motor deficits. Holmes called this new form of language disorder ataxic dysarthria. Moreover, individuals with cerebellar lesions have severe coordination difficulties (ataxia); in fact the main function of the cerebellum is that of coordinating voluntary movements. When a patient with such cerebellar lesions tries to carry out voluntary movements, his motor system is unbalanced, and for that reason all parts of his body which are involved in carrying out movements are affected by a widespread tremor. This pathological process affects even the motor production of speech, and therefore speech is generally slow and characterized by many severe errors in phonation and articulation. Furthermore, the voice sounds irregular due to the tremor of the organs involved in speech articulation. Neuroanatomical and neurophysiological investigations revealed that the left cerebral cortex is directly connected with the right cerebellar hemisphere through a neuronal pathway. Recent neurofunctional and lesion studies in patients have shown an activation of the lateral hemispheres during language processing, while the vermis and the paraverminal regions are implicated in motor aspects of speech. Various PET studies (positron emission tomography) which investigated the activation of neuronal structures during the performance of cognitive tasks have shown that there is an activation of the right cerebellar hemisphere during the execution of purely linguistic tasks. Other neurofunctional studies have revealed that the cerebellum participates in speech perception as well. In addition, it has been proved that some structures of the cerebellum, in particular the neocerebellum[1], play an important part in the regulation of nonmotor cognitive functions (cf. Fabbro, 1999).

2.6. Movement control and language production

Several cerebral structures which control the execution of movements are implicated in language production as well. These cerebral structures continuously inform the brain of the position of the articulatory organs in order to produce the correct articulatory movements which are needed for language production. This sensory information is transmitted to the brain by way of some cranial nerves: the trigeminal (V), the glossopharyngeal (IX), the vagal (X) and the hypoglossal (XII) nerves. These cranial nerves send the sensory information to the sensory nucleus of the cranial nerves and to the thalamus (ventral posterior medial nucleus) which reorganized the received sensory information. Subsequently, the information is transmitted from the thalamus to the sensory cortical areas, from the sensory cortical areas to the pre-motor areas and then to the motor areas of the tongue, the pharynx and the larynx. The pyramidal tract which controls the cranial nerves, implicated in speech and language production starts from the sensory, pre-motor, and motor areas. It seems that this cortical control of the cranial nerves is one of the neural bases which permit human beings to learn the entire sequence of movements which are implicated in language production without much effort. Neuroanatomical studies proved that this neural pathway is much less developed in primates, and according to most anthropologists and primatologists, this is the reason why primates are not able to speak. Sensory information is very important for the acquisition of a foreign language, for instance the acquisition of correct pronunciation happens only through listening and repeating of particular sound patterns. Moreover, the correction of articulatory errors involves the learning of the

[1] The right and the left cerebellar hemispheres and the dentate nuclei form the neocerebellum, which receives information from various cortical areas. The neocerebellum processes that information and sends it back to the motor and pre-motor cortical areas.

correct sequence of movements, for instance aphasic patients have to re-learn the correct sequence of movements in order to be able to produce the correct sound patterns. But it seems, that in adults who speak their mother tongue fluently and in fluent bilinguals the sequential movements of the supralaryngeal vocal tract are generated and coordinated as a set of motor programmes which function independently from sensory information (cf. Fabbro, 1999).

2.7. Memory and language

Learning is the process by which we acquire knowledge about the world, whereas memory is the process by which that knowledge is encoded, stored and later recovered. Many important behaviours are learnt. As a matter of fact, we are who we are because of what we learn and remember. For instance, we learn the motor skills that allow us to master our environment, and we learn languages which permit us to communicate what we have learnt and permit us to transmit our culture and knowledge to our descendents. But all these learnt skills and all this acquired knowledge must be stored somewhere in order to be retrieved. From a Darwinian point of view, all knowledge and all experiences, which have been acquired through lifelong learning, play a rather important role in the preservation and/or selection of individuals and species. In fact, human beings as well as animals remember dangerous situations, and therefore the sheer act of remembering is the conditio sine qua non to avoid such situations in the future and to repeat only those which are pleasant. This is the reason why, the emotional structures of the nervous system are actively implicated in the storing of memory traces (cf. Fabbro, 1999; Kandel et al., 2000; Ladavas & Berti, 2002).

Nowadays, we all know that memory is formed by different components which have distinct psychological characteristics and anatomo-physiological correlates; and they can be dissociated from a functional point of view. Human memory is normally defined as the ability to recall past events. They can be retrieved partially or totally and can correspond to real events which happened in the past or can be invented. Moreover, memory has also the function to generate new forms of knowledge as well as new explanatory models which are important for a continuing and up-to-date assessment of the external world. There are two main forms of memory, the short-term memory (STM) and the long-term memory (LTM). The STM is used for storing information which has just been presented. The information is stored for a very short period of time and must be recalled immediately after its presentation. Furthermore, the retrieved information must be correct, that is, it must correspond to the original information which has been previously presented. On the contrary, the LTM is used for retrieving information which has been stored for a long period of time. The information recalled through the LTM is not as accurate and precise as the information retrieved through the STM. In other words, the STM is activated when a sequence of numbers which has just been read or heard is recalled immediately after its presentation, while the LTM is activated when we are recalling an event which happened in the past or when we are retrieving acquired knowledge (cf. Fabbro, 1999; Kandel et al., 2000; Ladavas & Berti, 2002).

The STM has a limited memory capacity or span, i.e. a young and healthy person is not able to recall more than seven or eight words or numbers or objects in the same order in which they have been previously presented. It is important to point out that the ability of the STM to recall objects or words, which have just been presented, does not depend on the physical characteristics of the stimuli. For instance, if a sequence of four letters, such as “a”, “p”, “c” and “d” is shown to a subject, it is going to take up the same space in the STM as four single words which are formed by more than one letter. So, this means, that groupings (chunk) of single units increase the memory capacity of the STM. The STM has not only a limited memory capacity, but also a limited retention time, i.e. the STM is not able to retain information for more than 20 seconds. In fact, if the information is not continuously repeated, it will be lost after 20 seconds (cf. Fabbro, 1999; Kandel et al., 2000; Ladavas & Berti, 2002).

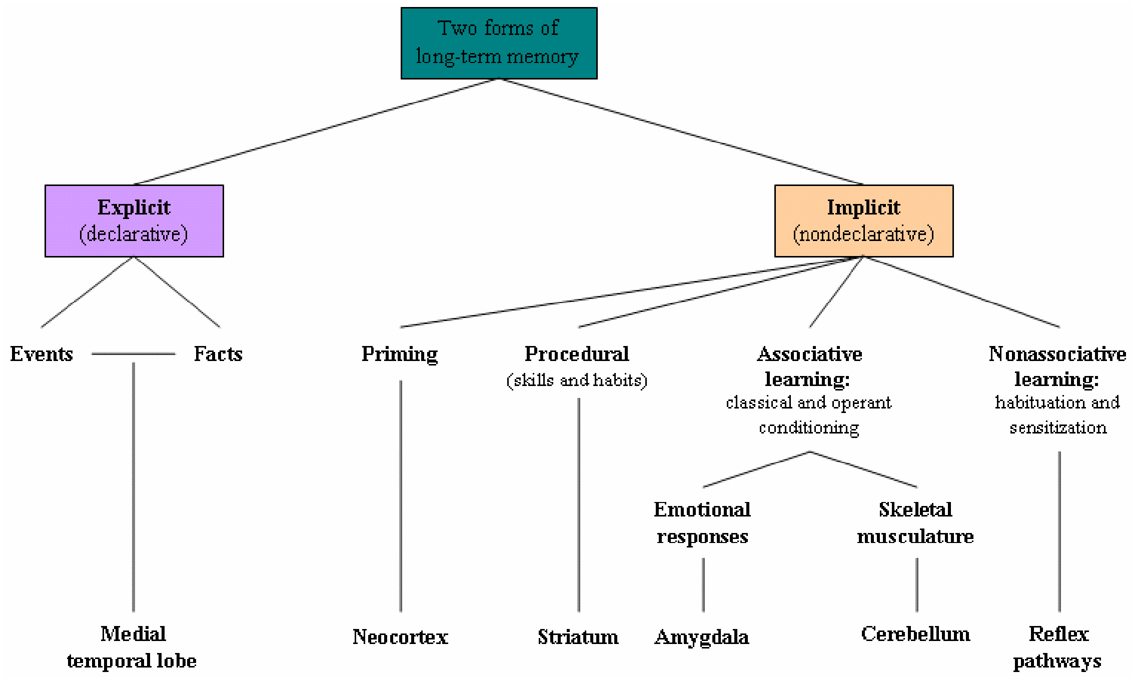


Figure 5: Hierarchical classification of LTM components (adapted from Kandel et al., 2000).

On the contrary, the LTM is able to store a large amount of different types of information for a long period of time. The LTM is not a unitary system, but is organized in many separate systems and subsystems (c.f. Fig. 5). In fact, there are two main types of LTM, namely the **implicit memory** or non-declarative memory and the **explicit memory** or declarative memory. Implicit memory is recalled unconsciously and is usually involved in training reflexive motor or perceptual abilities, such as the ability to play musical instruments by ear, the learning of sensory-motor sequences for the production of phonemes, the learning of morphosyntax, the use of grammar in the comprehension and production of an individual's mother tongue and so on. On the contrary, explicit memory is recalled in a conscious and deliberate way and is referred to all factual knowledge of people, places and things and what these facts mean. Furthermore, all this knowledge has been acquired through lifelong conscious and deliberate learning, and the subject is aware of the existence of this particular type of knowledge. In fact, it can be expressed verbally on request or at will. Explicit memory is extremely flexible and is formed by a countless number of pieces of information, whereas implicit memory is rather rigid and tightly bound to the original stimulus condition under which the learning happened. Explicit memory is additionally subdivided into episodic or autobiographical and semantic memory. Episodic memory or memory for events and experiences is used for storing the subject's personal experiences and for storing those events which happened during his/her lifetime. Furthermore, it is also used for storing aspects of the subject's personal life (autobiographical memory). For instance, we use episodic memory when we recall that we have seen Verdi's Rigoletto. While semantic memory or memory for facts is used for storing the subject's encyclopaedic knowledge which has been acquired through a lifelong learning process. For example, we make use of semantic memory to store and recall objective knowledge, namely the sort of knowledge which we learn at school and from books. The different forms of knowledge stored in the episodic and semantic memory can be recalled in a conscious and spontaneous way (cf. Fabbro, 1999; Kandel et al., 2000; Ladavas & Berti, 2002).

It seems that knowledge which is stored as explicit memory is first processed in one ore more of the three polymodal association cortices which are the prefrontal, limbic and parieto-occipital-temporal cortices. The main function of the three polymodal association cortices is that of synthesising visual, auditory and somatic information. Afterwards, that information is sent from the polymodal association cortices to the parahippocampal and perirhinal cortices, then to the entorhinal cortex, the dentate gyrus, the hippocampus, the subiculum and finally back to the entorhinal cortex which sends it back to the parahippocampal and perirhinal cortices. From there the information is sent back to the polymodal association areas of the neocortex (c.f. Fig. 6).

The two most important functions of the entorhinal cortex are (cf. Fig. 6):

1. The entorhinal cortex is the major input to the hippocampus and is connected to the dentate gyrus by means of the perforant pathway which transmits the information coming from the polymodal association cortices to the hippocampus.
2. The entorhinal cortex is also the main output of the hippocampus. The information which is transmitted from the polymodal association cortices to

the hippocampus and the information which is sent from the hippocampus to the polymodal association cortices converge in the entorhinal cortex.

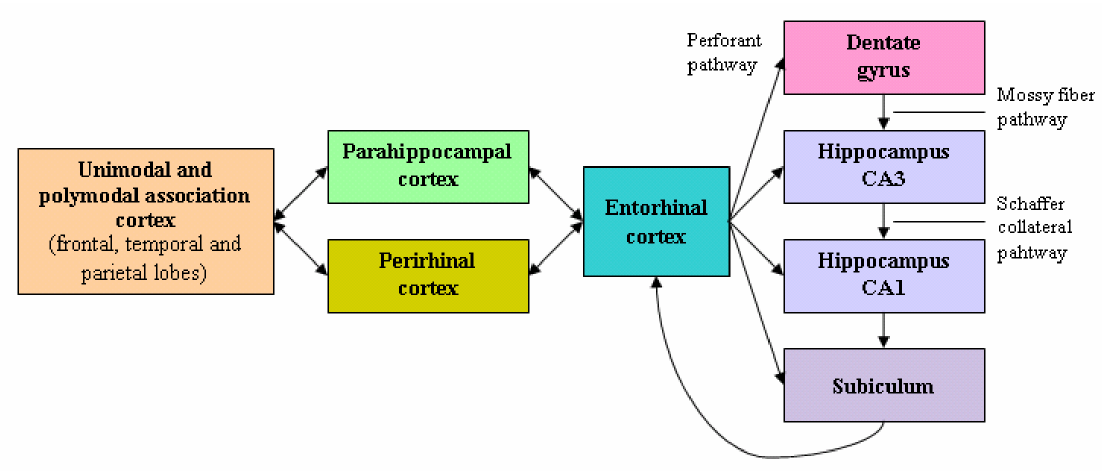


Figure 6: The input and output pathways of the hippocampal formation (adapted from Kandel et al., 2000).

This model explains why the memory impairments caused by damage to the entorhinal cortex are for the most part very severe and why the damage affects all sensory modalities rather than only one. As a matter of fact, the first pathological signs of the beginning of Alzheimer's disease (AD) are caused by damage to the entorhinal cortex. AD is the foremost degenerative disease which affects explicit memory. In addition, it has been proved that a lesion which hits any of the components of this system can have considerable effects on memory storage. It seems that damage to the perirhinal, parahippocampal and entorhinal cortices which does not affect the underlying hippocampus causes a bigger memory deficit than a lesion of the hippocampus which does not affect the cortex above it. In addition, it looks as if the hippocampus plays an important role in spatial representation. In fact, experimental studies proved that lesions of the hippocampus alter the correct functioning of the memory for space and context. Furthermore, fMRI studies demonstrated that the hippocampus placed in the right hemisphere is involved in the elaboration of spatial memory, whereas the hippocampus placed in the left hemisphere is involved in memories for words, objects and people. These neurofunctional findings are compatible with clinical findings according to which, lesions of the right hippocampus alter spatial orientation, while lesions of the left hippocampus give origin to deficiencies in verbal memory. Clinical studies have demonstrated that patients with amnesia are capable of recalling their entire childhood, but they are also able to remember all knowledge which they had acquired before damage to the hippocampus. These findings suggest that the hippocampus is no more than a temporary way station for LTM, and that the long-term storage of semantic and episodic knowledge takes place in the unimodal or multimodal association areas of the cerebral cortex. If so, it can be assumed that the hippocampal system mediates the first steps of long-term storage. The information is slowly transferred from the hippocampal system into the neocortical storage system. The gradual and slow addition of information to the neocortex avoids the disruption of the existing information by the new information. The hypothesis that the association areas are the final depots for explicit memory and the hypothesis that lesions in the association areas hinder the recall of explicit knowledge which had been acquired before the damage is supported by clinical data, as well. As a matter of fact, damage to these areas causes particular deficiencies in semantic and/or episodic memory (cf. Fabbro, 1999; Kandel et al., 2000; Ladavas & Berti, 2002).

As previously mentioned, semantic memory is a subtype of explicit memory which incorporates various types of knowledge, for instance knowledge of objects, facts, concepts, and words and their meaning. But the naming of objects, the definitions of spoken words and verbal fluency are part of the semantic memory too. Semantic knowledge is extremely flexible and well organized. Nowadays, it is clear to everybody, that semantic knowledge is the result of a lifelong accumulation of associations; and the capacity to evoke and use previously stored knowledge with success depends mainly on how well these associations have stored and arranged the information. Clinical studies have revealed that semantic knowledge is the outcome of the combination of numerous representations in the brain which are stored in many different anatomical areas. As a matter of fact, every anatomical area is related to only one aspect of the concept that we remember. This suggests that there is no universal semantic memory depot in our brains, i.e. semantic knowledge is not stored in a single region, but rather in dedicated memory stores. Therefore, a lesion of a particular cortical area can cause the complete or partial loss of particular information which leads to a general splitting of knowledge (cf. Fabbro, 1999; Kandel et al., 2000; Ladavas & Berti, 2002).

As already mentioned, lesions to multimodal association areas disrupt semantic knowledge, but these lesions can also hinder the correct recall of episodic memory. However, there are cases in which patients with a complete loss of episodic memory are able to recall a considerable quantity of semantic knowledge. So, the areas of the cerebral cortex which are involved in the long-term storage of episodic knowledge are mainly the association areas of the frontal lobe which collaborate with other areas of the neocortex in order to remember every single detail of the past event (cf. Fabbro, 1999; Kandel et al., 2000; Ladavas & Berti, 2002).

The three most important features of episodic and semantic memory are:

1. There is no universal memory store.
2. Knowledge is the outcome of the combination of numerous representations in the brain; every representation is related to only one aspect of the concept which we remember and can be recalled separately.
3. Semantic as well as episodic memory is the outcome of four types of processing (encoding, consolidation, storage and retrieval).

Encoding refers to those processes by which the newly acquired information is elaborated. The process of encoding is very important because it determines how well the acquired information will be remembered later on. The incoming information has to be encoded completely and deeply in order to last and be properly remembered. This is achieved by methodically linking the incoming information to knowledge which has been already properly stored in our memory (integration of knowledge).

Consolidation refers to those processes which modify the newly stored knowledge in order to make it steadier for long-term storage. Moreover, the process of consolidation is facilitated by the expression of particular genes and by the synthesis of new proteins, which cause particular structural changes, and these structural changes help to store memory effectively and stably over time.

Storage happens by means of particular mechanisms and anatomical structures (storage sites) which retain memory for an unlimited period of time. It looks as if long-term storage has more or less an unlimited capacity, whereas short-term working memory has an extremely limited storing capacity.

Retrieval takes place by way of those processes which allow the recall of the stored information and its subsequent use. As mentioned previously, the different pieces of information which form a particular concept are stored in dedicated memory stores, therefore this process of retrieval has to retrieve the information and put it together. The retrieval of explicit memory is supported by the short-term working memory.

Working memory: In the 1970s, the British scientist Alan Baddeley introduced the concept of working memory to facilitate the comprehension of those mechanisms which are involved in short-term storage. In his opinion, the working memory is a system which contains and processes not only information, but is also involved in other cognitive processes, such as reasoning, comprehension, learning and consciousness. For instance, it seems that there is a kind of relationship between working memory and learning disorders, such as dyslexia. In fact, various clinical studies have reported that children with dyslexia have a shorter memory span for digits than healthy children. Furthermore, they have difficulties in reading, in non-word repetition and in learning foreign languages. According to Baddeley's model, working memory is formed by an attention control system or central executive which seems to be located in the prefrontal cortex and which controls and coordinates two slave systems, namely the articulatory or phonological loop and the visuo-spatial sketch pad. The articulatory or phonological loop elaborates linguistic information and is composed of the articulatory rehearsal process and of the phonological store, while the visuo-spatial sketch pad elaborates all non-linguistic information, for instance the visual properties and the spatial location of the object which has to be remembered. The mnestic traces stored in the phonological store decay rather fast (approximately after 1-2 seconds). But the activation of the articulatory rehearsal process which is based on an inner rehearsal mechanism permits the maintenance of the memory trace for a much longer period of time (approximately 10 seconds), since the information refreshed through the rehearsal process re-enters into the phonological store (c.f. Fig. 7) (cf. Fabbro, 1999; Kandel et al., 2000; Ladavas & Berti, 2002).

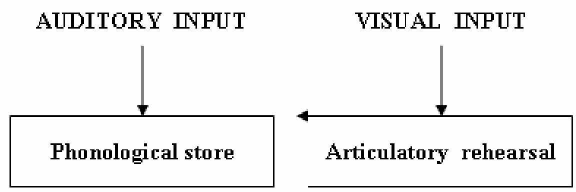


Figure 7: The phonological loop (adapted from Ladavas & Berti, 2002).

The articulatory rehearsal process also allows the transformation of written verbal material into a phonological code which will afterwards be transmitted to the phonological store, while auditory material is sent directly to the phonological store. Furthermore, the information processed by the working memory system can be stored in the LTM. The phonological similarity effect is based on the fact that words which are similar from an auditory point of view are remembered with more difficulty than those which are different. In other words, the phonological store of the working memory is based on a phonological code; therefore words which are similar from a phonological point of view are analogously stored. The correct recall of those words requires proper discrimination between the memory traces (codes). As a matter of fact, memory traces which are similar are easily confused. For that reason, the recall of such words is more difficult than the recall of those which are dissimilar from a phonological point of view. Furthermore, words which contain a smaller number of syllables are recalled in a better way than those which contain a greater number. But if those words have the same number of syllables, then only those which have a shorter articulation time are recalled in a better way. In other words, in these two cases, memory is crucially and tightly linked to the time of sound emission and to the articulation time of syllables. In point of fact, working memory span can be defined as the number of items which are uttered in two seconds. Therefore, there is a relationship between the length of words, the articulation time and the process of memory storage. The articulatory suppression effect takes place when a subject, while performing a verbal span task, is asked to pronounce an irrelevant sequence of syllables such as “la, la, la”. In this case, the production of irrelevant sounds seriously compromises the memory trace causing a decrease in the subject’s memory performance. As a matter of fact, the production of irrelevant sounds while performing a verbal span task impedes the use of the articulatory rehearsal process, and therefore hinders the fixing of the memory trace. In other words, the production of irrelevant sounds involves the central executive, and for that reason, it cannot be used for fixing the memory trace or for converting visual material into a phonological code. The decrease in span takes place whether the stimuli are presented acoustically or visually. The articulatory suppression impedes the conversion of visual material into a phonological code, whereas it does not influence the coding process of auditory stimuli, but it manipulates the working memory span, because it inhibits the rehearsal of the stimuli. The recency effect takes place when the last items of a wordlist are recalled in a correct and accurate way, while the primacy effect takes place when the first items of a wordlist are recalled in a hesitant way. It seems that the recency effect is attributable to phonological store; in fact, the errors caused during the recall of a wordlist are phonological errors. However, it seems that the recency effect is not attributable to subvocal rehearsal, as the articulatory suppression does not influence the recency effect. On the contrary, the memory span for digits is seriously compromised by the articulatory suppression; this suggests that the span is controlled by the subvocal rehearsal mechanism. Therefore, it seems that the recency effect and the memory span for digits are the end result of the phonological store and of the articulatory rehearsal process (cf. Fabbro, 1999; Kandel et al., 2000; Ladavas & Berti, 2002).

Implicit memory does not rely directly on conscious processes, and its recall happens in an unconscious way. Moreover, the storage of implicit memory happens gradually and unconsciously by means of a continuous repetition of a particular task (N.B. this type of learning happens very slowly and the execution of the task improves with practise) and by means of implicit strategies, which do not make information available for conscious introspection. Implicit memory comprises perceptual and motor skills as well as the learning of particular types of procedures and rules, for instance, the ability to play musical instruments by ear, the learning of sensory-motor sequences for the production of phonemes, the learning of morphosyntax, the use of grammar in the comprehension and production of an individual's mother tongue, etc. Information stored in implicit memory is used in an automatic way and is not consciously controlled; the subject's attention is focused on the result and not on the execution of the process. There are different forms of implicit memory which are acquired by way of different forms of learning and therefore are stored in different brain regions, for instance, the acquisition of procedural memory involves the striatum and the cerebellum (cf. Fig. 5). Various experimental studies on animals have suggested that there are different subclasses of implicit memory: priming (learning of acoustic or visual fill-in-the-blank tasks, lexical decision, etc.), procedural memory (learning of motor and cognitive processes and involves highly developed cerebral structures, such as basal ganglia, cerebellum and striatum), non-associative learning (the subject learns about the properties of a single stimulus) and associative learning (the subject learns about the relationship between two stimuli or between a stimulus and a behaviour). Psychological experiments have demonstrated that non-associative learning takes place as soon as a person or an animal is exposed on one occasion or repeatedly to a single type of stimulus. Furthermore, there are two subclasses of non-associative learning, i.e. habituation and sensitization (cf. Fabbro, 1999; Kandel et al., 2000; Ladavas & Berti, 2002).

Learning is a process which uses elements of both implicit and explicit learning, for instance learning to drive a car involves conscious execution of particular sequence of motor acts (explicit learning), but as soon as we get used to it, driving becomes automatic and unconscious (cf. Fabbro, 1999; Kandel et al., 2000; Ladavas

& Berti, 2002). Furthermore, it has been proved that both explicit memory and implicit memory are stored in stages. In addition, memory involves functional as well as structural changes at synapses in the circuits which participate in a learning task. But these modifications take place only in specific types of neurons (cf. Fabbro, 1999; Kandel et al., 2000; Ladavas & Berti, 2002).

2.8. The declarative/procedural model

Language is principally based on two mental capacities, which are the mental lexicon and the mental programme. The mental lexicon is a depot of stored information, which includes not only all word-specific information, but also those regarding complex linguistic structures, such as phrases and sentences. Furthermore, language and the construction of phrases and sentences are controlled by the rules of grammar. As a matter of fact, language is a complex rule-governed behaviour, and the rules which control language are a form of mental knowledge. The mental knowledge permits us to understand and produce complex linguistic forms. Moreover, all these rules are governed by mental operations which manipulate the words to allow us to produce complex structures. Therefore, it can be said that the learning and the use of these rules of grammar are implicit, i.e. they occur in a subconscious way (cf. Ullman, 2001).

The neurocognitive bases of mental lexicon and of mental grammar have been the subject of many neuroscientifical studies which gave rise to many theories and models, such as the declarative/procedural model. This model is very closely related to the declarative/procedural memory system, and as a matter of fact, some aspects of lexicon/grammar distinction are tied to the distinction between declarative and procedural memory (cf. Ullman, 2001).

As previously mentioned, the declarative memory system or explicit memory system is involved in the learning, in the representation and use of facts and events. Furthermore, it seems that the declarative memory is linked to the ventral visual stream and is rather important for learning arbitrarily related items. The knowledge is recalled in a conscious way, i.e. explicitly, and is not stored in a single region, but rather in dedicated memory stores. Several regions of the medial temporal lobe, such as the hippocampus, which is linked to various temporal and temporo-parietal neocortical regions, are involved in the declarative memory process. The main function of the medial temporal lobe is that of fixing and maybe retrieving new memories (cf. Hodges & Patterson, 1997). But it seems that other brain regions are involved in this system, as well. For instance, it seems that the anterior prefrontal cortex is involved in the selection and retrieval of declarative memories (cf. Desmond et al., 1998).

In contrast, the procedural memory system[2] is not only involved in learning new motor and cognitive skills, but also in controlling those which have been previously stored. All these processes are learned and recalled in an implicit way, i.e. unconsciously. The brain regions involved in the procedural memory system are principally the frontal cortex (comprising Broca's area and the supplementary motor area), the basal ganglia, the parietal cortex and the dentate nucleus of the cerebellum. Furthermore, it seems that the procedural memory is linked to the dorsal visual stream. The procedural memory system plays a rather important role in learning or processing skills which are involved in action sequences (cf. Ullman, 2001), and they are carried out by the posterior parietal cortex which is linked to the frontal regions. It seems that the inferior parietal regions are used as a kind of deposit for the knowledge of skills. The basal ganglia are connected through the thalamus with a particular cortical region which is mainly found in the frontal cortex (cf. Ullman, 2001).

The core concept of the declarative/procedural model is that the mental lexicon is controlled by the declarative system, while the mental grammar is controlled by the procedural system. Therefore, it can be said that the declarative memory system is an associative memory system; in other words, facts and events, but also lexical knowledge, such as sounds and meaning of words, are stored in it (cf. Ullman,

[2] The term "procedural memory" is used to refer to a particular brain memory system and not to all implicit memory systems.

2001). In addition, various medial temporal lobe structures are involved in learning new words. But it seems that knowledge of words also involves some particular neocortical areas, i.e. the temporal region (storing of word meanings) and the temporo-parietal region (storing of word sounds) (cf. Ullman, 2001).

Procedural memory promotes the implicit learning as well as the use of grammar (syntax, morphology and phonology) and is also rather important in grammatical structure building, for instance in the sequential and hierarchical combination of stored forms, such as "cook" + "-ed". The learning of rules is controlled by parts of the system which are involved in procedural learning. According to this model, there are some neuronal circuits between the basal ganglia and the frontal cortex which promote grammatical processing. The fontal cortex and the basal ganglia are domain general, as they promote non-linguistic as well as linguistic processes, but they contain parallel and domain-specific neuronal circuits too. Therefore, it is rather clear that not all components of the declarative/procedural memory system promote language (cf. Ullman, 2001).

It can be pointed out that the declarative/procedural model is in one way or another similar to other dual-system models as according to these models, lexicon and grammar are detachable and processed by distinct cognitive systems. In general, according to the dual-system models, all regular or default forms are processed by particular rules which manipulate symbols representing their parts, for instance according to the declarative/procedural model, affixes are stored lexical items which are affixed to stems, while the use of irregular or non-default forms involves form-specific stored representations (cf. Ullman, 2001). In other words, the use of an irregular transformation is arbitrary; therefore every word must be correlated with some kind of information which concerns any irregular transformations. It is hypothesised that a rote or associative memory system promotes the learning, representation and processing of words by means of one or more systems which are not only specialized for these functions, but are also dedicated to them. Moreover, according to these models, the temporal and temporo-parietal structures are involved in the use of stored words. The learning, knowledge and processing of grammar are promoted by way of one or more systems, and in this case the systems are related to the linguistic functions of these cognitive processes. As already mentioned, grammar manipulates symbols; as a matter of fact grammar combines lexical forms and abstract representations in order to build complex linguistic structures, such as sentences and phrases. It is believed that grammar is processed by various structures of the left frontal cortex, in particular by Broca's area and adjacent anterior regions. Therefore, it can be pointed out that the declarative/procedural model is very similar to other dual-system models; in fact, they have some characteristics in common (cf. Ullman, 2001).

However, according to single-system theories, not only the learning and use of words but also the learning and use of rules are based on a single computational system or a simple processing unit which comprises many interconnected anatomical regions. Moreover, single-system theories do not provide for a distinction between non-compositional and compositional forms, but on the contrary, rules are above all no more than descriptive entities. The system learns step by step the whole statistical structure of the language (cf. Ullman, 2001).

It is not very easy to decide which model to use; there are different tasks which search for lexicon and grammar, but most of them differ considerably. This depends mainly on their use of the two capacities. It is not very easy to join measures of lexical memory with measures of grammatical processing. For that reason, most scientists have focused on the distinction between regular and irregular morphology, which are a well-matched type of linguistic form and therefore are easy to compare. The construction of irregular past-tense forms is not wholly foreseeable, while the construction of regular past-tense forms is entirely predictable. Therefore, the study of irregular/regular forms permits the investigation of the neurocognitive correlates of lexicon and grammar without much effort (cf. Ullman, 2001).

According to most dual-system models, irregular forms are stored in lexical memory, while regular forms are the product of grammatical rules. On the contrary, according to single-system models, the associative memory is the system in which irregular and regular forms are learnt, represented and processed. According to the declarative/procedural model irregular forms are stored in the declarative memory, and the construction of regular forms from their parts happens in real time. The construction of morphologically complex forms requires the parallel activation of the declarative system as well as the activation of the procedural system. In other words, the declarative system attempts to process a form in associative memory, whereas the procedural system attempts to process a form by means of particular rules in real time. As the word formation precedes the memory-based system, i.e. the declarative system sends a signal to the rule-processing system in order to inform the procedural system about the probability of the successful recall of a form from declarative memory. The main function of this signal is to avoid the procedural system carrying out its computation. But if the declarative system is not able to recall a memorized form then the procedural system is activated, and the new word is formed following the particular rules which are needed in order to construct a regular form. Moreover, the activation of the procedural system and the successful construction of a form inhibit the memorization of the regular form in declarative memory (cf. Ullman, 2001).

Separability: according to the declarative/procedural model and other dual-system models, lexicon and grammar are processed by detachable cognitive systems which in part are formed by distinct neural correlates. Moreover, according to these models, there is a double dissociation[3] between the two language abilities (cf. Ullman, 2001).

Computation: according to the declarative/procedural model, language production happens by means of an associative memory system and by means of a symbol-manipulation system. Moreover, according to this model, psychological markers of associative memory (frequency-effects[4] and phonological-similarity effects) are characteristic of memorized lexical items and irregular forms, but not of regular and

[3] A double dissociation takes place when two different tasks produce complementary patterns in behaviour or brain activation, for instance task X is normal in patient A but not in patient B, while task Y is normal in patient B but not in patient A. Task X causes an activation in one brain area but not another, while task Y produces the opposite effect.
[4] Words with a high frequency are remembered better and faster.

other complex linguistic forms, which are computed in real time by way of particular rules (cf. Ullman, 2001).

Domain generality: according to the declarative/procedural model, lexicon and grammar are processed by different systems. Each system is controlled by a set of non-language functions. According to this model, there are associations between learning, representation and processing, and irregular forms, non-compositional lexical items, facts and events, as well as between regular forms, aspects of syntax and other domains of grammar, and motor and cognitive skills (cf. Ullman, 2001).

Localization: This model makes particular neuroanatomical claims; as a matter of fact, according to it, there are connections between the two language capacities and sets of particular brain. These connections happen on the basis of the roles of these structures in the two memory systems (cf. Ullman, 2001).

Aphasia: as we all know, there are two main types of aphasia, namely anterior and posterior aphasia. Anterior aphasia is not only caused by damage to the left frontal regions (Broca's area and adjacent cortex), but also by damage to the basal ganglia and segments of the inferior parietal cortex, whereas posterior aphasia is caused by lesions to the left temporal and temporo-parietal regions. People who suffer from anterior aphasia are agrammatic, and they have an ideomotor apraxia, as well. On the contrary, people with posterior aphasia have impairments in the production, reading and recognition of word sounds and meanings, but they produce more or less syntactically correct sentences and do not leave out morphological affixes, such as "-ed". Patients with posterior aphasia have impairments in non-language domains, too, but they do not have motor deficits. Clinical and neuropsychological studies have shown that people who suffer from anterior aphasia have considerable problems in producing, reading out loud, writing to dictation, repeating and judging regular versus irregular past tense forms, and they have also problems in reading and writing regular compared with irregular plurals. On the contrary, subjects with posterior aphasia have problems in production, reading and judgement of irregular past tenses. Neuropsychological findings associate irregular forms with lexical and non-linguistic semantic memory; and they associate irregular forms with the temporal/temporo-parietal cortex, as well. Moreover, these findings associate regular forms with syntax and motor skills, and they associate regular forms with the left cortex and the basal ganglia, too. This suggests that the declarative/procedural model has clinical implications; and according to this model, it is possible to recover disorders of the grammatical/procedural system through the memorization of complex forms with the aid of the lexical/declarative memory (cf. Ullman, 2001).

Different neuroscientific studies have investigated the acquisition, computation, processing and neural bases of lexicon and grammar, concentrating mainly on irregular and regular morphology. The obtained results confirm the existence of the dissociations and associations which have been predicated by the declarative/procedural model (cf. Ullman, 2001).

3. Neurolinguistics of bilingualism

3.1. Implicit linguistic competence vs. metalinguistic knowledge

The ability to communicate involves different competences:

- Linguistic competence, i.e. phonology, morphology, syntax and lexicon.
- Metalinguistic knowledge, i.e. the conscious knowledge of language facts (form, structure and rules of a language), for instance used to counterbalance the gaps in linguistic competence in later learned languages (cf. Paradis, 2004).
- Pragmatic competence; i.e. the capacity to deduce meaning from discourse and situational context, paralinguistic phenomena and general knowledge, as well as the ability to use language efficiently in order to reach a particular purpose (cf. Paradis, 2004).
- Motivation, i.e. the explicit wish to acquire a new linguistic code so as to communicate. Motivation varies from L2 learner to L2 learner and is modulated by a variety of emotional and sentimental factors (cf. Paradis, 2004).

These competences are fundamental but unfortunately not sufficient for normal verbal communication. They depend on their individual neuronal substrate which is at risk of selective impairments (cf. Paradis, 2004).

The declarative/procedural memory system is fundamental for the study of neurolinguistic aspects in bilingualism, too; and therefore, research in this field is no longer possible without it. Implicit linguistic competence is that form of knowledge which is deduced from an individuals' systematic verbal performance, but in general, the speakers are not aware of the existence of it. In other words, this particular competence is acquired in an unconscious way and stored implicitly; and therefore, it is used involuntarily. While explicit knowledge is that form of knowledge of which individuals are conscious. This form of knowledge is consciously learned and can be recalled on demand in a conscious way. Moreover, explicit knowledge is stored in the declarative memory system. The contents of implicit competence are not known. Explicit knowledge leads to a conscious recall of fact and events; whereas, according to Michel Paradis (2004, p. 10), "implicit competence refers to the change in the subject's behaviour attributable to such an event, without conscious recollection of the event." Therefore, "implicit knowledge has been described as knowing how whereas explicit knowledge is depicted as knowing that". For instance, implicit linguistic competence allows us to use the plural or the past tense marker in the appropriate context (cf. Paradis, 2004).

Individuals who have learned an L2 after the acquisition of their L1 are going to counterbalance the gaps in their implicit competence through the use of metalinguistic knowledge and pragmatics. In other words, the speaker is able to compensate for the gaps in implicit competence through the use of metalinguistic knowledge. Moreover, according to Michel Paradis (2004, p. 11) "there are two systems: one that implicitly internalizes the competence that allows speakers to automatically and unreflectively engage in systematic behaviour, and another that allows them to learn and apply a rule, with considerable interindividual and intra-individual variability in performance." Therefore, (Michel Paradis 2004, p.11), "there are two ways of speaking: using implicit linguistic competence only […];" or "using metalinguistic knowledge only […]", and "the distinction between metalinguistic knowledge and linguistic competence refers to the conscious versus unconscious nature of these representations, though the procedures involved in accessing them are unconscious for both types of representation." These two systems are found in all speakers who have acquired language in a normal way (for instance, comprehension presupposes the concurrent activation of semantic (explicit) memory, which is responsible for lexical recognition, and of implicit memory, which is responsible for grammatical comprehension) and are independently used, but in general, speakers tend to use the implicit system which retrieves information in a faster way (cf. Paradis, 2004). According to Paradis (2004, p. 45), "in acquiring linguistic competence of a second language, it is not the material which constitutes metalinguistic knowledge that is used, worked upon, and eventually transformed or automatized. The point that metalinguistic knowledge does not evolve or change into implicit linguistic competence is fundamental because of its many implications." Therefore, "metalinguistic knowledge remains available as metalinguistic knowledge after implicit linguistic competence has been acquired (and hence it has not been transformed into implicit linguistic competence). We now have two different sources of knowledge: One that remains explicit, another that independently develops in the form of implicit competence. The very nature of what is represented in metalinguistic knowledge differs from what underlies implicit linguistic competence (an explicit rule vs. a set of implicit computational procedures). Metalinguistic knowledge and linguistic competence rely on different memory systems that have separate, anatomically distinct, neural substrates. One does not internalize what one focuses one's attention upon. One cannot "notice" what becomes internalized because it is not there to be noticed". Therefore, it is not possible that explicit memory can be somehow converted or maybe transformed into implicit competence (cf. Paradis, 2004). At the very beginning of the L2 learning process, the learner almost completely relies on metalinguistic competence, but as he improves his L2 competences he relies more and more on implicit linguistic competence. In other words, there is a gradual shift from the use of metalinguistic knowledge to the use of implicit linguistic competence. This does not mean that metalinguistic knowledge has disappeared, but on the contrary, this means that it is simply not generally used. It is not possible that metalinguistic knowledge becomes implicit linguistic competence, as they are stored in two different memory systems. Moreover, it can be pointed out that if an L1 is acquired in a traditional way, implicit linguistic competence develops first and metalinguistic knowledge develops afterwards. On the contrary, in an L2 learner metalinguistic knowledge develops first and implicit linguistic competence develops afterwards. In conclusion, we can remark that the procedural/declarative system plays an important role in the acquisition, use and loss of languages. Implicit linguistic competence is acquired unconsciously, stored in an implicit way and utilized unconsciously, i.e. automatically. Competence is supported by procedural memory, while knowledge is supported by declarative memory. According to neurofunctional, neurophysiological and neuroanatomical findings, metalinguistic knowledge and implicit competence are two separate entities which rely on two different memory sources (declarative vs. procedural). They are supported by different and distinct neuroanatomical structures and neurophysiological mechanisms, i.e. hippocampal system and extensive areas of tertiary associative cortex versus cerebellum, striatum and focalized cortical areas (cf. Paradis, 2004). According to Paradis' theory, the L1 of a bilingual speaker and L2 are stored in separate memory systems.

Pathology has suggested that there is a double dissociation between implicit and explicit memory. Empirical studies have suggested that implicit linguistic competence and metalinguistic knowledge involve distinct neurofunctional systems. Moreover, it was proved that aphasic patients have a deficit in implicit memory for language, but an intact declarative memory system. In fact, aphasic patients have circumscribed lesions in the perisylvian area, i.e. Broca's and Wernicke's area, in parts of the left basal ganglia (neostriatum) and in the right cerebellum. On the contrary, patients with amnesia have a deficit in declarative memory but non in the procedural memory. There are severe lesions in the hippocampal as well as in the parahippocampal gyri and in the mesial temporal lobes. According to various clinical studies on bilingual aphasia, there are patients who had recovered a previously weaker L2 to a greater extent than their L1. This paradoxical recovery is (Michel Paradis 2004, p. 13) "the result of a reduced implicit linguistic competence in the context of available metalinguistic knowledge." There are also aphasic patients who recover their L2 better than their L1. In this case both languages are impaired, but the patient can use his explicit knowledge of L2 which is more extensive than his explicit knowledge of L1 (cf. Paradis, 2004). Furthermore, it has been shown that pathology restricts not only the available choices in grammar (circumscribed left-hemisphere damage – aphasia), in pragmatics (circumscribed right-hemisphere damage – dyshyponoia) and in metalinguistic knowledge, including vocabulary (diffuse bilateral damage – retrograde amnesia), but also reduces the wish to communicate orally (limbic damage – dynamic aphasia). Pathology can also damage the conceptual system which will cause dementia (cf. Paradis, 2004, p. 228).

Motivation and affect can influence not only the success of L2 learning, but also the use of L2. Moreover, a formal teaching method is going to involve the declarative memory system and result in metalinguistic knowledge. If the teaching method and the learning of an L2 set off emotions and therefore provide motivation, then the dopaminergic system is going to be activated which increases the performance of the L2 learner. And if the teaching method is communicative, it will probably involve the procedural memory system. But it is quite clear that "Übung macht den Meister" or practice makes perfect. In other words, practice accelerates controlled processing or favours implicit competence (cf. Paradis, 2004).

3.2. The activation threshold hypothesis

The activation threshold is a physiological process and is found in all higher cognitive representations. So, according to Paradis (2004, p. 28), the activation threshold hypothesis "proposes that an item is activated when a sufficient amount of positive neural impulses have reached its neural substrate. The amount of impulses necessary to activate the item constitutes its activation threshold. Every time an item is activated, its threshold is lowered and fewer impulses are required to reactivate it". Therefore, it is difficult to activate an item which is not stimulated enough, whereas all items which are continuously stimulated are easily activated and need fewer resources to be reactivated. For instance, an intensive use and/or intensive and prolonged exposure to a particular language lower the activation threshold for that particular language. This concept is borrowed from neurophysiology; where every neuronal cell has a critical threshold which must be reached in order to generate an action potential. So, it can be said that the activation of linguistic items occurs as soon as the neurons (i.e. groups of neurons which are interconnected and form neuronal circuits) involved in the representation of these items have reached the activation threshold, but if the activation threshold has not been reached, there is no action potential (all-or-none). It can be hypothesised that the mechanisms involved in the activation of neurons and those involved in the transmission of signals are also involved in linguistic representations (cf. Paradis, 2004).

3.3. Lateralization and localization of the language system in bilinguals

Various scientists (Sussman, Franklin & Simona, 1982; Albanèse, 1985; Vaid & Hall, 1991; Evans et al., 2002 etc.) state that in bilinguals the language system is less lateralized than in monolinguals, but according to Paradis and other scientists, this is not the case. Furthermore, according to Paradis, the experimental psycholinguistic methods which range from dichotic listening to time sharing used for investigating the lateralization of the language system in bilinguals are not adequate. In fact, according to him (2004, p. 116) "if these testing procedures were sensitive to anything other than the language system, such as pragmatics, they would be considered invalid since their purpose is to measure language". According to him (cf. Paradis, 2004), it is quite doubtful that the use of stimuli such as digits, isolated syllables or single words without context could be used for investigating pragmatics or for proposing models of language lateralization in bilinguals. As a matter of fact, there is no experimental or clinical evidence whatsoever that proves that language is less asymmetrically represented in bilinguals. There is no difference between bilinguals and monolinguals (cf. Paradis, 2004).

In the past, various scientists ranging form Pitres to Penfield stated that in bilinguals or polyglots the two languages are not "localized" in two distinct centres. But nowadays more and more scientists are convinced that they are represented in a different way and localized in separate anatomical sites. There are mainly five hypotheses which try to explain how representations of two or even more languages are organized in the human brain, namely the extended system hypothesis (the languages of the speaker are not differentiated in their representations and the many elements which form the languages are processed as allo-elements), the dual system hypothesis (the two languages of a bilingual speaker are represented independently in two different systems), the tripartite system hypothesis (the items which are identical in the two languages are represented in one distinct neural substrate which is common to the two languages, while those elements which are different are represented independently in two separate systems), the subsystems hypothesis (the bilingual speaker has two subsets of neuronal connections, one for language A and one for language B, which are located within the SAME cognitive system, i.e. the language system) (cf. Paradis, 2004) and the neuron assemblies hypothesis. According to Fabbro (1999), the best theoretical hypothesis is the neuron assemblies hypothesis proposed by the Canadian psychophysiologist Donald Hepp. According to Hepp's theory, cortical neurons are inclined to connect reciprocally during the execution of a particular linguistic function, such as word recognition. This reciprocal connection forms a closed multicircuit system (neuron assemblies). A long-lasting activation of a particular amount of neurons (for instance, during the execution of a particular linguistic task) increases the transmission of information between those neurons. Every time a group of neurons is activated, its threshold is lowered and fewer impulses are needed to reactivate it (activation threshold hypothesis). There are also inhibitory cells in these neuronal assemblies which activate and mediate the activity of the circuit. If there were not any, once activated it would continuously fire electrical impulses (Fabbro, 1999). These neuronal assemblies or units of neurons permit us to describe and study the anatomical and physiological level of a neurofunctional module.

According to Paradis (2004), the fourth hypothesis (subsystems hypothesis) is not only compatible with all models of recovery, but also with the ability of a bilingual speaker to combine languages at every level of linguistic structure. According to the subsystems hypothesis, parallel impairment can be explained as the result of damage to the linguistic system as a whole or as the result of interference with it, whereas differential impairment is the result of greater damage to one of the subsystems or the result of interference with it. Every language (seen as a subsystem) can be hit by particular pathological processes. Healthy bilinguals are able to alternate the use of elements of one or the other linguistic subsystem (code-switching) or they could use them almost simultaneously (code-mixing). The frequency of code-switching and code-mixing permits us to understand how the human brain processes the two languages. In conclusion, we can point out that the two languages used by bilingual speakers are not represented and processed in two distinct anatomical regions in the brain. But on the contrary, it seems that the two languages are represented as separate micro-anatomical subsystems which are located in the SAME gross anatomical areas. As previously seen, L2 speakers who have gaps in their implicit linguistic competences rely more than monolinguals on metalinguistic knowledge and pragmatics. As a matter of fact, they are used as compensatory strategies. It must be highlighted here, that implicit linguistic competence is not represented in neuro-anatomical areas which are out of the classical language areas, but rather in distinct micro-anatomical areas which form neurofunctional subsystems supported by dedicated neuronal circuits (cf. Paradis, 2004).

3.4. Paradis' theory of neurofunctional modularity

Paradis hypothesises that five neurofunctional mechanisms are directly involved in language use, namely:

1. The portion of the cognitive system which is responsible for formulating the message that has to be verbalized and for decoding the message that has to be understood (cf. Paradis, 2004).
2. The implicit linguistic competence system that is responsible for grammar (phonology, morphology, syntax and semantics) (cf. Paradis, 2004).

3. The metalinguistic system that controls whether a sentence that has to be produced is correct or not and that in particular conditions supplies knowledge of surface structures that have to be implemented or understood (cf. Paradis, 2004).
4. The pragmatic system, that is responsible for choosing the most suitable linguistic and paralinguistic elements for the message that is going to be communicated and that is responsible for deducing the interlocutor's intention by analyzing the context of the utterance (cf. Paradis, 2004).
5. The motivational system, that keeps communication alive (cf. Paradis, 2004).

Every system forms a neurofunctional module, and they are components of larger units. Moreover, they are isolated, autonomous, domain specific and purposeful, but they can also be interactive. This interaction between the various neurofunctional modules allows the execution of complex tasks. Their activity does not modify the character of their computational procedures. Neurofunctional modules operate in parallel or in rapid succession; they receive inputs and send outputs, and the output of one module is going to be the input of the other module. The internal structure of each module is not influenced or modified by the activity of other modules. But once they interact, one module chooses the items which are going to be processed by another module. The selected items are not manipulated, i.e. their internal structures are not modified. Neurofunctional modularity is not only representational modularity[5] but also process modularity[6]. We still do not know if implicit linguistic competence is innate or not, but this is not an essential characteristic for the language module. It could be that the characteristics of these modules are genetically programmed or developed by means of experience. Neurofunctional modules are formed by the neuronal substrates which have not to be anatomically contiguous, since the several components are linked and work as a large unit, and the mechanisms which regulate the neural activity are the same for all

[5] A neuronal based trace must be available which can be successively activated but also retained, for instance the neuronal based trace is retained when we sleep, but activated in the next morning so that we can speak without having to acquire language again.

[6] Every single neurofunctional module is processed following the universal rules of procedural or declarative memory.

modules. According to Paradis (2004, p. 150-151), "the neurofunctional system for language (i.e. the neural substrates of implicit computational procedures that constitute linguistic competence) contains modules (e.g. phonology, syntax), each of which has its own internal organization (in accordance with its general principles, i.e. the general principles of phonology and of syntax, respectively); for each subsystem of the language neurofunctional system (i.e. for each specific language, e.g. German, Italian) these principles are proceduralized in accordance with the parameters of that particular language subsystem." According to Paradis, the two or more language subsystems are not placed in two or more distinct gross anatomical regions, but instead they are represented as separate micro-anatomical subsystems which are located in the same gross anatomical areas (cf. Paradis, 2004). The existence of two separate subsystems has been confirmed by the detection of double dissociation which can be caused by pathology (for instance, the patient is able to understand but not speak or the patient is able to write but not to read or vice versa) and by antagonistic inhibition in order to avoid interference between the different subsystems through the modification of the activation threshold of one subsystem (cf. Fabbro, 1999; Paradis, 2004). The concept of subsystems could be applied to all other cognitive functions. The best candidates for neurofunctional modularity are without doubt all those cognitive functions which are somehow linked to procedural memory. But clinical studies have proved that also those cognitive functions which are linked to declarative memory could become components of neurofunctional modularity (cf. Paradis, 2004). According to Paradis (2004, p. 151), there is no central executive and "[…] the intuitive feeling of a unitary self that wills an action may simply be a subjective impression corresponding to the implicit summation of multiple decisions arrived at by various independent domain-specific computations".

3.5. Bilingual aphasia, recovery patterns & rehabilitation

In a bilingual individual a pathological process that damages the brain regions involved in language processing may cause the loss of all spoken languages, and he or she may exhibit the same type of aphasia in all languages. There are six different ways in which bilingual individuals with aphasia may recover their languages: parallel, differential, successive, selective, blended and antagonistic (cf. Paradis, 2004; Fabbro, 1999).

Parallel recovery: all languages are recovered at the same time and to the same extent (cf. Paradis, 2004). If a bilingual individual was more fluent in one of his languages before brain damage, this would also be the case after brain damage. As a matter of fact, the bilingual individual will get a higher score in that language which had been the stronger one before the damage (cf. Paradis, 2004).

Differential recovery: one language is recovered much better than the other (cf. Paradis, 2004).

Parallel recovery and differential recovery are two forms of synergistic recovery. In fact, the recovery of one language goes together with the recovery of the other language. On the contrary, antagonistic recovery takes place when the two languages are not simultaneously available. In other words, at the beginning only one language could be used by the patient, but as soon as the recovering process of the second language takes place or goes on, the language which was recovered first gradually regresses or disappears. But if there is a continuous switch between available and unavailable languages we speak of alternating antagonism (cf. Paradis, 2004).

Blending recovery: takes place when the patient unconsciously mixes his two languages and is not able to consciously use only one linguistic code at a time (cf. Paradis, 2004).

Selective aphasia: presence of aphasic symptoms in only one language without quantifiable deficits in the other language or languages (cf. Paradis, 2004).

Selective recovery: both languages are affected, but only one language is so severely impaired that it remains unavailable (cf. Paradis, 2004).

According to Paradis, there are three questions which have to be asked in relation to recovery patterns (Paradis, 2004, p. 68): "(1) what brain mechanism makes these various patterns possible? Assuming that we have an answer to this question, (2) what determines that a given patient undergoes one type of recovery, and another patient a different one? And, once the other two have been answered, (3) assuming that a patients exhibits a selective recovery, why is one language (say, English) preserved rather than the other (say, Japanese)?"

Various clinicians tried to answer these questions. Ribot (cited in Paradis, 2004, p. 69) had observed that the L1 was usually the language which was recovered first or in a much better way than the other languages. In fact, he hypothesised that (Paradis, 2004, p. 69) "the oldest memories are the most resistant to pathology." Pitres (cited in Paradis, 2004, p. 69) pointed out that "the native language was usually also the most familiar to the patient, and when this is not the case, patients recover the most familiar language before or better than their mother tongue." But according to Minkowski (cited in Paradis, 2004, p. 69), a patient recovers in a much better way the language to which he had been more affectively tied. On the contrary, other clinicians such as Goldstein and Bay (cited in Paradis, 2004, p. 69) proposed, that a patient recovers first and in a much better way the language which is the most useful to him or to her. By the way, Pitres was also the first clinician who tried to explain the mechanisms of differential recovery and of selective recovery. According to him, selective recovery could not be possible if each language is localized in a different anatomical site. Therefore, he suggested that selective recovery was the effect of a physiological inhibition of one of the languages and not the consequence of a physical demolition of the neural substrate involved in language processing. According to him, a temporarily physiological inhibition would cause a successive recovery, while a permanent physiological inhibition would cause a selective recovery. According to Paradis, the most plausible hypothesis is the one proposed by Green (cited in Paradis, 2004, p. 69). Green believes that this could be explained in terms of control over limited resources. This plays an important role in the inhibition of one language or the other. In fact (Paradis, 2004, p. 69), "in the activation threshold hypothesis, this inhibition is viewed as subject to degree (commensurate with variable amounts of available resources) rather than as an absolute on/off phenomenon." As a matter of fact, a permanent inhibition causes selective recovery; a temporary inhibition may produce a sequential recovery, while an alternating inhibition causes an antagonistic recovery. Furthermore, a greater inhibition of a particular language produces a differential recovery, whereas a loss of inhibition causes blinding (cf. Paradis, 2004, p. 69).

Clinical studies have reported that there are patients who have recovered one of their languages sooner or better than the other. But there are also clinical studies which have reported a paradoxical recovery of a particular language, for instance there are patients who have had a better recovery in the language which they did not speak not so well before their stroke. As previously mentioned, implicit linguistic competence and metalinguistic knowledge are two independent systems which are controlled by two different cerebral mechanisms. Moreover, they are represented and processed in different and separate cortical regions. Therefore, it seems very plausible that there may be patients who have lost access to parts of their implicit linguistic competence, but not to their metalinguistic knowledge. As previously discussed, at the very beginning of the L2 learning process, the learner almost completely relies on metalinguistic competence, but as he improves his L2 competences he relies more and more on implicit linguistic competence. Moreover, it can be pointed out that if an L1 is acquired in a traditional way, implicit knowledge develops first and metalinguistic knowledge develops afterwards. On the contrary, in an L2 learner metalinguistic knowledge develops first and implicit linguistic competence develops afterwards. L1 is acquired implicitly during infancy, but the child may later get some metalinguistic knowledge at school. Therefore, it can be stated, that speakers with an extremely low level of education have little metalinguistic knowledge about their L1 (cf. Paradis, 2004). On the contrary, speakers with a very high level of education in their L1 have a more extensive metalinguistic knowledge of it (cf. Paradis, 2004). According to Paradis, this is also valid for the learning process of an L2; in fact (Paradis, 2004), a very formal teaching method, enhances metalinguistic knowledge about L2. As previously mentioned, non-parallel recovery may be caused by mechanisms of inhibition/disinhibition. This inhibition/disinhibition has an effect on the neuronal substrate which controls linguistic competence. Therefore, the so called "paradoxical recovery", is caused by the use of compensatory strategies, i.e. by the use of the metalinguistic knowledge of the foreign language. In such patients, implicit linguistic competence is impaired in both languages, but metalinguistic knowledge is not; and therefore, metalinguistic knowledge regarding the foreign language is available (N.B. a foreign language is learned in a more formal way than the L1), and the patient can use it (cf. Paradis, 2004).

We expect that damage to the classical cortical language areas causes language deficits, but does not impair the declarative memory. Clinical studies have reported that patients with damage to the classical cortical language areas have a major language deficit, but they do not have an impairment of their declarative memory; therefore, they remember events distinctly, even those regarding their performance on different tasks which had been done the previous day (cf. Paradis, 2004).

Furthermore, it has been proved that an adult L2 speaker can retrieve language data from two separate sources, namely declarative and procedural memory. These two systems can be damaged or impaired by different pathological processes, causing aphasia when affecting implicit linguistic competence or amnesia when affecting explicit metalinguistic knowledge. This allows us to distinguish between (1) spontaneous language recovery induced by disinhibition of procedural competence and (2) ability to control production which happens through the use of metalinguistic knowledge. In other words, in this case, metalinguistic knowledge is used as a compensatory strategy which relies on preserved explicit memory. So, aphasia is the result of the disintegration of linguistic competence or of the automatic use of it. Metalinguistic knowledge is acquired by means of a formal instruction; and therefore the patient must have access to his metalinguistic knowledge which is used as a substitute for linguistic competence. The same process is done by an L2 learner during the initial phases of formal language instruction that uses metalinguistic knowledge as a substitute for linguistic competence (cf. Paradis, 2004).

As a matter of fact, non-standard dialects which do not have a standard written form are acquired in an implicit way, and therefore metalinguistic knowledge is not used very much by the native speaker. But very often, speakers of non-standard dialects learn another language (L2) in school. In general, those two languages are somehow related; in fact, the L2 is very often a related standard language, for instance Tyrolean/Standard German or Walser/Standard German etc. The L2, i.e. the standard language is taught in school in an explicit way; therefore, the speaker develops some metalinguistic knowledge of the standard language. As we know, aphasia is caused by damage to procedural memory (i.e. implicit linguistic competence) and is attributable to a focal cortical lesion. On the contrary, metalinguistic knowledge is controlled by a different neural system; and therefore can be used by the patient without much effort. A speaker of a non-standard dialect who has learned the standard language in an explicit way in school possesses much more metalinguistic knowledge of his L2 than of his L1. This concept can also be extended to a bilingual speaker who has learned a foreign language in a formal way. It is rather clear that in a patient with aphasia the implicit linguistic competence for both languages or dialects are impaired to the same extent. Whereas metalinguistic knowledge, that had been achieved during the L2 learning process has been spared and is therefore available (cf. Paradis, 2004). As the amount of metalinguistic knowledge in the non-native standard or in the foreign language is much greater than the metalinguistic knowledge in the L1, it seems that the patient has recovered his non-native language better (cf. Paradis, 2004).

There is another contradiction which has to be mentioned: it seems that the structural distance between two languages does not influence the recovery of a language, but on the contrary, it seems that the structural distance between two languages could predict the benefits which would be achieved by means of the transfer of therapy benefits from the treated to the untreated language. Various studies have suggested that the maximum transfer happens mainly in those areas where the two languages are closest from a structural point of view, but it has to be mentioned that patients recover either both or only one of their languages in a spontaneous way, independently of their structural distance. But we have to remember that aphasia damages implicit linguistic competence, and that speech and language therapy uses explicit strategies to increase the declarative metalinguistic knowledge (cf. Paradise, 2004).

We all know that normal ageing alters our memory system; as a matter of fact normal ageing impairs declarative memory more than procedural memory. According to various clinical reports, it seems that older aphasic patients have bigger problems with their later-acquired language. In fact, Obler and Albert (cited in Paradis, 2004, p. 87) reported, that young and middle-aged aphasic patients recovered their most familiar L2 in a better way than elderly aphasic patients. This is ascribable to the fact that the declarative memory system which is involved in language is age-sensitive; in other words, the declarative memory system is easily impaired by the normal physiological ageing-process (cf. Paradis, 2004).

Nowadays, we still do not know if speech and language therapy in bilingual aphasic patients has some kind of beneficial result on the non-treated language; but in the case it should have, we do not know in what proportion, in what manner and in what circumstances it applies (cf. Paradis, 2004).

Most neurolinguists are of the opinion that a simultaneous speech therapy in the two languages spoken by the patient before damage inhibits speech recovery, and in the worst case, can impede the recovery of all languages used before damage (cf. Paradis, 2004).

In general, speech and language therapy in bilingual aphasics brings up various problems; in fact, it is not easy to decide which language should be treated first. Some scientists propose that the first language to be treated should be the mother tongue. Others indicate that the speech and language therapist should first treat the language which appears in a spontaneous way. Lebrun (cited in Paradis, 2004, p. 90) proposes "that if the patient lives in a bilingual environment, it would be desirable for his interlocutor to use only the patient's best recovered language." (cf. Paradis, 2004).

It has been reported that therapy in the L2, which in this case has to be the language spoken in the patient's environment, has not only a positive effect on the non-treated native language but also on the treated one (cf. Paradis, 2004).

According to Paradis (2004, p. 93), "it is *possible* for therapy to be effective in only one of a patient's languages and not in the other, even though at onset of therapy both languages present the same qualitative and quantitative picture (i.e. the same symptoms to the same degree). Hence, if therapy shows no effect in one language, that does not mean that it should not be attempted in the other."

4. Sardinian languages

The linguistic situation in Sardinia is characterized by a particular form of bilingualism, which is bilingualism with diglossia. In fact, most of the inhabitants of the island of Sardinia use Italian as their official language (offices, university, schools and so on), whereas Sardinian is used in particular and limited situations (family and friends) and is therefore the informal language. Moreover, Sardinian is not taught in School, so it is acquired implicitly and not explicitly. Therefore, most L1 Sardinian speakers are illiterate in their L1.

This situation is the result of a particular condition which has affected Sardinia ever since: Sardinia had been colonized by many different countries for more than 500 years, and therefore Sardinian could never evolve properly and become a standard language. In fact, in Sardinia, there are many varieties of Sardinian, but unfortunately, there is no standard Sardinian language.

There are various forms of linguistic varieties in Sardinia, namely (cf. Fig. 8):

1. Standard Italian
    a) Regional Italian
2. Sardinian Language
    a) Logudorese (subregional variety)
    b) Campidanese (subregional variety)
    c) Logudorese (local variety)
    d) Campidanese (local variety)
3. Gallurese
4. Sassarese
5. Algherese-Catalan
6. Carlofortino-Tabarchino

There are various forms of Logudorese, namely Central Logudorese, Southern Logudorese and Northern Logudorese. Central Logudorese is the most archaic and conservative form of Sardinian, for instance the Central Logudorese the voiceless occlusive consonants are maintained, whereas in the other varieties of Logudorese they are transformed into fricatives.

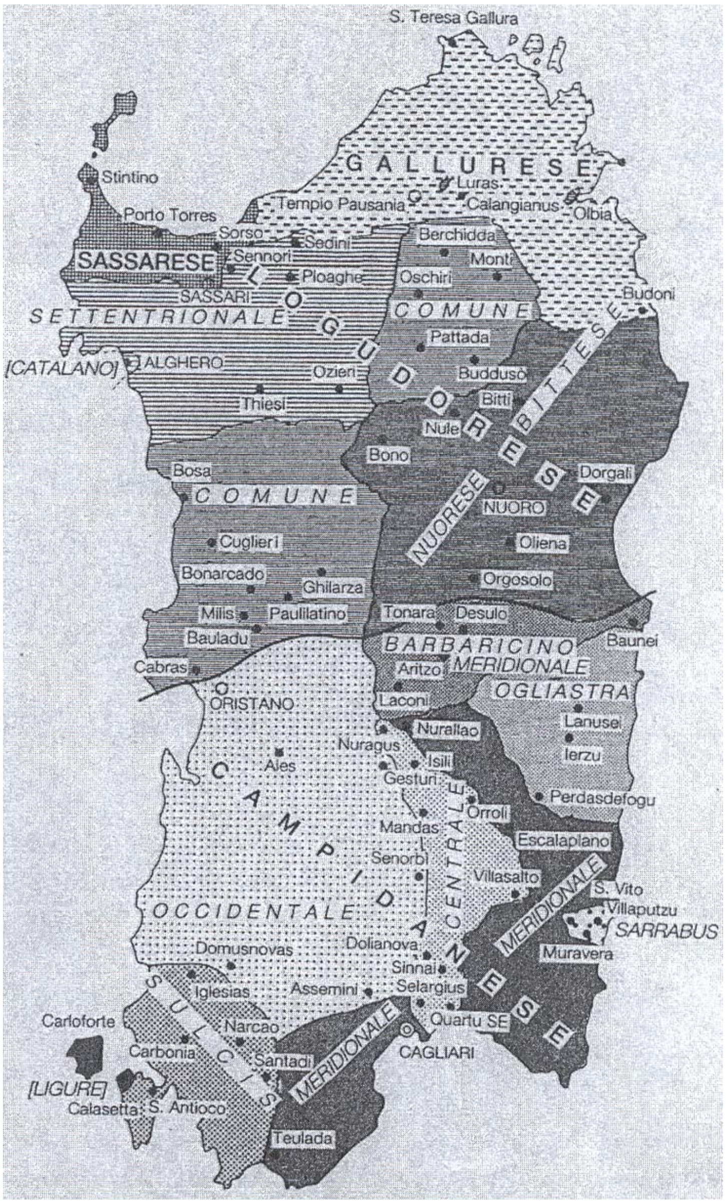


Figure 8: Classification of Sardinian dialects. (Source: Ferrer, 1984).

5. Aims of the research and hypothesis

According to the "Associazione Italiana Afasici", there are about 150,000 aphasic patients in Italy, and every year 20,000 new cases of aphasia. This pathological process is devastating; in fact, aphasic patients have lost that feature which makes us unique, namely speech and language. Since, the first case of aphasia described by the French physician Paul Broca, science has made great strides.

According to various neuroscientists, the declarative and procedural memory systems are fundamental for the study of neurolinguistic aspects not only in monolinguals but also in bilinguals. As a matter of fact, implicit linguistic competence, for instance, which is responsible for grammatical comprehension relies on procedural memory. This type of knowledge is stored and retrieved in an unconscious way. On the contrary, metalinguistic knowledge, for instance, which is responsible for semantics and all forms of knowledge, that are learnt in an explicit way, i.e. consciously, whether at school or by means of self-learning rely on explicit or declarative memory. We can describe implicit knowledge as knowing how, whereas we can describe explicit knowledge as knowing that. For instance, an individual who has learnt an L2 after the acquisition of his L1 is going to counterbalance the gaps in his implicit competence through the explicit use of metalinguistic knowledge and pragmatics. Furthermore, it must be pointed out, that metalinguistic knowledge never becomes implicit linguistic competence. This is not possible, because these two forms of knowledge rely on two different memory systems. At the very beginning of the L2 learning process, the L2 learner almost completely relies on metalinguistic knowledge, but as he improves his L2 competences he more relies and more on implicit linguistic competence; there is a gradual shift from the use of one memory system to the use of the other memory system, but not a "transformation" of the explicit memory into implicit memory. According to Paradis' theory, the L1 of a bilingual speaker and his L2 are stored in separate memory systems. We share the same opinion as Paradis. Pathology has revealed that there is a double dissociation between implicit and explicit memory; as a matter of fact, they involve distinct neurofunctional systems. Moreover, it was shown that aphasic patients have a deficit in implicit memory for language, but an intact memory system. There are aphasic patients who recover their L2 better than their L1. In this case both languages are impaired, but the patient can use his explicit knowledge of L1.

Some scientists (Sussman, Franklin & Simona, 1982; Albanèse, 1985; Vaid & Hall, 1991; Evans et al., 2002 etc.) claim that in bilinguals the language system is less lateralized than in monolinguals. But according to Paradis and other scientists, this is not the case. This has never been proved. Also according to us, this is not very plausible. In fact, we believe that there is no difference between monolinguals and bilinguals. Other neuroscientists believe that in bilinguals the two languages are localized in two distinct centres. There are mainly four hypotheses which try to explain how two or more languages are organized in the brain, namely extended system hypothesis (the languages of the speaker are not differentiated in their representations), the dual system hypothesis (the two languages of a bilingual speaker are represented independently in two different systems), the tripartite system hypothesis (the items which are identical in the two languages are represented in one distinct neural substrate which is common to the two languages, while those elements which are different are represented independently in two separate systems), the subsystems hypothesis (the bilingual speaker has two subsets of neuronal connections, one for language A and one for language B, which are located within the SAME cognitive system, i.e. the language system). According to most neuroscientists, the fourth hypothesis or the subsystems hypothesis is not only compatible with all recovery models, but also with the ability of the bilingual speaker to combine languages at every level. Also according to us, this theory is the most plausible one. Paradis hypothesises that five neurofunctional mechanisms are directly involved in language use, namely the part of the cognitive system which is responsible for the formulation of the message, implicit linguistic competence, the metalinguistic system, the pragmatic system and the motivational system. Every system forms a neurofunctional module, and they are components of larger units. The interaction between these modules permits the execution of a complex task, such as speech and language. The existence of two separate subsystems has been suggested by the detection of double dissociation, which is normally caused by a pathological process.

We hope that our study could be a positive contribution to neuroscience and to neurolinguistics to help us to understand how our brain processes speech and language.

The second aim is to adapt Paradis' Bilingual Aphasia Test to Sardinian. It is very important that all languages of a person with aphasia are assessed with an equivalent instrument, not a simple translation of a standardized test from another language. As a matter of fact, the assessment of only one language is not enough, and in the worst case, the assessment of only one language can even cause negative social and/or clinical results. The assessment of both languages by means of a standardized bilingual psychometric test allows to compare the two languages and to ascertain which language is impaired and which recovers first and best. Based on the results obtained by the assessment of both languages, the clinician together with the patient's family can decide which language should be treated. The data obtained through the use of the BAT permits us not only to correlate the patient's recovery patterns to various factors, such as acquisition and use of the languages but also to understand how language is organized in the brain. Therefore, those factors which are important for research on the neurofunctional organization of a bilingual's brain are not only useful to the clinicians in order to make a better diagnosis, but also to the speech and language therapists in order to treat the impaired language in a much better way.

6. Materials and Methods

If an individual suddenly loses the ability to speak and/or to comprehend language, or if he begins to make many errors while speaking then we can be rather sure that the subject is affected by aphasia. In general, aphasic subjects have many other concomitant neurological problems, such as right-sided hemiparesis or hemiplegia, single or repeated episodes of loss of consciousness, loss of the visual capacity of the right visual field and so on (cf. Fabbro, 1999).

When the patient is admitted to a Neurological Unit or Stroke Unit, the presence or absence of a linguistic disorder is first assessed through the evaluation of spontaneous speech. The purpose of this first informal dialogue is that to find out whether the patient speaks fluently or non-fluently. Moreover, it has also the function of detecting errors in expression, such as anomia, semantic paraphasia and verbal paraphasia. If the patient speaks fluently, it can be expected that the patient will not have only difficulties in understanding verbal orders or questions, but will also make many errors, such as phonemic paraphasia and neologisms (cf. Fabbro, 1999). But on the contrary, if the patient speaks non-fluently, it can be expected that he does not only make errors in word articulation, but that he also makes errors in phoneme substitution and in the grammatical construction of sentences.

After this rough evaluation of the patient's preserved and damaged language abilities, the patient's language skills are going to be studied by means of different standardized psychometric tests. In this case, the most important target which has to be reached is that of describing the patient's language deficit in an objective and detailed way. In fact, a detailed and objective examination of the patient's language deficit permits the assessment of the patients' recovery pattern. A sheer clinical description of an aphasic disorder is not enough, as it is based on the personal skills of the clinician (cf. Fabbro, 1999).

The two most important standardized psychometric tests used in Italy to assess the linguistic abilities in Italian aphasic patients are:

- "Esame del Linguaggio II" (Ciurli, Marangolo, Basso);
- Italian version of the "Aachener Aphasie Test – AAT (Huber, Poeck, Weniger and Willmes).

We used the following psychometric tests to assess the linguistic abilities of our patient:

- The "Esame del Linguaggio" by Ciurli, Marangolo, Basso.
- The Bilingual Aphasia Test by Michel Paradis (McGill University – Canada):
  - ❖ BAT Italian version by Paradis, M., Baruzzi, A. & Canzanella, M.A.
  - ❖ BAT Italian/Sardinian version by Paradis, M., Zanetti, D. et al. (to appear). Bilingual Aphasia Test (Sardinian-Italian Version). Mahwah, NJ: L.E.A.

6.1. The "Esame del Linguaggio II"

The "Esame del Linguaggio" comprises various parts for the evaluation of the patient's oral and written language abilities, such as spontaneous speech, denomination and comprehension, repetition, reading and writing (dictation). All stimuli have been selected according to the actual knowledge of the functional organization of the lexical system, and they have been selected according to the following parameters:

- Parts of speech (noun, verbs).
- Frequency of use:
  a. Nouns: high frequency ≥ 30/million; mean frequency ≤ 20/million;
  b. Verbs: high frequency ≥ 100/million; mean frequency ≤ 100/million.
- Length (short =4/6 phonemes; long > 6 phonemes.

All stimuli are in black and white, and according to the healthy subjects, they are easy to recognize and are not ambiguous. Words belonging to the following semantic groups were used for the semantic comprehension task: animals, fruit, clothes and means of transport.

The "Esame del Linguaggio" evaluates the different aspects of oral and written language by means of the following tasks:

- **Verbal expression task**:
    a) Description of a complex scene: the patient is asked to describe a scene in a detailed way. This task assesses the communication skills, as well as the error types made by the aphasic patient. The scene comprises five hidden elements which the patient has to identify and describe. For every correct item the patient is given max. two points (10 is the highest obtainable score). The following error types are considered: no-answer (NR), anomia (A), semantic paraphasia (PS), non-correlated paraphasia (Pnc), phonemic paraphasia (PF), neologism (N), paraphasic jargon (GP), neologistical-phonological jargon (GFN), recurrent expressions (ER), conduit d'approche (C d'a), articulatory difficulties (DA), agrammatism (Agr), echolalia (E) and perseveration (P).
    b) Naming (nouns): the patient is asked to name simple objects when shown their picture (20 pictures placed on cardboards).
    c) Naming (verbs): the patient is asked to name common actions (10 pictures placed on cardboards).
- **Oral comprehension task**:
    a) Comprehension of words: the patient is asked to match figures with words. The words are dictated by the examiner and the pictures (20) are all placed on the same sheet of paper.
    b) Semantically related words: the patient is asked to match figures with words. The words are dictated by the examiner and the pictures (20)

are all placed on the same sheet of paper. The words belong to four semantic groups (animals, fruit, clothes and means of transport).

c) Sentences: the patient is asked to carry out particular commands (10 commands).

- **Repetition of**:
    a) Words: these are the same words used in the naming task of nouns.
    b) Neologisms: the patient is asked to repeat senseless invented words.
    c) Sentences.
- **Writing task** comprises: naming of nouns, naming of verbs and naming of a complex scene (the material used in the writing task is the same used in the verbal expression task)
- **Reading comprehension task**:
    a) Words: the patient is asked to read words which are placed on cardboards and to point to the equivalent picture (20 items).
    b) Semantically related words.
    c) Sentences.
- **Reading aloud**: words, sentences and neologisms.
- **Dictation:** words, sentences and neologisms.
- **Coping:** words.

6.2. Bilingual Aphasia Test (BAT)

According to Paradis (2004, p. 94): "all languages of a person with aphasia must be assessed with an equivalent instrument, not a simple translation of a standardized test from another language." In Paradis' opinion, the assessment of only one language is not enough, and in the worst case it possibly will have negative social and/or clinical results. The assessment of both languages by means of a standardized bilingual psychometric test allows us to compare the two languages and to ascertain which language is impaired and which recovers first and best. Based on the results obtained by the assessment of both languages, the clinician together with the patient's family can decide which language should be treated (cf. Paradis, 1999).

The data obtained through the use of the BAT permits us not only to correlate the patient's recovery patterns to various factors, such as acquisition and use of the languages but also to understand how language is organized in the brain. Therefore, those factors which are important for research on the neurofunctional organization of a bilingual's brain, are not only useful to the clinicians in order to make a better diagnosis, but also to the speech and language therapists in order to treat the impaired language in a much better way (cf. Paradis, 1999).

The principal aim of the BAT is not that to make a distinction between speech and language disorders and other cognitive disorders, such as dementia, psychosis etc., but rather to find out which language or language abilities are impaired or best preserved or recovered. The BAT could also be used to make a distinction between the different aphasic syndromes (cf. Paradis, 1999).

In general, there are no neuropsychological tests available by means of which all speech and language abilities can be assessed. A neuropsychological test should give a general overview of those cognitive functions involved in speech and language; but the most important feature of a neuropsychological test is that it should be carried out easily and quickly. The BAT examines linguistic performance in all four modalities (hearing, speaking, reading and writing), in almost all linguistic levels (phonological, morphological, syntactic, lexical and semantic) and linguistic tasks/skills (comprehension, repetition, judgement, lexical access, propositionizing) at the level of the word, the sentence and paragraph, and at different levels of spontaneity (Paradis, 2004). As we have seen right now, the test examines those speech and language abilities which are likely to be impaired by a pathological process, such as aphasia. It contains sufficient items to eliminate almost completely the effects of variability (cf. Paradis, 1999).

The aim of the BAT is not that of examining functional communication, but that of examining the patient's speech and language abilities in both languages and the patient's residual implicit linguistic competence. The BAT assesses the patient's ability to communicate by means of pure linguistic elements only, i.e. the patient's ability to use paralinguistic or non-linguistic elements is not assessed here. In other words, what is assessed is the implicit linguistic part of communication competence.

Subtest and number of items	**P**	**M**	**S**	**L**	**S**
Spontaneous speech 18-22, 514-539	**X**	**X**	**X**	**X**	**X**
Pointing 23-32				**X**	
Orders 33-47			**X**	**X**	
Verbal auditory discrimination 48-65	**X**			**X**	
Comprehension of syntactic structure 66-152			**X**		
Semantic categories 153-157				**X**	**X**
Synonyms 158-162				**X**	**X**
Antonyms 163-172				**X**	**X**
Grammaticality judgment 173-182			**X**		
Semantic judgment 183-192					**X**
Repetition of words 193-251	**X**			**X**	
Lexical decision 194-252				**X**	
Sentence repetition 253-259			**X**		
Series 260-262					
Verbal fluency 263-268				**X**	
Naming 269-288				**X**	
Sentence construction 289-313			**X**		
Semantic opposites 314-323				**X**	**X**
Derivational morphology 324-333		**X**			
Morphological opposites 334-343		**X**			
Description of a story 344-346, 504-565	**X**	**X**	**X**	**X**	**X**
Mental arithmetic 347-361					
Text listening comprehension 362-366					**X**
Reading words aloud 367-376	**X**			**X**	
Reading sentences aloud 377-386			**X**		
Text reading comprehension 387-392					**X**
Copying of words 393-397				**X**	
Dictation of words 398-402				**X**	
Dictation of sentences 403-407			**X**	**X**	
Word reading comprehension 408-417				**X**	
Sentence reading comprehension 418-427			**X**		
Spontaneous writing 813-835		**X**	**X**	**X**	**X**

Table 2: Assessed linguistic level (P: Phonology, M: Morphology, S: Syntax, L: Lexicon and S: Semantics).

What the patient is doing with language depends mostly on the degree of his knowledge (whether implicit or explicit) about it. Linguistic competence is essential for the sheer act of communicating. Therefore, the BAT examines implicit knowledge of grammar of every language spoken by the patient. Furthermore, the BAT does not assess the degree of language mixing which is used by the patient as a communication strategy, but rather the patient's ability to use every language in a monolingual context (cf. Paradis, 1999).

Subtest and number of items	**C**	**R**	**J**	**L**	**S**	**Re**	**W**
Spontaneous speech 18-22, 514-539				X	X		
Pointing 23-32	X						
Orders 33-47	X						
Verbal auditory discrimination 48-65	X						
Comprehension of syntactic structure 66-152	X						
Semantic categories 153-157				X			
Synonyms 158-162				X			
Antonyms 163-172				X			
Grammaticality judgment 173-182			X				
Semantic judgment 183-192			X				
Repetition of words 193-251		X					
Lexical decision 194-252			X				
Sentence repetition 253-259		X					
Series 260-262			X				
Verbal fluency 263-268				X			
Naming 269-288				X			
Sentence construction 289-313					X		
Semantic opposites 314-323				X			
Derivational morphology 324-333				X	X		
Morphological opposites 334-343				X	X		
Description of a story 344-346, 504-565				X	X		
Mental arithmetic 347-361				X			
Text listening comprehension 362-366	X						
Reading words aloud 367-376						X	
Reading sentences aloud 377-386						X	
Text reading comprehension 387-392	X					X	
Copying of words 393-397							X
Dictation of words 398-402	X						X
Dictation of sentences 403-407	X						X
Word reading comprehension 408-417	X					X	
Sentence reading comprehension 418-427	X					X	
Spontaneous writing 813-835				X			X

Table 3: Assessed linguistic abilities (C: Comprehension, R: Repetition, J: Judgment, L: Lexicon, S: Semantics, Re: Reading and W: Writing).

Most of the tasks proposed in the BAT assess the discrimination of phonemes, the comprehension of syntactic structures and the access to semantic categories, while other tasks focus their attention on specific aspects in order to evaluate further variables such as the type/token ratio[7]. If we group the scores obtained in the various sections (cf. Tab. 2 & Tab. 3), then we will get not only an overview of the patient's degree of phonological integrity, morphological integrity, syntactical integrity and lexical integrity, but also an overview of the degree of the integrity of comprehension, repetition, judgment, lexical access, production, reading and writing. For instance, a phonemic paraphasia is not counted as an error when the patient produces it while selecting correctly a synonym, but on the contrary they are counted in those sections where they are explicitly assessed (cf. Paradis, 1999).

The degree of intelligence and education does not play an important role in the evaluation of the results obtained during the execution of the different tasks in the two languages, as it can be deduced that the patient's degree of intelligence does not change from one language to the other. But patients with a high degree of intelligence and education obtain better results than those with a low degree of intelligence and education. Nevertheless, the degree of education may influence the patient's ability to read and write: the patient could be illiterate in one language, whereas he could have a high degree of education in the other one. Since the reading habits of the patient before the onset of the pathological process as well as his degree of education can have a much bigger impact on his reading and writing skills, the different tasks which assess these skills are composed of a limited number of items. It is not possible to compare the scores obtained in these sections, as the patient could be illiterate in one language rather than in the other one (cf. Paradis, 1999).

Since the two languages can be differently impaired, it is not possible to ascertain the seriousness of the aphasic syndrome by assessing only one language. Therefore, for the sake of therapy and research, what counts is not the score obtained by the patient in a given version of the Bilingual Aphasia Test, but rather if a particular language is better retrieved than the other one; and if so, which one (cf. Paradis, 1999).

[7] The type/token ratio is used to calculate the degree of the patient's lexical access.

The BAT was designed to be short but not too short, and to be complete without being too long. In general, if a neuropsychological test is too long, then the test will lose its functionality (cf. Paradis, 1999).

It is not the score of the single task which is used here to determine linguistic dominance, but rather the overall score. However, partial scores are useful, too; in fact, they can be used to detect which grammatical aspect or which particular skill is most impaired (cf. Paradis, 1999).

The assessment of both languages by means of a standardized bilingual psychometric test allows us to compare the two languages and to ascertain which language is impaired and which recovers first and best. As a matter of fact, the Bilingual Aphasia Test was not only developed as an instrument for the assessment of aphasia in speakers of more than one language; but also to be equivalent across all languages for which it is currently available. Therefore, the various versions of the BAT are not sheer translation of each other, but culturally and linguistically equivalent tests. The principles of cross-language equivalence change with each task, as the sheer translation of standard aphasia tests into languages which are different from the language in which they were originally constructed would be inadequate. In fact, the selected items may be culturally unsuitable, for instance they could be misunderstood or not recognized. The grammatical differences between the two languages could be too wide, so the mere translation of those tasks from language "A" into language "B" would probably change the rationale of the task. Furthermore, the translation of those tasks which are based on phonological minimal pairs or rhyming words is useless, as this would not work at all. In conclusion, we can point out that a mere translation of a standard aphasia test from one language into the other will not produce interpretable results. So, the adaptation of a particular task to another language must take place in accordance with the rationale which motivated the construction of that particular task. Each task needs a different criterion of equivalence which depends mainly on the rationale behind the design of each task and obviously on the structural distance between the languages and the cultural differences between the communities (cf. Paradis, 2004).

If we want to assess the richness and diversity of a patient's lexicon, then we have to find and use a comparable measure. That is to say, the measuring criteria should have almost the same consequences in all tested languages; and furthermore, it should not generate a significantly larger or smaller count when applied to languages with particular structural characteristics (cf. Paradis, 2004). It seems that the type/token ratio is a particular good measure of the richness and of the diversity of the lexicon which could be used by the patient. We can calculate the type/token ratio by dividing the number of different words (types) by the total number of words (tokens) which are found in the corpus. In other words, the more varied the vocabulary in a particular corpus (that is, the greater the number of different words used by the patient), the closer the ratio is to 1 (a score of 1 stands for a corpus in which not a single word was repeated (cf. Paradis, 2004). Therefore, a high type/token ratio stands for a rich and diversified vocabulary, but on the contrary, a low type/token ratio stands for a poor vocabulary (cf. Paradis, 2004).

The structural diversity of languages menaces cross-language equivalence. In fact, a mere and unsystematic word count would not permit a valid comparison between languages (cf. Paradis, 2004). For instance, languages without articles or copulas would produce higher type/token ratios than languages in which articles, accompanying every noun. Furthermore, languages which use noun phrases that are formed as compound words would have obviously fewer words in a corpus of equal length. In other words, in languages that uses noun phrases what counts as one word, in a more analytic language counts as three (cf. Paradis, 2004).

Whenever a patient uses a language which is different from the one spoken by the hospital staff, the hospital staff can ask a member of the family to administer the BAT. So, because the native speakers who administer the BAT are not necessarily clinicians or neurolinguists or speech and language pathologists, the scoring procedure has been made as objective as possible and the instructions given to the patient must be precisely those which are written in the instruction book of the Bilingual Aphasia Test. For the very same reason, scoring does not need the examiner's opinion or judgment. As a matter of fact, most scoring consists in circling a symbol that corresponds to what the patient said or did. For instance, if there is more than one correct answer, the examiner circles "+" (if the answer is correct), and "1" (if the answer is different but correct; the examiner has to note down the alternative answer). Therefore, "+" and "1" are used for correct answers. On the contrary, the examiner circles "0" if the patient does not answer or if he does not understand the task or question. The examiner circles "-", if the patient's answer is incorrect (cf. Paradis, 1999; Paradis, 2004).

Michel Paradis developed a systematic and effective test for a detailed analysis of the various components of language. The original version of the test was designed for assessing aphasia in English-French bilinguals, but from the very beginning the various tests were designed with the intention of being applicable to all languages (cf. Fabbro, 1999). In fact the Paradis' Bilingual Aphasia Test is currently available in more than 65 languages (Part B) and in more than 160 language pairs (Part C) (cf. Fabbro, 2002). The Bilingual Aphasia Test is divided into **three parts**:

- Part A;
- Part B;
- Part C.

Part A

As we know, in general, bilinguals do not form a homogeneous group. As a matter of fact, they differ in a number of aspects: age, manner of acquisition, degree of mastery and pattern of use of each language; and it is rather obvious that these differences will have an impact on the relative availability of each language. Moreover, they could also cause neuropsychological differences. As a matter of fact, in recent times it has been realized that early and late bilinguals may not use the various cerebral mechanisms involved in verbal communication to the same extent. As already mentioned, so as to compensate for gaps in their implicit linguistic competence in their L2, speakers of a language learnt in adulthood rely mostly on metalinguistic knowledge and pragmatic competence, whereas speakers who have learned their L2 during infancy rely mostly on implicit linguistic competence, but also on metalinguistic knowledge. That is why it is very important to get a detailed description of the patient's history of acquisition and pattern of use for each spoken language, which is going to help the clinician interpret possible differential scores in light of an informed estimation of the patient's premorbid fluency in the two languages. Therefore, the BAT starts with a 50-item (1-50) branching questionnaire which is common to both languages on the patient's bilingual history (Part A). This questionnaire needs to be administered only once, in the language of the hospital or the language best spoken by the patient, and information may be gathered from relatives, friends or colleagues as well (cf. Paradis, 2004). The questions are about the patient's linguistic environment at home as a child and about the language or languages of education. In addition, these questions are supplemented by the first 17 questions of Part B which examine not only the pattern of use of each language, but also the degree of literacy in each language (cf. Paradis, 2004).

Part B

The Part B contains 32 tasks which assess linguistic performance of patients in all four modalities (hearing, speaking, reading and writing), in almost all linguistic levels (phonological, morphological, syntactic, lexical and semantic) and linguistic tasks or skills (comprehension, repetition, judgement, lexical access, propositionizing) at level of the word, the sentence and paragraph, and at different levels of spontaneity (from extemporaneous speech to more formal tasks such as writing to dictation). Since many bilinguals could be illiterate in one language, whereas they could have a high degree of education in the other one the different tasks which assess the reading and writing skills are composed of a limited number of items (cf. Paradis, 2004).

Questionnaire regarding acquisition and use of languages

Number of items: 17 (1-17)

Description The first 17 questions of Part B examine the pattern of use of each language and the degree of literacy in each language.

1 Spontaneous speech

Number of items 5 items (18-22)

Time limit 5 minutes

Recording Yes

Description The examiner asks some questions regarding the patient's life. The aim of this task is to obtain 5 minutes of spontaneous speech. The examiner can encourage the patient to continue or to change topic. This task assesses: the amount of words, fluency, pronunciation and morphology.

Post-test analysis Yes – item 514-539

2 Pointing

Number of items 10 items (23-32)

Time limit 5 seconds; if the patient does not give an answer within 5 seconds, then the examiner has to administer the next item.

Recording No

Description The examiner puts some objects on the table (from the left side to the right side), and the patient is asked to tap on the object when the examiner names it. This task assesses the patient's ability to recognize different, common and familiar objects.

Stimuli 10 different, common and familiar objects

Correction
+ : correct answer
- : incorrect answer
0 : no-answer

Post-test analysis No

3 Orders

A Simple orders

Number of items	5 items (33-37)
Time limit	5 seconds; if the patient does not give an answer within 5 seconds, then the examiner has to administer the next item.
Recording	No
Description	The patient has to carry out simple verbal commands which the examiner orders him/her to do.
Stimuli	The verbal commands are simple movements or gestures.
Correction	+ : correct answer - : incorrect answer 0 : no-answer
Post-test analysis	No

B Semi-complex orders

Number of items	5 items (38-42)
Time limit	5 seconds; if the patient does not give an answer within 5 seconds, then the examiner has to administer the next item.
Recording	No
Description	The examiner puts five objects on the table, and the patient is asked to place them in contact with the other objects.
Stimuli	The objects are common and medium sized.
Correction	+ : correct answer - : incorrect answer 0 : no-answer
Post-test analysis	No

C Complex orders

Number of items 5 items (43-47)

Time limit 5 seconds; if the patient does not give an answer within 5 seconds, then the examiner has to administer the next item.

Recording No

Description The examiner puts three objects on the table, and the patient is asked to do something with each of them. The patient is allowed to begin only after the examiner has finished reading all three instructions.

Stimuli The five items are: three pieces of paper of different size, three pencils of different colour, three coins of different size, three sticks of different length and three books.

Correction + : correct sequence
"3, 2, 1": numbers of correct sequence
0 : no-answer

Post-test analysis No

4 Verbal auditory discrimination

Number of items 18 items (48-65)

Time limit No

Recording No

Description The examiner reads a word, and the patient has to tap the equivalent picture (set of 4 pictures, where only one picture corresponds to the word read). If there is no equivalent picture, then the patient has to tap the "X".

Stimuli Only 15 out of 18 items have an equivalent picture. The remaining 3 items cannot be matched; the patient has to tap the "X". The words used in this section are all representable words which form minimal-pairs (words of a language that differ only in their initial consonant) with other three representable words.

Correction For instance, the examiner circles the digit 3 if the patient touched picture 3 on the stimulus page.
0 : no-answer

Post-test analysis No

5 Comprehension of syntactic structures

Number of items 87 items (66-152)

Time limit 5 seconds; if the patient does not give an answer within 5 seconds, then the examiner has to administer the next item.

Recording No

Description The examiner reads a sentence, and the patient has to tap the picture which corresponds to the meaning of the sentence.

Stimuli The sentences used in this section form three big groups: affirmative sentences (47 items), negative sentences (24 items) and construction of reversible nominal syntagm (16 items).

There are five classes of affirmative sentences:

a. Standard sentences (S): formed by a subject, verb and object; 13 items (66, 67, 71, 72, 77, 81, 82, 89, 90, 97, 100, 105 and 106)

b. Pronominal reference to animated items (P): use of pronouns instead of animated nouns; 6 items (68, 69, 70, 78, 79 and 80)

c. Pronominal reference to non-animated items (A): 8 items (73, 74, 75, 76, 107, 108, 109 and 110)

d. Type 1 non standard sentences (NS1): passive construction (use of nouns instead of subjects and objects); 8 items (83, 84, 91, 92, 98, 99, 117 and 120)

e. Type 2 non standard sentences (NS2): there are two forms of type 2 non standard sentences:
    1. Topicalization of subject 6 items (85, 86, 93, 94, 101 and 103)
    2. Topicalization of object 6 items (87, 88, 95, 96, 102 and 104)

Negative sentences; there are two classes of negative sentences:

1. Standard negative sentences (SN): 12 items (111, 112, 115, 116, 121, 123, 125, 126, 131, 132, 133 and 135)

2. Type 1 non standard negative sentence (NS1n): 12 items (113, 114, 118, 119, 122, 124, 127, 128, 129, 130, 134 and 136)

Construction of Reversible nominal syntagm: eight pairs of reversible possessive constructions; 16 items (137-152)

Correction For instance, the examiner circles the digit 3 if the patient touched picture 3 on the stimulus page.
0 : no-answer

Post-test analysis No

6 Semantic categories

Number of items	5 items (153-157)
Time limit	No
Recording	No
Description	The examiner reads four words. Furthermore, the examiner informs the patient that three words form a semantically related group. The patient is asked to name the odd one out. In order to be able to do this, the patient has to understand which word is semantically wrong.
Correction	The examiner circles the digit which corresponds to the answer given by the patient.
Post-test analysis	No

7 Synonyms

Number of items	5 items (158-162)
Time limit	No
Recording	No
Description	The examiner reads the target word first and then other four words. The patient is asked to name the word which has almost the same meaning of the target word. This subtest assesses the patient's ability to recognize the significance of the single words and their correlation.
Stimuli	The items (nouns) are all common words.
Correction	The examiner circles the digit which corresponds to the answer given by the patient.
Post-test analysis	No

8 Antonyms

Number of items	10 items (163-172)
Time limit	No
Recording	No
Description	This subtest is formed by two parts of 5 items each. Part 1: The examiner reads a word first and then other

four words. The patient is asked to name the word which has the opposite meaning of the target word. Part 2: the words are all similar from a morphological point of view. The patient is asked to name the word which has almost the same meaning of the target word. Part 2 assesses the patient's metalinguistic knowledge.

Stimuli	The target words are common adjectives which are not ambiguous.
Correction	The examiner circles the digit which corresponds to the answer given by the patient.
Post-test analysis	No

9 Grammaticality judgment

Number of items	10 items (173-182)
Time limit	5 seconds; if the patient does not give an answer within 5 seconds, then the examiner has to administer the next item.
Recording	No
Description	The examiner reads a sentence, and the patient is asked to judge whether the sentence is grammatically correct or not.
Stimuli	7 grammatically correct sentences and 3 grammatically incorrect sentences.
Correction	+ : correct answer - : incorrect answer 0 : no-answer
Post-test analysis	No

10 Semantic judgment

Number of items	10 items (183-192)
Time limit	5 seconds; if the patient does not give an answer within 5 seconds, then the examiner has to administer the next item.
Recording	No
Description	The examiner reads a sentence, and the patient is asked to judge whether the sentence is semantically correct or

	not. The semantic judgment task is a subtest which assesses the patient's ability to comprehend general sentences. In other words, this subtest assesses the patient's knowledge of the real world and his linguistic knowledge.
Stimuli	7 sentences are semantically or pragmatically incorrect.
Correction	+ : correct answer - : incorrect answer 0 : no-answer
Post-test analysis	No

11&12 Repetition of real words and non-words, and related lexical decision

Number of items	60 items (30 items repetition and 30 items lexical decision)
Time limit	5 seconds for repeating 5 seconds for lexical decision
Recording	Yes
Description	The examiner reads a word, and the patient is asked to repeat the word and to decide whether the word exists or not.
Stimuli	This subtest is formed by 6 parts: a. Repetition of real monosyllabic words – 10 items (193, 195, 197, 201, 207, 211, 213, 215, 217 and 221) b. Repetition of real polysyllabic words – 10 items (223, 225, 229, 235, 237, 241, 243, 245, 249 and 251) c. Repetition of monosyllabic non-words – 5 items (199, 203, 205, 209 and 219) d. Repetition of polysyllabic non-words – 5 items (227, 231, 233, 239 and 247) e. Lexical decision: monosyllabic words – 15 item (194-222) f. Lexical decision: polysyllabic words – 15 items (224-252)
Correction	+ : correct answer - : incorrect answer 0 : no-answer
Post-test analysis	Yes – item 566-573

13	**Sentence repetition**

Number of items	7 items (253-259)
Time limit	No
Recording	Yes
Description	The examiner reads a sentence, and the patient is asked to repeat it.
Stimuli	The stimuli are those which were used in the comprehension of syntactic structures task.
Correction	+ : correct answer - : incorrect answer 0 : no-answer
Post-test analysis	Yes – item 574-622

14	**Series**

Number of items	3 items (260-262)
Time limit	No
Recording	Yes
Description	The patient is asked to count from 1-25, to name the days of the week and the months of the year.
Correction	+ : correct answer - : incorrect answer 0 : no-answer
Post-test analysis	No

15	**Verbal fluency**

Number of items	6 items (263-268)
Time limit	1 minute for every consonant
Recording	Yes
Description	The patient is asked to name as many as possible words which begin with a particular consonant ("T", "M" and "P").
Stimuli	Three consonants ("T", "M" and "P")
Correction	Every word uttered by the patient is written down.
Post-test analysis	No

16 Naming

Number of items	20 items (269-288)
Time limit	No
Recording	Yes
Description	The examiner shows an object to the patient, and the patient is asked to name that particular object.
Stimuli	Common objects which are used in everyday life; 10 objects are new and 10 have been used in other subtests.
Correction	+ : correct answer - : incorrect answer 0 : no-answer
Post-test analysis	No

17 Sentence construction

Number of items	25 items (289-313)
Time limit	No
Recording	Yes
Description	The examiner reads 2, 3 or 4 words, and the patient is asked to form correct and simple sentences. This subtest assesses the patient's ability to produce sentences.
Stimuli	5 groups of items are used here: First group: 2 words Second group: 3 words Third group: 3 words Fourth group: 4 words Fifth group: 4 words
Correction	The examiner has to write down every sentence produced by the patient. This subtest assesses 2 major aspects, i.e. morphology and semantic. The examiner has to make notes on the correctness of the sentence, the number of the used words and the total number of words in the produced sentence.
Post-test analysis	No

18 Semantic opposites

Number of items	10 items (314-323)
Time limit	5 seconds; if the patient does not give an answer within 5 seconds, then the examiner has to administer the next item.
Recording	Yes
Description	The examiner reads a word, and the patient is asked to name the antonym.
Stimuli	The words used for this task are adjectives, and the antonyms are easy to form. In fact, all words have a very high frequency.
Correction	+ : correct answer - : incorrect answer 0 : no-answer
Post-test analysis	No

19&20 Derivational morphology & Morphological opposites

Number of items	20 items (324-343)
Time limit	5 seconds; if the patient does not give an answer within 5 seconds, then the examiner has to administer the next item.
Recording	Yes
Description	This subtest is divided into two parts: a. Derivational morphology (items 324-333): the examiner reads a word, and the patient is asked to change the word into another by adding a suffix. In this case, the patient is asked to form a diminutive by adding a suffix. b. Morphological opposites (items 334-343): the examiner reads a word, and the patient is asked to change the word into another by adding a prefix. In this case, the patient is asked to form a morphological opposite by adding a prefix. This subtest assesses the patient's ability to produce particular morphological structures. This subtest relies on the patient's metalinguistic knowledge, and the results obtained in this subtest are subject to change in accordance with the patient's degree of education.
Stimuli	The words used here change from language to language.
Correction	+ : correct answer - : incorrect answer 0 : no-answer
Post-test analysis	No

21 Description of a story through pictures

Number of items 3 items (344-346)
Time limit 2 minutes
Recording Yes
Description The examiner puts a sequence of 6 pictures (picture story) in front of the patient, and the patient is asked to tell the story figured in the strip cartoon.
This subtest assesses the patient's ability to tell a structured story. The results obtained in this subtest should be compared with those gained in the spontaneous speech task.
Stimuli The picture story is the same in all BAT versions.
Correction The examiner has to note down: the amount of words produced by the patient, whether the patient was able to finish the story or not and whether the picture story is told following the logical succession of the pictures or not.

Post-test analysis Yes – item 540-564

22 Mental arithmetic

Number of items 15 items (347-361)
Time limit 10 seconds; if the patient does not give an answer within 10 seconds, then the examiner has to administer the next item.
Recording Yes
Description The patient is asked to solve a mathematical operation without using a pencil and a sheet of paper. The examiner has to interrupt the task when the patient makes five consecutive mistakes. This subtest assesses a non linguistic cognitive ability.
Stimuli There are different types of mathematical operations: 4 additions, 4 subtractions, 4 multiplications and 3 divisions.
Correction
+ : correct answer
- : incorrect answer
0 : no-answer

Post-test analysis No

23 Text listening comprehension

Number of items 5 items (362-366)
Time limit No
Recording Yes
Description The examiner reads a story (40 words; 3-4 sentences), and the patient is asked to answer five questions regarding that particular story. This subtest assesses the patient's listening comprehension ability and the ability to produce fluent speech.
Stimuli There are two different types of stimuli: the story which has the same construction in all BAT versions (obviously the words change: cross-linguistic equivalence), and the questions.
Correction + : correct answer
- : incorrect answer
0 : no-answer

Post-test analysis No

24 Reading words aloud

Number of items 10 items (367-376)
Time limit No
Recording Yes
Description The examiner shows a word to the patient, and the patient is asked to read it aloud. This subtest assesses the patient's ability to read single words aloud.
Stimuli The stimuli are those which were used in verbal auditory discrimination task.
Correction + : correct answer
- : incorrect answer
0 : no-answer

Post-test analysis Yes – items 623-628

25 Reading sentences aloud

Number of items 10 items (377-386)
Time limit No
Recording Yes

Description	The examiner shows a sentence to the patient, and the patient is asked to read it aloud. This subtest assesses the patient's ability to read single sentences aloud.
Stimuli	The stimuli are those which were used in the comprehension of syntactic structures of increasing complexity task.
Correction	+ : correct answer - : incorrect answer 0 : no-answer
Post-test analysis	Yes – items 629-708

26 Text reading comprehension

Number of items	6 items (387-392)
Time limit	90 seconds
Recording	Yes
Description	The patient is asked to read a short story silently (about 40 words). Afterwards, the examiner asks 6 questions which assess the patient's ability to comprehend a short story. Furthermore, this subtest assesses the patient's ability to produce a fluent speech.
Stimuli	There are two different types of stimuli: the story which has the same construction in all BAT versions (obviously the words change: cross-linguistic equivalence), and the questions.
Correction	+ : correct answer - : incorrect answer 0 : no-answer
Post-test analysis	No

27 Copying of words

Number of items	5 items (393-397)
Time limit	No
Recording	No
Description	The examiner shows a word to the patient, and the patient is asked to copy it. This subtest assesses the

	patient's ability to convert a sequence of graphemes into a sequence of graphemes.
Stimuli	The stimuli are those which were used in the verbal auditory discrimination task.
Correction	+ : correct answer - : incorrect answer 0 : no-answer
Post-test analysis	Yes – items 709-743

28 Dictation of words

Number of items	5 items (398-402)
Time limit	No
Recording	No
Description	The examiner dictates a word, and the patient is asked to write it down. This subtest assesses the patient's receptive and productive abilities.
Stimuli	The stimuli are those which were used in the verbal auditory discrimination task.
Correction	+ : correct answer - : incorrect answer 0 : no-answer
Post-test analysis	Yes – items 744-783

29 Dictation of sentences

Number of items	5 items (403-407)
Time limit	No
Recording	No
Description	The examiner dictates a sentence, and the patient is asked to write it down. This subtest assesses not only the patient's comprehension ability, but also his ability to produce a written sentence.
Stimuli	The stimuli used in this subtest are new.
Correction	+ : correct answer - : incorrect answer 0 : no-answer
Post-test analysis	Yes – items 784-812

30	**Word reading comprehension**

Number of items	10 items (408-417)
Time limit	No
Recording	No
Description	The patient is asked to read a word and to tap the corresponding picture (set of 4 pictures, where only one picture corresponds to the word read). This subtest assesses the patient's ability to comprehend what he/she is reading.
Stimuli	The stimuli are those which were used in the verbal auditory discrimination task.
Correction	+ : correct answer - : incorrect answer 0 : no-answer
Post-test analysis	No

31	**Sentence reading comprehension**

Number of items	10 items (418-427)
Time limit	No
Recording	No
Description	The patient is asked to read a sentence and to tap the corresponding picture (set of 4 pictures, where only one picture corresponds to the sentence read). This subtest assesses the patient's ability to comprehend what he/she is reading.
Stimuli	The stimuli are those which had were used in the comprehension of syntactic structures of increasing complexity task.
Correction	+ : correct answer - : incorrect answer 0 : no-answer
Post-test analysis	No

32 Spontaneous writing

Time limit 5 minutes
Recording No
Description The patient is asked to write something about his life, his family or about anything he likes.

Post-test analysis Yes – items 813-835

Part C

This part of the Bilingual Aphasia Test has been designed for the assessment of translation abilities and detection of interference in each language pair. Part C of the BAT comprises 58 items. Currently, part C is available in 160 language pairs.

1 Word recognition

Number of items 10 items (5 items for each language)
Sardinian→Italian 428-432
Italian→Sardinian 433-437
Time limit 5 seconds; if the patient does not give an answer within 5 seconds, then the examiner has to administer the next item.
Recording No
Description The examiner points out the words to the patient, one at a time and reads each word aloud. The patient must tell and/or show the word in the list of 10 words, which is its equivalent in Italian/Sardinian. The task assesses the patient's ability to understand the meaning of each word and to find its equivalent word in the other language.
Stimuli The stimuli are five nouns, which have to be associated to the equivalent words in a list of 10 words.
Correction The examiner has to circle the number corresponding to the patient's choice.

2	**Translation of words**

Number of items	20 items (5 items for each language) Sardinian→Italian 438-447 Italian→Sardinian 448-457
Time limit	5 seconds; if the patient does not give an answer within 5 seconds, then the examiner has to administer the next item.
Recording	No
Description	The examiner is going to say a word in language "A" and the patient is asked to translate it into language "B" and vice versa. This task assesses the patient's ability to translate a word from language "A" into Language "B" and vice versa.
Stimuli	The stimuli are five concrete nouns, and five abstract nouns for each language.
Correction	The examiner has to circle "+", if the patient's answer is the word in brackets. The examiner has to circle "1", if the word is different but acceptable. The Examiner has to circle "-", if the translation is incorrect. If the patient has given no answer after 5 seconds, the examiner has to circle "0".

3	**Translation of sentences**

Number of items	24 items (12 items for each language) Sardinian→Italian 458-469 Italian→Sardinian 470-481
Time limit	No
Recording	No
Description	The examiner is going to read a sentence aloud to the patient. The patient is asked to translate a sentence from language "A" into language "B" and vice versa. The task assesses the patient's ability to translate a sentence from language "A" into language "B", and then from language "B" into language "A". Moreover, this task reveals which language is the dominant one.
Stimuli	This task is formed by 12 items for each language. The first and the second sentences are formed by one reversible contrastive feature[8], the third and the forth by

[8] According to Paradis (2004, p. 78), "[…] it is important to ensure that it is equally difficult to translate sentences in both directions between a specific pair of language", but also "[…] the grammaticality

	two reversible contrastive features, the fifth and the sixth by 3 reversible contrastive features.
Correction	The score corresponds to the number of word groups (as indicated in the suggested translation in brackets) correctly translated. The examiner has to circle the number corresponding to the number of word groups containing no error. An omission also counts as an error. If all groups contain one or more errors, or if the patient says nothing, after three consecutive repetitions, the examiner has to circle "0". The examiner has to circle "+", if the sentence is different but acceptable.

4 Grammaticality judgment

Number of items	32 items (458-481)
Time limit	No
Recording	No
Description	The examiner reads a sentence aloud to the patient. The patient is asked to indicate whether the sentence is correct in language "A" or not (and then vice versa). If the patient judges the sentence to be ungrammatical, she or he is asked to make it right. This task assesses the patient's ability to recognize a sentence which is constructed according to the grammatical rules of the other language. Moreover, this task reveals which language is the dominant one.
Stimuli	This task is formed by 8 sentences for each language (2 correct sentences and 6 incorrect sentences in language A; and 2 correct sentences and 6 incorrect sentences in language B).
Correction	"+": if the patient considers the sentence to be correct; "-": if the patient considers the sentence to be incorrect; "0": if the patient gives no answer;

The Bilingual Aphasia Test should be administered on successive day. There are two assessment patterns of the Bilingual Aphasia Test: (1) an immediate evaluation

judgment sections fur each language […] must also present equivalent difficulties. To achieve this end, sentences are constructed so as to include reversible morphosyntactic features. A morphosyntactic feature is reversible if its word-for-word translation from language A into language B is ungrammatical and the equivalent would be equally ungrammatical when translated word for word from language B to language A." In order to be reversible, a contrastive feature has to be obligatory in both languages (cf. Paradis, 2004).

pattern and (2) a more complex evaluation pattern, which implies a neurolinguistic assessment of all tests in order to obtain quantitative data on the patient's linguistic performance in the languages he knows and on the type and quantity of errors he made.

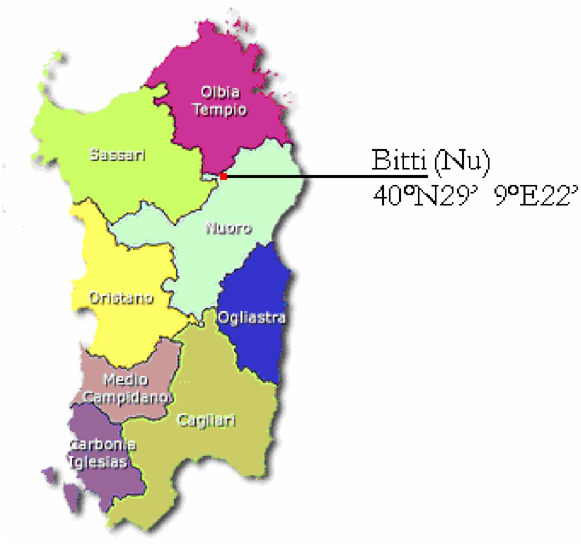
6.3. Adaptation of the BAT to Sardinian

Paradis, M., Zanetti, D. et al. (to appear). Bilingual Aphasia Test (Sardinian-Italian Version). Mahwah, NJ: Lawrence Erlbaum Associates.

We decided to adapt the Bilingual Aphasia Test to Sardinian, since we noticed that many aphasic patients who came to our attention were bilinguals (Sardinian→Italian). According to various clinicians and neuroscientists, it is imperative that aphasic patients are assessed in all the languages they spoke premorbidly by way of an equivalent instrument and not by an instrument which is the outcome of a mere translation of a standardized test from another language. A test aimed at assessing bilingual aphasia was needed to support research in the field on clinical issues, such as which language has been affected most?, which language is to be rehabilitated, and why?, as well as on cognitive and scientific issues (How does the brain of a bilingual elaborate and process languages? Et cetera.).

For the adaptation of the Sardinian version of the Bilingual Aphasia Test, we have used Sardinian variety spoken in Bitti. Bitti is a small town (3,487 inhabitants in 2001) of the province of Nuoro (cf. Fig. 9). The language spoken in Bitti (Bittese) is a variety of Central Logudorese, and is one of the most conservative varieties spoken in Sardinia; in fact, this language is very distant from standard Italian and does not have so many calques and loanwords from standard Italian (cf. Chapter 4: Sardinian languages).

Figure 9: Map of Sardinia, Italy, showing the 8 provinces and the city of Bitti.



The Bilingual Aphasia Test was adapted to Sardinian by Dario Zanetti, by Rinaldo Zanetti (native speaker of Bittese), by Prof. Sebastiano Turtas (native speaker of Bittese), whereas Prof. Ciriaco Carru (native speaker of Bittese) and Prof. Bachisio Bandinu (native speaker of Bittese) have read and commented the Sardinian Bilingual Aphasia Test.

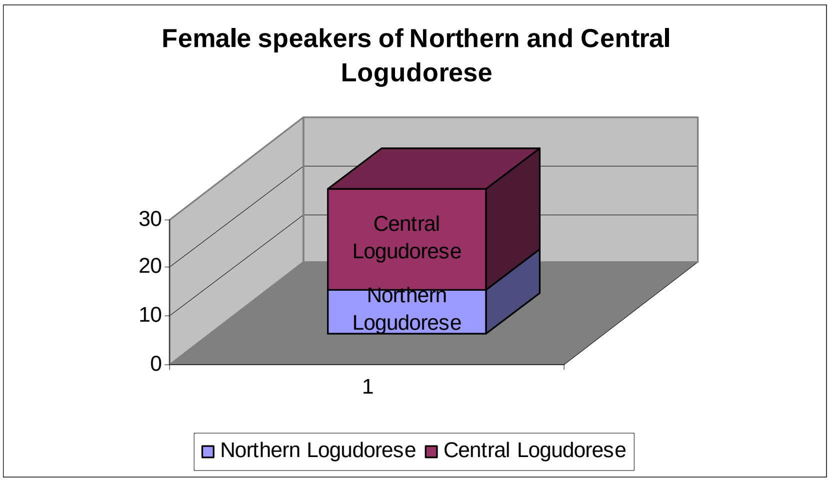
We have adapted the BAT to Sardinian in accordance with the guidelines published in "The Assessment of Bilingual Aphasia" (cf. Paradis, 1987). The standardization of the BAT consisted of asking 60 native speakers (control group) whether, according to them, the linguistic and iconographic materials used for the construction of the BAT were acceptable or not. The examiner, who has to be a native speaker of that particular language, writes down the answers given by the control group, and afterwards the answers are analyzed. Items which do not reach the threshold criterion have to be changed, and the whole test must be re-administered to a new control group of 60 people. The first step of the standardization of the BAT happens by means of an acceptability study, i.e. every item has to be accepted by the control group, and the threshold criterion is 100%. All stimuli are in black and white, and according to the control group, they are easy to recognize and are not ambiguous. **All items used in our Bilingual Aphasia Test version reached the threshold criterion, i.e. they reached an acceptability of 100%**.

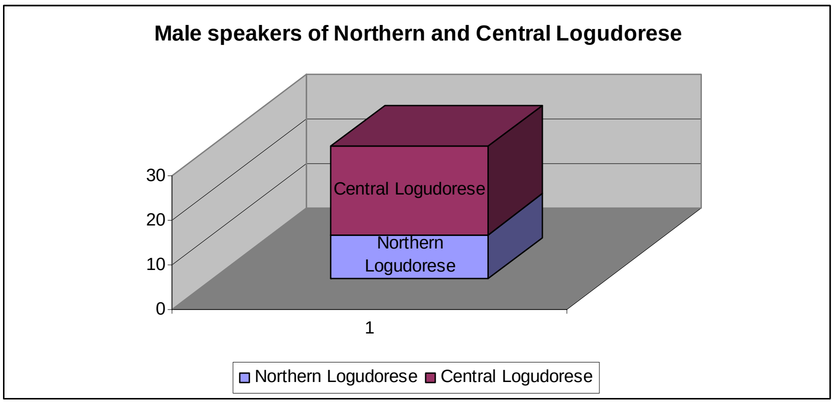
The first step of the standardization of the Bilingual Aphasia Test was conducted on 60 healthy bilinguals (30 men and 30 women) who were grouped by age (20 subjects between age 51 and 60; 20 subjects between age 61 and 70 and 20 subjects over age 71) (cf. Tables 1-6, Annexes). The subjects used for the standardization of The Bilingual Aphasia Test were speakers of Central Logudorese and Northern Logudorese. We decided to use only those two varieties in order to avoid linguistic incompatibility. The Mini Mental State Examination (MMSE) was used to screen for major cognitive impairments, such as mild cognitive impairment (MCI) and dementia. The cut-off for suspected dementia is ≤ 23 out of 30 points (cf. Fillenbaum et. al., 1990). All raw scores were adjusted according to age and rate of school attendance. The subjects took part in the study after providing informed consent (see Annexes) to the protocol.

The average age of the female control group is 64.23 years, whereas the average age of the male control group is 64.7 years. Therefore, our group is very homogenous from this point of view; in fact, the average age of the entire control group is 64.46 years (cf. Table 1-6, Annexes).

The average of the rate of school attendance of the female control group is 11.66 years. On the contrary, the average of the rate of school attendance of the male control group is 10.33 years. The female control group has a higher rate of school attendance. The overall average of the rate of school attendance is 10.99 years (cf. Table 1-6, Annexes).

Sardinian language: 1/3 of the male control group speaks Northern Logudorese, while the remaining 2/3 speak Central Logudorese; almost 1/3 of the female control group speaks Northern Logudorese, while the remaining 2/3 speak Central Logudorese. Nineteen subjects out of sixty speak Northern Logudorese, whereas forty-one subjects out of sixty speak Central Logudorese (cf. Chart 1-3) (cf. Table 1-6, Annexes).





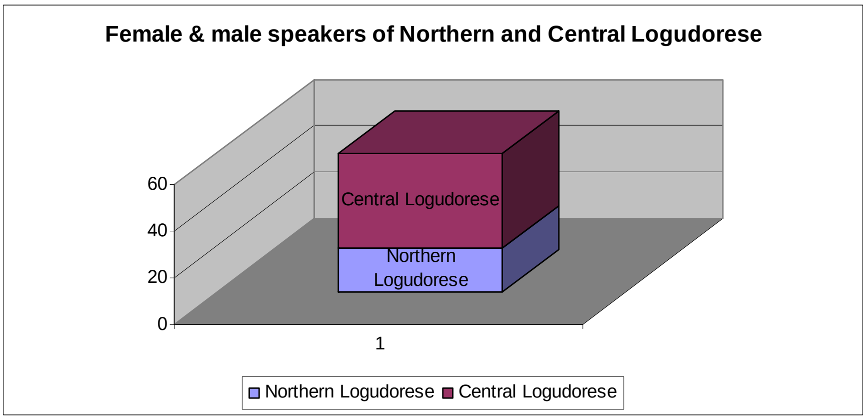


Chart 1-3: Graphical representation of the distribution of Northern and Central Logudorese speakers in the control group.

As mentioned above, the Mini Mental State Examination (MMSE) was used to screen for major cognitive impairments, such as mild cognitive impairment (MCI) and dementia. All subjects gained a good score in the MMSE. The average adjusted score of the female control group is 27.23, whereas the average adjusted MMSE score of the male control group is 27.36. The two groups are homogenous; in fact, the overall adjusted MMSE score is 27.29.

The females were all right-handed. On the contrary, in the male's control group, there were two ambidexters subjects and one left handed subjects.

In the following chapter, we are going to illustrate the Sardinian BAT version. The complete adapted Sardinian Bilingual Aphasia Test Version can be found in the Annexes.

Part A

For the questionnaire see Annexes.

Part B

Questionnaire regarding acquisition and use of languages

Number of items: 17 (1-17)
See Annexes.

1 Spontaneous speech

Number of items 5 items (18-22)
See Annexes.

2 Pointing

Number of items 10 items (23-32)
See Annexes.
Stimuli 10 different, common and familiar objects
These objects are the same in every language, but must be appropriate to the cultural and climatic conditions of the relevant community.

For example:
23. Pro piaghere, tocca s'aneddu.
(Please, touch the ring.)

3 Orders

A Simple orders

Number of items 5 items (33-37)
See Annexes.
Stimuli The verbal commands are simple movements or gestures, and are the same in every language.

For example:
33. Pro piaghere tanca sos ocros.
(Please close your eyes.)

B Semi-complex orders

Number of items 5 items (38-42)
See Annexes.
Stimuli The objects are common and medium sized, and are the same in every language.

For example:
38. Pone s'aneddu issos luminos.
(Put the ring above the matches.)

C Complex orders

Number of items 5 items (43-47)
See Annexes.

Stimuli The five items are: three pieces of paper of different size, three pencils of different colour, three coins of different size, three sticks of different length and three books. The stimuli are the same in every language.

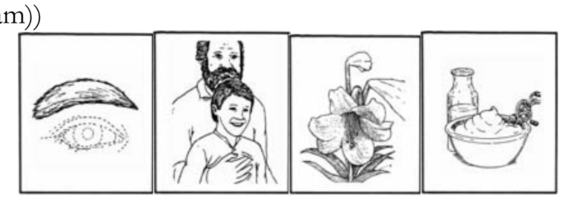
For example:
47. Mi tre libros.
Aberi su primu, ortula su sicunnu, e artzia sue trese.
(Here – take these three books. Open the first, turn the second and lift the third.)

4 Verbal auditory discrimination

Number of items 18 items (48-65)
See Annexes.

Stimuli Minimal pairs differ from language to language. Therefore they are not translated, and different stimuli are constructed along the same principles, i.e. words of the language that differ only in their initial consonant, and by as few phonetic features as possible.

For example:
59. Chitzu (Vitzu, Litzu, Pitzu)
(eyebrow (child, lily, cream))



5 Comprehension of syntactic structures

Number of items 87 items (66-152)
See Annexes.

Stimuli To the extent, that language differ structurally (for instance, with either relative free or strict word order or with various degrees of complexity of inflectional morphology – marking person, gender tense, aspect and/or mood), the complexity of a particular construction will vary. The sentences used in this section form three big groups: affirmative sentences (47 items), negative sentences (24 items) and construction of reversible nominal syntagm (16 items). These items are different from language to language; and therefore they have to be adapted.

There are five classes of affirmative sentences:

f. Standard sentences (S): formed by a subject, verb and object; 13 items (66, 67, 71, 72 77, 81, 82, 89, 90, 97, 100, 105 and 106)

g. Pronominal reference to animated items (P): use of pronouns instead of animated nouns; 6 items (68, 69, 70, 78, 79 and 80)

h. Pronominal reference to non-animated items (A): 8 items (73, 74, 75, 76, 107, 108, 109 and 110)

i. Type 1 non standard sentences (NS1): passive construction (use of nouns instead of subjects and objects); 8 items (83, 84, 91, 92, 98, 99, 117 and 120)

j. Type 2 non standard sentences (NS2): there are two forms of type 2 non standard sentences:
    3. Topicalization of subject 6 items (85, 86, 93, 94, 101 and 103)
    4. Topicalization of object 6 items (87, 88, 95, 96, 102 and 104)

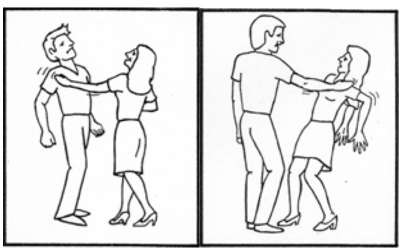
Negative sentences; there are two classes of negative sentences:

1. Standard negative sentences (SN): 12 items (111, 112, 115, 116, 121, 123, 125, 126, 131, 132, 133 and 135)

2. Type 1 non standard negative sentence (NS1n): 12 items (113, 114, 118, 119, 122, 124, 127, 128, 129, 130, 134 and 136)

Construction of Reversible nominal syntagm: eight pairs of reversible possessive constructions; 16 items (137-152)

For example (Standard negative sentence):
111. Sa pitzinna no ispinghet su pitzinnu.
(The girl does not push the boy.)
112. Su pitzinnu no ispinghet sa pitzinna.
(The boy does not push the girl.)
113. Sa pitzinna no est ispinta dae su pitzinnu.
(The girl is not pushed by the boy.)
114. Su pitzinnu no est ispintu dae sa pitzinna.
(The boy is not pushed by the girl.)



6 Semantic categories

Number of items 5 items (153-157)

See Annexes.

Stimuli These stimuli should be the closest equivalents in the various languages, but obviously they have to be culturally appropriate.

For example:

155. 1) manu 2) pede 3) cartzinu 4) uricra

(hand, foot, socks, ear)

7 Synonyms

Number of items 5 items (158-162)

See Annexes.

Stimuli These stimuli should be the closest equivalents in the various languages, but obviously they have to be culturally appropriate.

For example:

160. Lapis: 1) pinna 2) bonette 3) chisineri 4) meledda

(pencil, pen, cap, ashtray, apple)

8 Antonyms

Number of items 10 items (163-172)

See Annexes.

Stimuli The target words are common adjectives which are not ambiguous. These stimuli should be the closest equivalents in the various languages, but obviously they have to be culturally appropriate.

For example:

167. Veru: 1) vartzu 2) vonu 3) puru 4) bellu

(right, wrong, good, pure, nice)

9 Grammaticality judgment

Number of items 10 items (173-182)

See Annexes.

Stimuli 7 grammatically correct sentences and 3 grammatically incorrect sentences. The nature of the alterations depends on the structure of each language. In all languages, sentences are made ungrammatical by the insertion, deletion or substitution of a grammatical morpheme. But the sentences 173, 177 e 181 are correct. These sentences are taken from the task of comprehension of syntactic structures of increasing complexity.

For example:
175. Su gattu este mossicanne dae su cane.
(The cat is bite by the dog.)

10 Semantic judgment

Number of items 10 items (183-192)

See Annexes.

Stimuli 7 sentences are semantically or pragmatically incorrect. All sentences must be grammatical correct. The items 184, 187 and 191 are semantically correct.

For example:
189. Sa sarditza atta mannicatu su cane.
(The sausage has eaten the dog.)

11&12 Repetition of real words and non-words, and related lexical decision

Number of items 60 items (30 items repetition and 30 items lexical decision)

See Annexes.

Stimuli The words for repetition are selected in accordance with the same criteria in each language. This subtest is formed by 6 parts:

g. Repetition of real monosyllabic words – 10 items (193, 195, 197, 201, 207, 211, 213, 215, 217 and 221)
h. Repetition of real polysyllabic words – 10 items (223, 225, 229, 235, 237, 241, 243, 245, 249 and 251)
i. Repetition of monosyllabic non-words – 5 items (199, 203, 205, 209 and 219)

j. Repetition of polysyllabic non-words – 5 items (227, 231, 233, 239 and 247)
k. Lexical decision: monosyllabic words – 15 item (194-222)
l. Lexical decision: polysyllabic words – 15 items (224-252)

For example:
233. Rusore
(non word)
235. Terrinu
(ground)

13 Sentence repetition

Number of items 7 items (253-259)
See Annexes.
Stimuli The stimuli are those which were used in the comprehension of syntactic structures task.

For example:
253. Su pitzinnu ispinghete sa pitzinna.
(The boy pushes the girl.)

14 Series

Number of items 3 items (260-262)
See Annexes.
Stimuli The same series are used in all languages. The patient is asked to count from 1-25, to name the days of the week and the months of the year.

15 Verbal fluency

Number of items 6 items (263-268)
See Annexes.
Stimuli Initial consonantal sounds that are productive in each language are selected. These are not necessarily the same sounds in every language. Three consonants ("T", "M" and "P")

16 Naming

Number of items 20 items (269-288)
See Annexes.

Stimuli The same objects are used in all languages. Common objects which are used in everyday life; 10 objects are new and 10 have been used in other subtests.

For example:
270. Crae
(key)

17 Sentence construction

Number of items 25 items (289-313)
See Annexes.

Stimuli Translation equivalents are used to the extent that they are culturally appropriate in each language. 5 groups of items are used here:
First group: 2 words
Second group: 3 words
Third group: 3 words
Fourth group: 4 words
Fifth group: 4 words

For example:
294. Crateone/ dottore/ sédere
(armchair/ doctor/ sit)

18 Semantic opposites

Number of items 10 items (314-323)
See Annexes.

Stimuli Translation equivalents are used to the extent that they are culturally appropriate in each language.

For example:
315. Poveru/ Riccu
(poor/rich)

19&20 Derivational morphology & Morphological opposites

Number of items 20 items (324-343)

See Annexes.

Stimuli

The type of derivation varies from language to language depending on its morphology (adjective from noun, adverbs from adjectives etc.) Whenever there is no variety in derivational forms for morphological opposites, another type of derivation is selected. This subtest is divided into two parts:

c. Derivational morphology (items 324-333): the examiner reads a word, and the patient is asked to change the word into another by adding a suffix. In this case, the patient is asked to form a diminutive by adding a suffix.
d. Morphological opposites (items 334-343): the examiner reads a word, and the patient is asked to change the word into another by adding a prefix. In this case, the patient is asked to form a morphological opposite by adding a prefix.

For example:
327. Cane/ caneddu
(dog/ doggy)
334. Justu/ injustu
(correct/ incorrect)

21 Description of a story through pictures

Number of items 3 items (344-346)

See Annexes.

Stimuli

The picture story is the same in all BAT versions.

22 Mental arithmetic

Number of items 15 items (347-361)

See Annexes.

Stimuli This task is the same in all languages. Mathematical symbols (+, -, x, ÷) should be avoided. There are different types of mathematical operations: 4 additions, 4 subtractions, 4 multiplications and 3 divisions.

For example:

347. Cantu achetechimbe prus battoro?

(How much are 5 added to 4?

23 Text listening comprehension

Number of items 5 items (362-366)

See Annexes.

Stimuli In the listening comprehension task a different story is used in each language. The structure of the paragraph is the same, the sentences are of the same type and length, and the number of referential noun phrases and predicates is the same, but only the lexical items change. The information load is identical in all languages.

24 Reading words aloud

Number of items 10 items (367-376)

See Annexes.

Stimuli The words for reading aloud are selected from the foil pictures of the verbal auditory discrimination test. Their equivalence resides in the fact that, in each language, they form minimal pairs with the verbal auditory discrimination stimuli for each language. The cross-linguistic equivalence is limited.

25 Reading sentences aloud

Number of items 10 items (377-386)

See Annexes.

Stimuli The sentences for reading aloud are selected from the stimuli used in the syntactic comprehension section.

26 Text reading comprehension

Number of items 6 items (387-392)

See Annexes.

Stimuli In the text reading comprehension task a different story is used in each language. The structure of the paragraph is the same, the sentences are of the same type and length, and the number of referential noun phrases and predicates is the same, but only the lexical items change. The information load is identical in all languages.

27 Copying of words

Number of items 5 items (393-397)

See Annexes.

Description The words for the coping task are selected from the foil pictures of the verbal auditory discrimination test. Their equivalence resides in the fact that, in each language, they form minimal pairs with the verbal auditory discrimination stimuli for each language. The cross-linguistic equivalence is limited.

28 Dictation of words

Number of items 5 items (398-402)

See Annexes.

Stimuli The words for the dictation task are selected from the foil pictures of the verbal auditory discrimination test. Their equivalence resides in the fact that, in each language, they form minimal pairs with the verbal auditory discrimination stimuli for each language. The cross-linguistic equivalence is limited.

29 Dictation of sentences

Number of items 5 items (403-407)

See Annexes.

Stimuli The stimuli used in this subtest are new, but they contain words used in the syntactic comprehension task. Item 403 contains a pronominal reference to animated items; item 404 contains a pronominal reference to non-animated items; item 405 contains a type 1 non standard negative sentence; item 406 contains a standard negative sentences and item 407 contains a type 2 non standard sentence.

For example:

405. Su pitzinnu este tiratu dae su cane.

(The boy is pulled by the dog.)

30 Word reading comprehension

Number of items 10 items (408-417)

See Annexes.

Stimuli The words for the reading comprehension task are selected from the foil pictures of the verbal auditory discrimination test. Their equivalence resides in the fact that, in each language, they form minimal pairs with the verbal auditory discrimination stimuli for each language. The cross-linguistic equivalence is limited.

31 Sentence reading comprehension

Number of items 10 items (418-427)

See Annexes.

Stimuli The stimuli are those which were used in the comprehension of syntactic structures of increasing complexity task.

32 Spontaneous writing

Time limit 5 minutes

See Annexes.

Part C

See Annexes.

1	**Word recognition**

Number of items 10 items (5 items for each language)
Sardinian→Italian 428-432
Italian→Sardinian 433-437

See Annexes.

Stimuli The stimuli are five nouns, which have to be associated to the equivalent words in a list of 10 words.

For example:

428. alvore	1. mela	433. formaggio	1. crateone
429. cariasa	2. ciliegia	434. cavallo	2. casu
430. barcone	3. lampo	435. volpe	3. mattzone
431. marteddu	4. martello	436. fiore	4. mesa
432. astore	5. porta	437. poltrona	5. vrore
	6. falco		6. abba
	7. finestra		7. lapis
	8. pieghe		8. caddu
	9. albero		9. otzolu
	10. pecora		10. ainu

2	**Translation of words**

Number of items 20 items (5 items for each language)
Sardinian→Italian 438-447
Italian→Sardinian 448-457

See Annexes.

Stimuli The stimuli are five concrete nouns, and five abstract nouns for each language.

For example:

438. leputzu (coltello) 449. muro (muru)

3 Translation of sentences

Number of items 24 items (12 items for each language)
Sardinian→Italian 458-469
Italian→Sardinian 470-481

See Annexes.

Stimuli This task is formed by 12 items for each language. The first and the second sentences are formed by one reversible contrastive feature, the third and the forth by two reversible contrastive features, the fifth and the sixth by 3 reversible contrastive features. According to Paradis (2004, p. 78), "[…] it is important to ensure that it is equally difficult to translate sentences in both directions between a specific pair of language", but also "[…] the grammaticality judgment sections fur each language […] must also present equivalent difficulties. To achieve this end, sentences are constructed so as to include reversible morphosyntactic features. A morphosyntactic feature is reversible if its word-for-word translation from language A into language B is ungrammatical and the equivalent would be equally ungrammatical when translated word for word from language B to language A." In order to be reversible, a contrastive feature has to be obligatory in both languages (cf. Paradis, 2004).

For example:
462. Jorgia ha postu sutta a sa cratea una cassetta de arantzu.
(Prep(loc.)+Noun) ((container) + prep + mass Noun)
(Giorgia ha messo sotto la sedia una cassetta di arance).
(Prep+prep+Noun) ((container) + prep + plur.noun)

4 Grammaticality judgment

Number of items 32 items (458-481)
See Annexes.

Stimuli The sentences contain reversible contrastive features. This task is formed by 8 sentences for each language (2 correct sentences and 6 incorrect sentences in language A; and 2 correct sentences and 6 incorrect sentences in language B).

For example:
494. Apo leatu unu saccu de castantzas.
(container) + prep + mass Noun)
510. Ho raccolto una cesta di mela.
(container) + prep + plur.noun)

7. Clinical Case

M.M. is a 74-year-old right-handed female with 5 years of school attendance. She came to our attention in 2001. When M.M. was hospitalized in August 2001, she was rather confused, and she told to the clinicians that she had had a horrible dream: "*An ambulance was driving through the town, and in front of my house the ambulance had an accident. I was rather sure that the ambulance driver had died, and then I woke up*". When M.M. woke up she felt as if her left hand, her left limb, but also the left half of her face did not belong to her. M.M. had a reduction of muscular strength in her left upper limb and in her left hand associated with persistent formication and paraaesthesiae. The hemisomatoagnosia regressed spontaneously after 30 minutes, but her sensitive-motor deficits did not regress. Moreover, a neurological investigation revealed a tactile hypoaesthesia which affected the left upper limb, a slight drive to left when walking and the forefinger-nose task was slowed down.

The anamnesis revealed that the patient suffered from hypertension, and that she is bilingual (Northern Logudorese→Italian). The physicians suspected that the patient was affected by a cerebral ischaemia, M.M. was therefore hospitalized, and a cranial computed tomography (CT) was programmed.

After five days, while eating lunch in the hospital canteen, M.M. was suddenly unable to use the fork and the knife correctly. **From that moment on, the patient was aphasic (global aphasia)**. The CT of the 25.08.2001 (cf. Fig. 10 /25.08.01) revealed a hypodensity in the right parietal lobe in association with an oedema and flattening of the cerebral sulci. This lesion has probably caused the somatosensory deficits described previously, but certainly not the global aphasia.

This particular clinical picture suggested that the cortical dysfunctions were probably caused by different thrombi.

The second CT of the 30.08.2001 (cf. Fig. 11 /30.08.01) revealed a new lesion: there was a hypodense area (about 3 cm diameter) in the left fronto-parietal lobe associated with a moderate hyperdensity ascribable to a haemorrhagic effusion of blood due to a subacute ischaemic lesion. Moreover, the CT of the 30.08.2001 revealed that the lesion in the right parietal lobe had been completely absorbed.

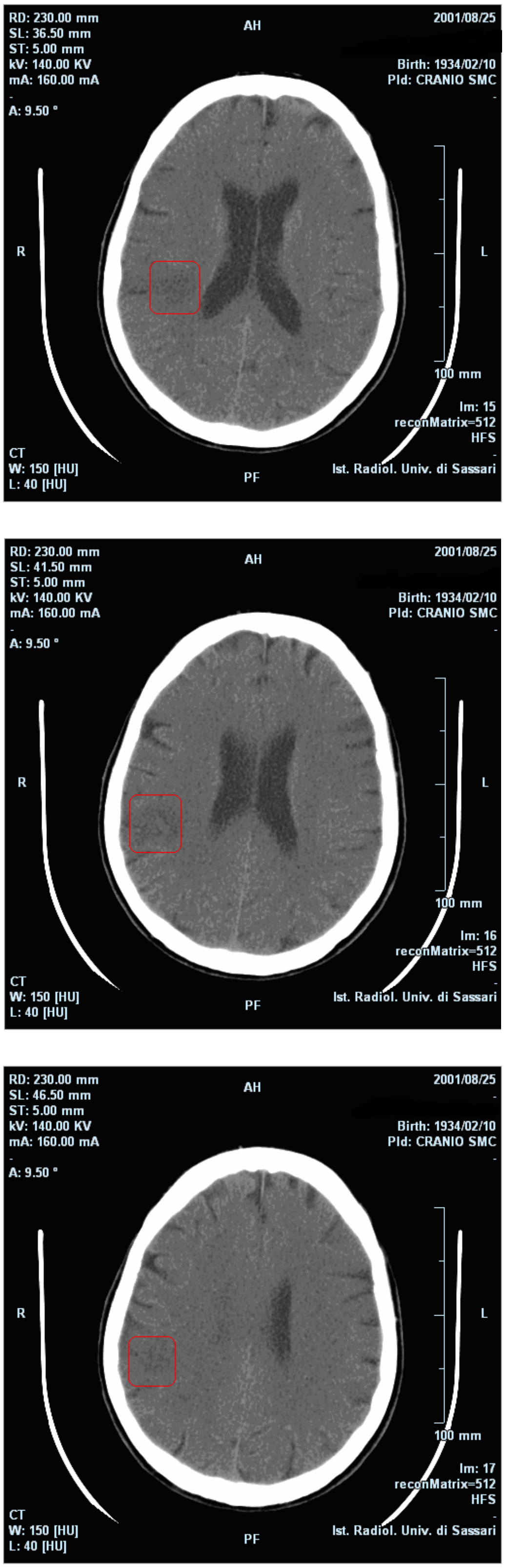


Fig. 10: CT scan 25.08.01.

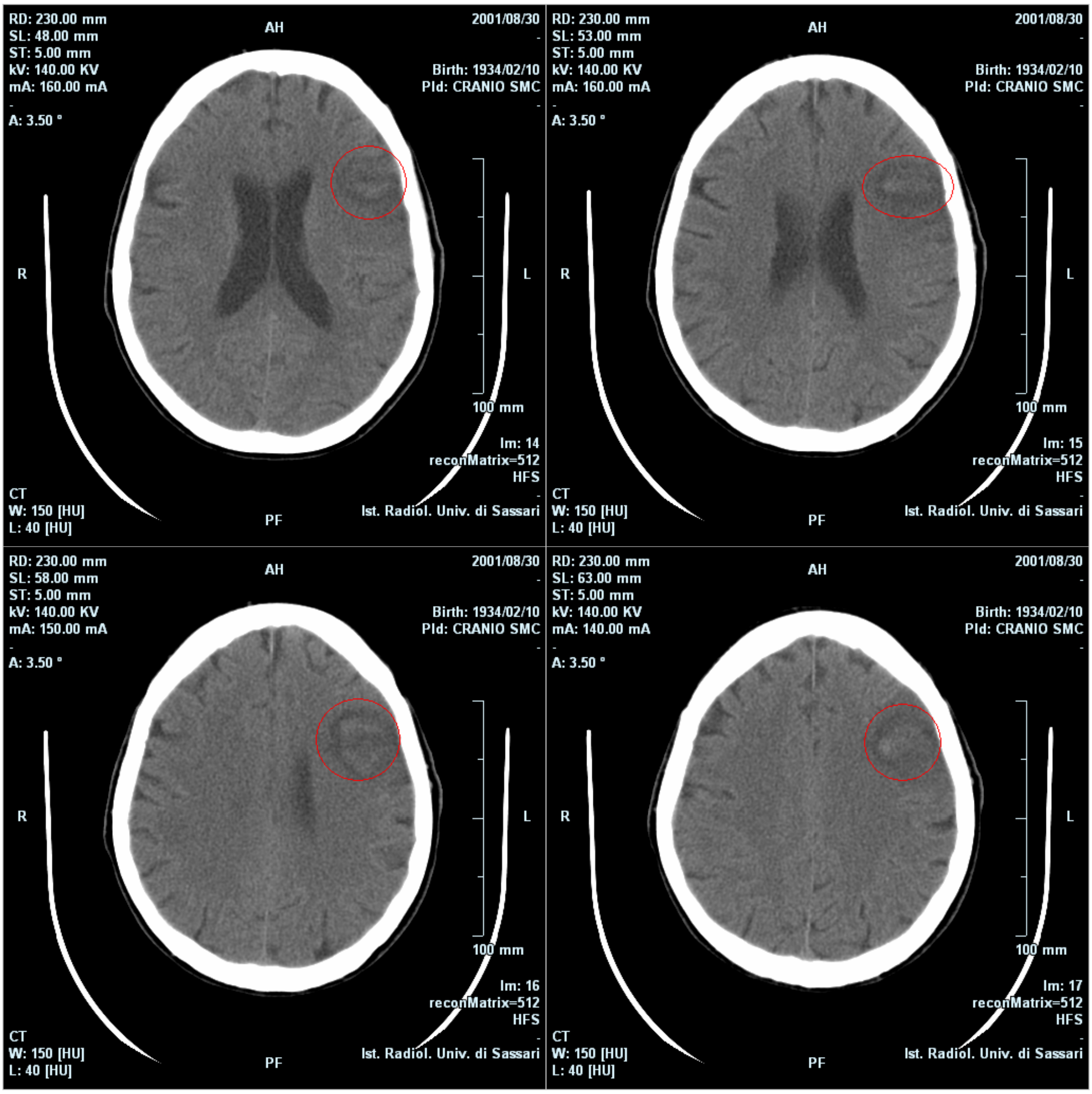


Fig. 11: CT scan 30.08.01.

Six days after the appearance of the above cited symptoms, the non-fluent aphasic syndrome had not disappeared. The first informal dialogue with the patient showed that M.M was non-fluent, but she had discrete comprehension of simple orders.

7.1. Neurolinguistic investigation

<u>First Neurolinguistic investigation "Esame del Linguaggio II" (14.09.2001)</u>:

The patient was administered the "Esame del Linguaggio II" seventeen days after the appearance of the first aphasic symptoms. Since her aphasic symptoms were extremely severe, it was not possible to administer the entire "Esame del Linguaggio II". The speech and language pathologist administered only the part which assesses the linguistic functions (cf. Fig. 12). The verbal expression task revealed that the patient was not able to produce phonemes in a correct way, as she was affected by a severe bucco-facial apraxia. The patient was not able to perform the verb naming tasks; moreover, she used non linguistic skills to communicate. M.M. had difficulty in performing the series task. The oral comprehension task revealed a deficit of the lexical-semantic comprehension, which was confirmed by the sentence writing comprehension task. The repetition task revealed a phonetic disintegration. The writing task revealed phonemic paraphasiae. The reading comprehension task revealed a deficit in the comprehension of semantically related words. The patient was not able to perform the writing comprehension task. The "Esame del Linguaggio II" revealed a **global aphasia** associated with a phonetic disintegration.

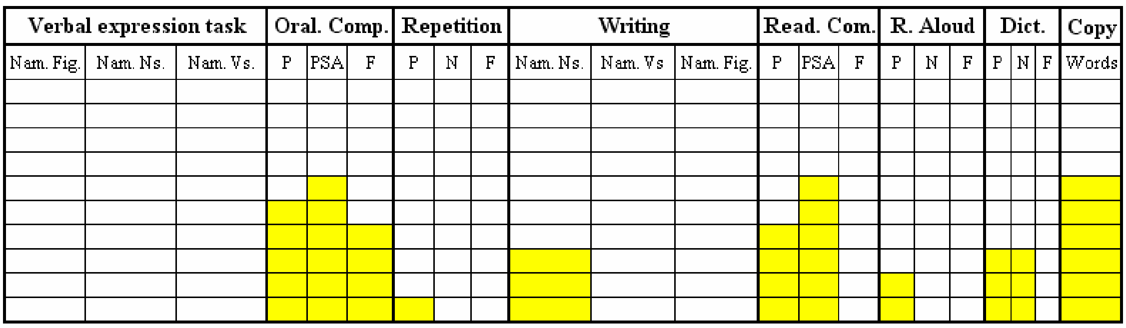


Fig. 12: <u>First "Esame del Linguaggio II"</u> (Nam. Fig.: Figure naming, Nam. Ns: Naming nouns, Nam. Vs.: Naming verbs, Oral. Comp.: Oral comprehension, Read. Comp.: Reading comprehension, R. aloud: Reading aloud, Dict.: Dictation.

Speech and language therapy:

M.M. was extremely cooperative and interested in speech and language therapy. The speech and language therapist started to treat M.M.'s bucco-facial apraxia by means of various exercises which were aimed to increasing her articulatory abilities. Afterwards, she started various exercises for increasing the patient's semantic comprehension abilities, in order to start speech and language rehabilitation. Speech and language therapy was done in Italian, which is the patient's L2. M.M.'s speech and language therapy has started in 2001. At the moment, she is having speech and language therapy in Italian twice a week.

Second Neurolinguistic investigation "Esame del Linguaggio II" (April 02):

The second neurolinguistic (cf. Fig. 13) investigation was administered six months after the beginning of speech and language therapy. The second neurolinguistic investigation revealed an important increase in the patient's performances in almost every subtest of the "Esame del Linguaggio II". The patient's verbal expression abilities improved considerably (50%); in fact, in the verbal expression task M.M. gained an improvement of almost 50%. The patient had a good recovery of verbal abilities, and was able to utter events in fluid succession. M.M.'s speech and language is poor and ungrammatical (articles, conjunctions and auxiliary verbs are missing), and characterized by phonemic paraphasiae (omissions and inversions).

The naming of nouns was almost correct (85%). The series task revealed an almost correct articulation of numbers, days of the week and months.

Repetition task: 70% of the produced items were correct, but phonemic paraphasiae were still present.

Writing task: phonemic paraphasiae were still present.

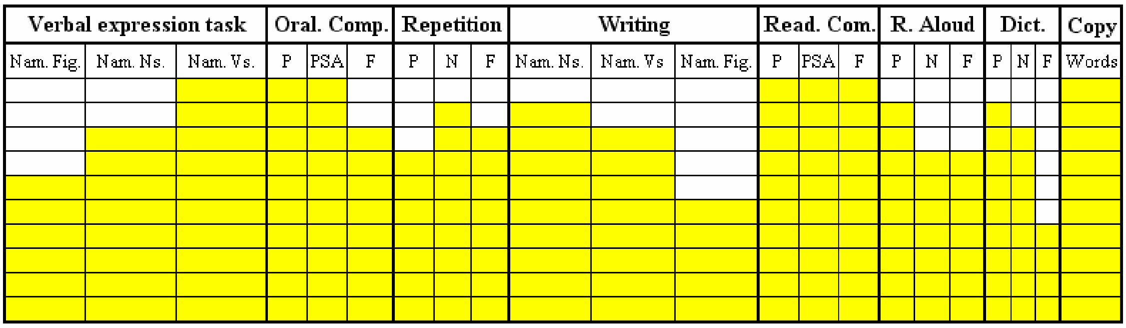


Fig. 13: <u>First "Esame del Linguaggio II"</u> (Nam. Fig.: Figure naming, Nam. Ns: Naming nouns, Nam. Vs.: Naming verbs, Oral. Comp.: Oral comprehension, Read. Comp.: Reading comprehension, R. aloud: Reading aloud, Dict.: Dictation.

<u>Sardinian-Italian Bilingual Aphasia Test (21.07.2008)</u>:

The Bilingual Aphasia Test was administered by a speech and language pathologist who is a native Sardinian speaker (Northern Logudorese). The BAT was administered in five sessions of one hour each. The patient took part in the study after providing informed consent (see Annexes) to the protocol.

Part A

Part A revealed that M.M.'s L1 is Sardinian (Northern Logudorese), and she was born in Osilo (SS); and she spoke only Sardinian at home during her infancy. Her father's and her mother's L1 were Sardinian (Northern Logudorese). M.M. spoke in Sardinian with her parents and with most of her friends, especially during childhood. She had attended school for only 5 years, and although the official language spoken in school was Italian; she spoke in Sardinian with her classmates.

Part B

	Questionnaire regarding acquisition and use of languages

Number of items: 17 (1-17)

M.M. had lived in another Sardinian town (Tempio) for almost 10 years. M.M. had learned Italian (L2) at school and Sardinian as a child (L1). She spoke Italian and Sardinian at home with her family before her cerebral insult. She spoke Italian and Sardinian rather well. She had gained her Italian reading and writing skills at school, whereas she had never learnt reading and writing in Sardinian. In fact, she is illiterate in her L1.

1	Spontaneous speech

Number of items 5 items (18-22)

	Italian	Sardinian
Number of utterances:	30	
Total number of words:	70	
Average length of utterances:	2,3	
Average length of the 5 most length utterances:	3,6	
Number of different words:	36	
Type/token ratio:	0,51	
Number of phonemic paraphasiae in real words:	17	
Number of perseverations:	6	
Number of paragrammatisms:	0	
Number of verbs in the utterances:	32	
Number of pauses:	90	
Number of sterotypes:	5	
Word finding difficulties:	few	
Related in a coherent manner:	"-"	

When the patient was asked to speak in Sardinian, she started in Sardinian saying three utterances, and then switched to Italian. The speech and language pathologist said to her to speak in Sardinian, but the patient answered in Italian and in a very sad way she said in Sardinian: "*I have lost my Sardinian*." She continuously switched from Sardinian to Italian. Therefore, the evaluation of her Sardinian spontaneous speech was not possible.

2 Pointing

Number of items 10 items (23-32)

Italian: Sardinian:
all 10 items were correct all 10 items were correct

She performed very well, both in Italian and Sardinian.

3 Orders

A Simple orders

Number of items 5 items (33-37)
Italian: Sardinian:
all 5 items were correct all 5 items were correct

She performed very well, both in Italian and Sardinian.

B Semi-complex orders

Number of items 5 items (38-42)
Italian: Sardinian:
all 5 items were correct all 5 items were correct

She performed very well, both in Italian and Sardinian.

C Complex orders

Number of items 5 items (43-47)
Italian: Sardinian:
2 items were correct 2 items were correct

The patient was able to perform correctly two items in Italian and two items in Sardinian.

4 Verbal auditory discrimination

Number of items 18 items (48-65)

Italian:
15 items were correct

Sardinian:
14 items were correct

The patient did not recognize 3 words in the Italian and 4 words in the Sardinian verbal auditory discrimination task.

5 Comprehension of syntactic structures

Number of items 87 items (66-152)

Italian:
38 items were correct
49 items were incorrect

Sardinian:
34 items were correct
53 items were incorrect

The patient made many mistakes in both languages; in Italian 49 items were incorrect, and in Sardinian 53 items were incorrect.

The patient made some mistakes in the standard sentences, but almost all standard negative sentences were incorrect (more in Sardinian than in Italian). Type 1 non standard sentences: in Italian only a few were incorrect but in Sardinian she made some more mistakes. In both languages almost all type 1 non standard negative sentences were incorrect (few in Italian); the same can be said for the type 2 non standard sentences (few in Italian). In Sardinian almost all sentences with pronominal reference to non animated items were incorrect (the patient did not understand the meaning of the sentences). The construction of reversible nominal syntagm: few mistakes in both Italian (1) and Sardinian (1).

6 Semantic categories

Number of items 5 items (153-157)

Italian:
all 5 items were correct

Sardinian:
3 items were correct
2 items were incorrect (Items 155, 157)

In Italian all items were correct, whereas in Sardinian 2 items were incorrect.

7 Synonyms

Number of items	5 items (158-162)
Italian:	Sardinian:
all 5 items were correct	2 items were correct
	3 items were incorrect

In Italian all items were correct, whereas in Sardinian 3 items were incorrect.

8 Antonyms

Number of items	10 items (163-172)
Italian:	Sardinian:
7 items were correct	6 items were correct
3 items were incorrect (Items 169, 170, 172)	**4 items were incorrect (Items 168, 169, 170, 171)**

M.M. made 3 mistakes in Italian and 4 mistakes in Sardinian.

9 Grammaticality judgment

Number of items	10 items (173-182)
Italian:	Sardinian:
3 items were correct	2 items were correct
7 items were incorrect	**8 items were incorrect**

In Italian 7 items were incorrect and in Sardinian 8 items were incorrect.

10 Semantic judgment

Number of items	10 items (183-192)
Italian:	Sardinian:
9 items were correct	8 items were correct
1 item was incorrect	**2 items were incorrect**

In Italian 1 item was incorrect, whereas in Sardinian 2 items were incorrect.

11&12 Repetition of real words and non-words, and related lexical decision

Number of items 60 items (30 items repetition and 30 items lexical decision)

Italian:	Sardinian:
50 items were correct	41 items were correct
10 items were incorrect (phonemic paraphasiae which form real words)	**13 items were incorrect (phonemic paraphasiae which form real words)**
	6 items were incorrect (decision)

The patient was able to recognize if a word was a non word or a real word in Italian, but she made 10 phonemic paraphasiae. On the contrary, in Sardinian she made 6 mistakes in the decision task and 13 phonemic paraphasiae.

13 Sentence repetition

Number of items 7 items (253-259)

Italian: the patient made 2 phonemic paraphasiae which form real words in the first sentence, 2 in the third sentence, 1 in the fourth sentence, 1 in the fifth sentence and 1 in the seventh sentence. Missing grammatical morphemes: in the third sentence 1, in the fourth 1 and in the fifth 1.

Sardinian: the patient made 3 phonemic paraphasiae which form real words in the first sentence, 2 in the third sentence, 2 in the fourth sentence, 1 in the fifth sentence and 1 in the seventh sentence. Missing grammatical morphemes: in the third sentence 2, in the fourth 2, in the fifth 1 and in the seventh 2.

14 Series

Number of items 3 items (260-262)

Italian:	Sardinian:
all 3 items were correct	all 3 items were correct

Both in Italian and Sardinian the series were all correct.

15	**Verbal fluency**

Number of items 6 items (263-268)

Italian:	Sardinian:
5 words with “t”, 4 words with “m” and 4 words with “p”	1 word with “t”, 1 word with “m” and 0 words with “p”

The Patient performed better in Italian than in Sardinian; in fact, in Italian she produced: 5 words with “t”, 4 words with “m” and 4 words with “p”; whereas in Sardinian the patient produced: 1 word with “t”, 1 word with “m” and 0 words with “p”.

16	**Naming**

Number of items 20 items (269-288)

Italian:	Sardinian:
all 20 items were correct	15 items were correct **She was not able to name 5 items**

In Italian all Items were correct, whereas in Sardinian the patient was not able to name 5 objects. But there are semantic paraphasiae in both languages, as well as some conduit d’approche.

17	**Sentence construction**

Number of items 25 items (289-313)

Italian:	Sardinian:
incorrect items: 295, 300, 301, 305, 306, 310, 311	**incorrect items: 297, 300, 301, 305, 306, 307, 310, 311, 312**

Italian: 5 phonemic paraphasiae; sentence: 2, 3, 4 and 5 were grammatically incorrect (function words were missing) and were senseless. The patient did not use all words for the construction of sentence 3, 4 and 5.

Sardinian: 6 phonemic paraphasiae; sentence: 2, 3, 4 and 5 were grammatically incorrect (function words were missing) and were senseless. The patient did not use all words for the construction of sentence 3, 4 and 5.

18 Semantic opposites

Number of items 10 items (314-323)

Italian:	Sardinian:
all 10 items were correct	8 items were correct
	2 items were incorrect

In Italian all 10 items were correct. In Sardinian 8 items were correct and only two were incorrect. There are also some phonemic paraphasiae.

19&20 Derivational morphology & Morphological opposites

Number of items 20 items (324-343)

Italian:	Sardinian:
7 items were correct	4 items were correct
13 items were incorrect	**16 items were incorrect**

The patient had considerable problems in both languages. In Italian the patient made 13 mistakes. In Sardinian she made 16 mistakes.

21 Description of a story through pictures

Number of items 3 items (344-346)

	Italian	Sardinian
Number of utterances:	21	12
Total number of words:	46	30
Average length of utterances:	2,1	2,5
Average length of the 5 most length utterances:	3.6	2.6
Number of different words:	18	11
Type/token ratio:	0.39	0.36
Number of phonemic paraphasiae in real words:	11	10
Number of perseverations:	2	5
Number of paragrammatisms:	0	3
Number of verbs in the utterances:	10	5
Number of pauses:	31	38
Number of sterotypes:	6	8
Word finding difficulties:	few	a bit more
Related in a coherent manner:	-	-

22 Mental arithmetic

Number of items 15 items (347-361)

Italian:
7 items were correct
8 items were incorrect

Sardinian:
7 items were correct
8 items were incorrect

Seven items were correct in Italian and in Sardinian, and 8 items were incorrect in Italian as well as in Sardinian.

23 Text listening comprehension

Number of items 5 items (362-366)

Italian:
4 items were correct
1 item was incorrect (364)

Sardinian:
2 items were correct
3 item were incorrect (362, 363, 365)

The patient understood the Italian text better than the Sardinian; in fact, she made only 1 mistake in Italian, but she made 3 mistakes in Sardinian.

24 Reading words aloud

Number of items 10 items (367-376)

Italian: 1 phonemic paralexia in the first word, 1 in the second word, 1 in sixth word and 1 in the eight word.

Sardinian: 1 phonemic paralexia in the first word, 1 in the third word and 1 in the fifth word. N.B. she had difficulty in reading Sardinian, as she is illiterate in Sardinian.

25 Reading sentences aloud

Number of items 10 items (377-386)

Italian: First sentence: 1 phonemic paralexia, 1 grammatical morpheme missing; Second sentence: 1 grammatical morpheme missing; Fourth sentence: 1 phonemic paralexia and 1 grammatical morpheme missing; Fifth sentence: 1 grammatical morpheme missing; Sixth sentence: 1 phonemic paralexia; Seventh sentence: 1 grammatical morpheme missing.

Sardinian: the patient is illiterate: could not read, tried to read them but then broke down.

26 Text reading comprehension

Number of items 6 items (387-392)

Italian:
all 6 items were correct

Sardinian:
She had difficulty in reading Sardinian, as she is illiterate in Sardinian; tried to read it; but she was not able to finish within the given time limit.

27 Copying of words

Number of items 5 items (393-397)

Italian: First word: 1 paraphasia; Fourth word 1 paraphasia.

Sardinian: the patient was able to copy them even if she is illiterate. Second word: 1 paraphasia; Third word: 1 paraphasia.

28 Dictation of words

Number of items 5 items (398-402)

Italian: all words are readable and recognizable. Fourth word: 1 paragraphia.

Sardinian: the patient was not able to write them as she is illiterate.

29 Dictation of sentences

Number of items 5 items (403-407)

Italian: all sentences are readable and recognizable. First sentence: 1 paragraphia; second, third and fourth sentence: 1 function word missing.

Sardinian: was not able to perform this task; the patient is illiterate.

30 Word reading comprehension

Number of items 10 items (408-417)

Italian:	Sardinian:
all items were correct	**3 items were incorrect**

Italian all 10 items were correct.

Sardinian 3 items were incorrect.

31 Sentence reading comprehension

Number of items 10 items (418-427)

Italian:	Sardinian:
5 items were incorrect	**6 items were incorrect**

Italian: 5 items were incorrect

Sardinian: 6 items were incorrect

32 Spontaneous writing

Time limit 5 minutes

Italian:	Sardinian:
Not administered; she did not want to write.	**Not administered; she is illiterate in Sardinian.**

Part C

1 Word recognition

Number of items 10 items (5 items for each language)
Sardinian→Italian 428-432
Italian→Sardinian 433-437

Sardinian→Italian:	Italian→Sardinian:
all items were correct	all items were correct

She performed very well, both in Italian and Sardinian.

2 Translation of words

Number of items 20 items (5 items for each language)
Sardinian→Italian 438-447
Italian→Sardinian 448-457

Sardinian→Italian:
Two no answers (438, 445)
3 items were incorrect (445, 456, 457)

Italian→Sardinian:
One no answer (448)

The patient has more difficulties in translating the words from Sardinian to Italian than vice versa.

3 Translation of sentences

Number of items 24 items (12 items for each language)
Sardinian→Italian 458-469
Italian→Sardinian 470-481

Sardinian→Italian:
6 items were incorrect (471, 473, 475, 477, 479, 481)

Italian→Sardinian:
4 items were incorrect (463, 465, 467, 469)

The patient has more difficulties in translating the sentences from Sardinian to Italian than vice versa.

4 Grammaticality judgment

Number of items 32 items (458-481)

Sardinian:
11 items were incorrect (482, 483, 484, 485, 489, 490, 491, 494, 495, 496, 497)

Italian:
8 items were incorrect (499, 502, 503, 504, 505, 510, 511, 513)

M.M. made many mistakes both in Sardinian and Italian.

Conclusions (BAT):

Summery of the various tasks of part B:

Subtest	max. score	Italian	Sardinian
Pointing	10	10	10
Orders	15	12	12
Verbal auditory discrimination	18	15	14
Comprehension of syntactic structures	87	38	34
Semantic categories	5	5	2
Synonyms	5	5	2
Antonyms	10	7	6
Grammaticality judgement	10	4	2
Semantic judgement	10	9	8
Repetition of real words	30	10	13
Lexical decision	30	30	26
Series	3	3	3
Verbal fluency ("t", "m", "p")		5 4 4	1 1 0
Naming	20	20	10
Sentence construction	25	18	16
Semantic opposites	10	10	8
Morphological opposites	20	7	4
Mental arithmetic	15	7	7
Text listening comprehension	5	4	2
Word reading comprehension	10	10	7

The results obtained through the BAT confirm that M.M. is affected by global aphasia. M.M. had an astonishing recovery especially in those skills which are ascribable to metalinguistic knowledge. On the contrary, those skills which are ascribable to implicit linguistic competence are still deficient in both languages. Moreover, the patient has been treated in Italian since 2001, and the improvements in those tasks may be a consequence of this.

Phonology: M.M. still has articulatory problems in both languages; it seems that in Sardinian her difficulties are even greater. The patient makes many phonemic paraphasiae in almost every subtest of the Bilingual Aphasia Test. She uses some stereotypes and makes long and frequent pauses; and therefore, her speech is non-fluent. Her type/token ratio in the description of a story through pictures is 0.39 in Italian and 0.36 in Sardinian. M.M. had also some pathological code-switching; in fact, during the spontaneous speech task she was not able to speak in Sardinian without using Italian words. There are also some perseverations (6); and there is also some conduit d'approche. Italian is better recovered than Sardinian. This clinical picture is typical of global aphasia.

Morphology: M.M. is ungrammatical more or less to the same extent in both languages. She makes many mistakes in every subtest which assesses morphology and is unable to produce grammatical correct sentences. In fact, in the sentence construction task the patient was not able to build grammatically correct sentences. She omits function words, such as articles and copula. Her performance was also deficient in the derivational morphology task and in the morphological antonym task. This clinical picture is typical of global aphasia; and therefore, we can deduce that her implicit linguistic competences are impaired in both languages, but the slight difference between Italian and Sardinian is explained in the following way: Italian was acquired in school, and in this way, she acquired metalinguistic knowledge about Italian, and to some extent she also acquired metalinguistic knowledge in morphology. In other words, she uses metalinguistic knowledge, which she has to a greater extent in Italian, as a compensatory strategy.

Syntax: The patient is also deficient in syntax in both languages. In fact, she was not able to perform the syntactical comprehension task (Italian 38 items correct out of 87 and Sardinian 34 item correct out of 87) in both languages. She made many mistakes in the grammaticality judgment task in Italian as well as in Sardinian. Her spontaneous speech was not syntactically correct. Furthermore, the sentences produced in the sentence construction task were syntactically incorrect, too. In conclusion, we can say that the comprehension of syntactical forms and the production of syntactical forms are deficient in Sardinian as well as in Italian. This is typical of global aphasia, which impairs implicit linguistic competence.

Semantics: M.M. made very few mistake in semantics; in fact, she had an astonishing recovery in all tasks which assess semantic ability. There is a difference between Italian and Sardinian. The patient recovered her semantic abilities in Italian in a better way than in Sardinian. This may be in part ascribable to speech and language therapy which she received in Italian and not in Sardinian since 2001, and in part to the fact, that Italian relies to a greater extent on metalinguistic knowledge than Sardinian which is used as a compensatory strategy by the patient. Moreover, speech and language therapy relies on metalinguistic knowledge. Semantic, which is a form of metalinguistic knowledge, i.e. declarative, is stored in a different system which is not impaired by aphasia and therefore well preserved and improved by speech and language therapy.

Part C: the assessment of part C revealed that her Italian is much better preserved and retrieved than her Sardinian. She has more problems in translating words and sentences from Sardinian into Italian than vice versa. The grammaticality judgement task (reversible contrastive features) is deficient in both languages. The slight difference between Italian and Sardinian is explained in the following way: M.M. had learned Italian in an explicit way (mostly in school), and therefore, Italian relies more on metalinguistic knowledge that Sardinian does, which had been acquired in an implicit way, i.e. unconsciously.

8. Discussion and Conclusions

8.1. Discussion

According to the data obtained through the neurolinguistic investigation, at first sight the case looks like a differential recovery, but after a better analysis of the data, we can say that our patient had a parallel recovery; in fact, the aphasic speech parallels the previous relative abilities. This is ascribable to metalinguistic knowledge. From an implicit point of view, both languages are impaired to the same extent. But Italian was learned in school (according to M.M., she spoke ONLY Sardinian with her parents which therefore was acquired implicitly) in an explicit way, so Italian relies more on explicit knowledge than on implicit linguistic competence. Therefore, the patient has more metalinguistic knowledge in Italian than in Sardinian. Aphasia impairs implicit linguistic competence, but not metalinguistic knowledge, because metalinguistic knowledge is stored in another system. M.M. uses metalinguistic knowledge as a compensatory strategy; i.e. she compensates her lack in implicit linguistic competence through the use of metalinguistic knowledge which she has to a greater extent in Italian, because Italian was acquired explicitly. So, it seems that the patient recovers Italian in a better way than Sardinian, but this is not so. In fact, if a patient was more fluent in one of his languages before brain damage, this would also be the case after brain damage. In other words, the bilingual individual would get a higher score in the language which had been the stronger before the damage. In our case, both languages are impaired to the same extent from an implicit point of view. But metalinguistic knowledge is not impaired by aphasia and as the patient has more metalinguistic knowledge in Italian than Sardinian, it can be said that Italian is the stronger language from that point of view. Therefore, it can be stated that M.M. has a parallel recovery (cf. Fabbro, 1999, Paradis, 2004).

In fact, according to Paradis, individuals who have learned an L2 after the acquisition of their L1 will counterbalance the gabs in their implicit linguistic competence through the use of metalinguistic knowledge and pragmatics. In other words, the speaker is able to compensate for the gaps in implicit competence through the use of metalinguistic knowledge. This is exactly what happened to our patient. According to Paradis, a speaker can speak in two different ways, namely by using implicit linguistic competence only or by using metalinguistic knowledge only. As we know, metalinguistic knowledge is learned in a conscious way, whereas implicit linguistic competence is learnt in an unconscious way. But the procedures involved in assessing them are unconsciously not only for implicit linguistic competence but also for metalinguistic knowledge. These two forms of knowledge are present in all speakers who have acquired language in a normal way. The data obtained by our neurolinguistic investigation confirms the hypothesis that metalinguistic competence does not evolve or change into implicit linguistic competence. In fact, those neurolinguistic tasks which rely on metalinguistic knowledge are performed better than those which rely on implicit linguistic competence. But if metalinguistic knowledge were "transformed" into implicit linguistic competence, our patient would certainly have made mistakes there. The transformation of metalinguistic knowledge into implicit linguistic competence is not possible, because metalinguistic knowledge and implicit linguistic competence rely on two different memory systems. These two systems have separate, anatomical distinct neural substrates. At the very beginning of the L2 learning process, the learner almost completely relies on metalinguistic knowledge, but as he improves his L2 competence he relies more and more on implicit linguistic competence; there is a gradual shift from the use of metalinguistic knowledge to the use of implicit competence. This does not mean that metalinguistic knowledge has somehow disappeared, but on the contrary, this means that it is not generally used. But if there is a pathological process, which destroys or impairs implicit linguistic competence, then metalinguistic knowledge is used as a compensatory strategy by the patient. This happened also to our patient; in fact, she uses metalinguistic knowledge as a compensatory strategy. Moreover, it can be pointed out that if an L1 is acquired in a traditional way, implicit competence develops first and metalinguistic knowledge develops first and metalinguistic knowledge develops afterwards On the contrary, in an L2 learner metalinguistic knowledge develops first (the L2 is learnt through explicit strategies in school) and implicit linguistic competence develops afterwards. Implicit linguistic competence is acquired unconsciously, stored in an implicit way and utilized unconsciously (procedural memory), whereas metalinguistic knowledge is supported by declarative memory. According the Paradis, the L1 and the L2 of a speaker are stored in separate memory systems. In fact, pathology has suggested that there is a double dissociation between implicit and explicit memory. Aphasic patients, such as M.M. have a deficit in implicit memory, but not in declarative or explicit memory.

Moreover, our patient has been treated in Italian for almost seven years by a speech and language therapist. Speech and language therapy is focused whether consciously or unconsciously on metalinguistic knowledge. In other words, speech and language therapists use techniques or strategies which are based on the use of explicit knowledge, for instance a patient is treated by explicitly drawing his attention to the linguistic exercise in the same way as an L2 learner is when he is learning his L2 in school. The speech and language improvements obtained by our patient could also be explained through the threshold hypothesis, according to which an item is activated as soon as a sufficient quantity of positive neural impulses have reached its neural substrate. The activation threshold is the quantity of positive impulses which are needed for the activation of the item. Every time a particular item is activated its activation threshold is lowered, and for that reason, fewer neural impulses are needed to reactivate that particular item. So, according to the threshold hypothesis, it is difficult to activate an item which is not stimulated enough as his activation threshold is higher than that of an item which is continuously stimulated. An item which is easily activated needs fewer resources to be reactivated. For that reason, an intensive use and/or intensive and prolonged exposure to a particular language lowers the activation threshold for that language. In other words "Übung macht den Meister" or practice makes perfect. In fact, this happened to our patient, too. The continuous exercise through speech and language therapy has lowered her activation threshold for Italian, and therefore Italian is retrieved in a better and faster way than Sardinian.

Nowadays, various scientists believe that in bilinguals the two languages are localized in two distinct centres. There are mainly four hypotheses which try to explain how two or more languages are organized in the brain, namely extended system hypothesis (the languages of the speaker are not differentiated in their representations), the dual system hypothesis (the two languages of a bilingual speaker are represented independently in two different systems), the tripartite system hypothesis (the items which are identical in the two languages are represented in one distinct neural substrate which is common to the two languages, while those elements which are different are represented independently in two separate systems), the subsystems hypothesis (the bilingual speaker has two subsets of neuronal connections, one for language A and one for language B, which are located within the same cognitive system, i.e. the language system). According to most neuroscientists, the fourth hypothesis or the subsystems hypothesis is not only compatible with all recovery models, but also with the ability of the bilingual speaker to combine languages at every level. Every language (seen as a subsystem) can be hit by particular pathological processes. In other words, parallel impairment can be explained as the result of damage to the linguistic system as a whole or as the result of interference with it. In fact, the speech and language impairments in M.M.'s both languages are ascribable to the fact that her language system is destroyed. The data obtained through our neurolinguistic investigation seem to confirm the hypothesis that the two languages used by bilingual speakers are not represented and processed in two distinct anatomical regions in the brain, but rather in separate micro-anatomical subsystems which are located in the same gross anatomical areas. As previously seen, L2 speakers who have gaps in their implicit linguistic competence rely more than monolinguals on metalinguistic knowledge and pragmatics. As a matter of fact, they are used as compensatory strategies. It must be highlighted here, that implicit linguistic competence is not represented in neuroanatomical areas which are out of the classical language areas, but rather in distinct micro-anatomical areas which form neurofunctional subsystems supported by dedicated neuronal circuits.

8.2. Conclusions

The results obtained through our study seem to agree with the general hypotheses that:

- metalinguistic knowledge and implicit linguistic competence are implicated in speech and language;
- implicit linguistic competence and metalinguistic knowledge rely on two different memory systems;
- implicit linguistic competence and metalinguistic knowledge can be double dissociated through pathology;
- aphasic patients seem to use metalinguistic knowledge as a compensatory strategy in order to counterbalance the gaps in implicit linguistic competence;
- metalinguistic knowledge can not be transformed into implicit linguistic competence;
- the amount of available metalinguistic knowledge is influenced by education;
- the L1 and the L2 of a speaker may be stored in two separate memory systems;

- speech and language therapy may influence the recovery pattern of a language;

- speech and language therapy increases metalinguistic competence;

- the intensive use and/or intensive and prolonged exposure to a particular language lowers the activation threshold for that language;

- language is not represented and processed by two distinct anatomical regions;

- the subsystem hypothesis is the most plausible one, according to which language is processed and represented in separate micro-anatomical subsystems that are located in the same gross anatomical areas.

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Annexes

TEST PRO S'AFASIA IN LIMBA SARDA PRO UNU CHI CONNOSCHETE DUA LIMBAS O UNU POLIGLOTTA

A. PARTE COMUNE A TOTTU SAS LIMBAS

ISTORIA DE SU BILINGUISMU

Custas dimannas chi enini como devene essere lessasa a su malaidu, coment'este iscrittu sutta. Si su malaidu non bi l'achete a dare sas informatziones netzessarias carch'atteru (e.g. su babbu o sa mama o unu de sa vamiglia) potet'essere interrogatu in propositu. Pro tottu cussas dimannas chi sa risposta este embo/nono, iscriere "+" pro una risposta justa, "-" pro una risposta irbagliata.

Si sa risposta a una dimanna non si potet dare NO lassala in biancu. Iscriere, imbetze, "0" in su locu riservatu a sa risposta. Custu chere' narrere chi non b'at risposta. Issu libru des'esame, tottu sas istrutziones a s'esaminatore sono sichitasa da ***. Custas istrutziones non benini lessasa a su malaidu.

***Comintzare a leghere a boche arta.

1. Cale este sa data tua 'e naschita? ________(1)
2. Uve se' naschitu? ________(2)
3. Dae pitzinnu/a cale limba aeddaias de prusu in domo? ________(3)
4. Dae pitzinnu/a aeddaiasa ateras limbas in domo? + - 0 (4)

***Si sa risposta a sa dimanna (4) este "nono", colare a sae (6).

5. Dae minore cale ateras limbas aeddaiasa in domo? ________ ________ ________(5)
6. Cal'es' sa limba chi ata aeddatu babbu tuo? ________(6)
7. Aeddaiata carch'atera limba? + - 0 (7)

***Si sa risposta a sa dimanna (7) este "nono", colare a sae (12).

8. Cal'iti s'atera limba 'e babbu tuo? ________ ________(8)
9. In cale limba t'aeddaiat de prusu babbu tuo? ________(9)
10. Babbu tuo aeddaiata ateras limbas in domo? + - 0 (10)

***Si sa risposta a sa dimanna (10) este "nono", colare a sae (12).

11. Cale ateras limbas aeddaiata babbu tuo in domo? ________ ________ ________(11)
12. Cal'este sa limba 'e mama tua? ________(12)
13. Aeddaiata ateras limbas? + - 0 (13)

***Si sa risposta a sa dimanna (13) este "nono", colare a sae (18).

14. Cal'este s'atera limba 'e mama tua? ________ ________(14)

15. In cale limba t'aeddaiat de prusu mama tua? ________(15)
16. Mama tua aeddaiat ateras limbas in domo? + - 0 (16)

***Si sa risposta a sa dimanna (16) este "nono", colare a sae (18).

17. Cale ateras limbas aeddaiat mama tua in domo? ________ ________ ________(17)
18. Carch'ateru t'at datu cara canno is' minoreddu/a? + - 0 (18)

***Si sa risposta a sa dimanna (18) este "nono", colare a sae (25).

19. Cal'iti sa limba sua? ________(19)
20. Custa pessone aeddaiata ateras limbas? + - 0 (20)

***Si sa risposta a sa dimanna (20) este "nono", colare a sae (25).

21. Cal'atera limba aeddaiat? ________ ________ ________(21)
22. Chin cale limba t'aeddaiat de prusu cust'atera pessone? ________(22)
23. Aeddaiat ateras limbas in domo? + - 0 (23)

***Si sa risposta a sa dimanna (23) este "nono", colare a sae (25).

24. Cale ateras limbas aeddaiat in domo? ________ ________ ________(24)
25. Dae minore cale limba usaiat de prusu chin sos cumpantzos? ________(25)
26. Pro cantos annos ses annatu a iscola? ________(26)
27. Cann'as cumintzatu a annare a iscola cal'iti sa limba pro imparare? ________(27)
28. Eniana usatas ateras limbas pro imparare tanno? + - 0 (28)

***Si sa risposta a sa dimanna (28) este "nono", colare a sae (30).

29. Cal'ini sas ateras limbas pro imparare? ________ ________ ________(29)
30. Cale limba aeddaian de prusu sos istudentes in cust'iscola? ________(30)
31. Ti ses trasferitu ind'un'ater'iscola chind'una limba diversa pro imparare? + - 0 (31)

***Si sa risposta a sa dimanna (31) este "nono", colare a sae (42).

32. Cal'iti cust'atera limba? ________(32)
33. Dopo cantos annos ses colatu a custa limba? ________(33)
34. Eniana usatas ateras limbas pro imparare tanno? + - 0 (34)

***Si sa risposta a sa dimanna (34) este "nono", colare a sae (36).

35. Cal'ini sas ateras limbas pro imparare? ________ ________ ________(35)
36. Cale limba aeddaiana de prusu sos istudentes in cust'iscola? ________(36)
37. Ti ses trasferitu ind' una iscola chind' una limba divessa pro imparare? + - 0 (37)

******Si sa risposta a sa dimanna (37) este "nono", colare a sae (49).

38. Cale iti custa limba? ________(38)

39. Dopo cantos annos ses colatu a custa limba? ________(39)
40. Eniana usatas ateras limbas pro imparare tanno? + - 0 (40)
41. Cal'ini sas ateras limbas pro imparare? ________ ________ ________(41)
42. Cale limba aeddaian de prusu sos istudentes in cust'iscola? ________(42)
43. A pustisi, ti ses trasferitu ind'un'iscola
chind'una limba divessa pro imparare? + - 0 (43)

***Si sa risposta a sa dimanna (43) este "nono", colare a sae (49).

44. Cal'iti custa limba? ________(44)
45. Dopo cantos annos ses colatu a custa limba? ________(45)
46. Eniana usatas ateras limbas pro imparare? + - 0 (46)

***Si sa risposta a sa dimanna (46) este "nono", colare a sae (48).

47. Cal'ini sas ateras limbas pro imparare? ________ ________ ________(47)
48. Cale limba aeddaian de prusu sos istudentes in cust'iscola? ________(48)
49. Una via agabbata s'iscola cal'iti su travagliu tuo? ________(49)
50. Prima de t'irmalaidare cale limba aeddaiasa? ________ ________ ________(50)

B. PARTE SPECIFICA A SU SARDU

CONTESTO D'APPRENDIMENTU E DE USU DE SU SARDU

***Dae sas istrutziones a su malaidu e poi li aches custas dimannas.
Como ti aco dimannas in sardu. Ses prontu?

1. As bivitu ind' un'atera idda uve si aeddaiata su sardu? ________(1)

***Si sa risposta este "nono", colare a sa dimanna (4).

2. In cale idda? ________(2)

3. Pro cantu tempus as bivitu in custa idda? ________(3)

***Pro tottu sas dimannas chi poten'aere prus rispostas, achere unu tzirollu a intunnu a su numeru chi currisponnet a sa risposta justa.

4. Prima de t'irmalaidare, su sardu tuo it?:
1) non meta bellu 2) bellu 3) meta bellu 0 1 2 3 (4)
5. Cantos annos aias canno as'imparatu a faeddare su sardu? ________(5)
6. Prima de t'irmalaidare aeddaias su sardu in domo? + - (6)
7. Prima de t'irmalaidare aeddaias su sardu is' su travagliu? + - (7)
8. Prima de t'irmalaidare aeddaias su sardu chi' sos cumpantzos tuos? + - (8)

9. Issa vita ‘e d’ontzi die, prima de t’irmalaidare aeddaias su sardu...
 1) d’ontzi die 2) carchi via sa chita 3) carchi via su mese
 4) carchi via as’annu 5) manc’una via as’annu 0 1 2 3 4 5 (9)
10. As’imparatu a leghere su sardu? + - (10)

*** Si sa risposta este “nono”, colare a su LIMBATZU ISPONTANEU (18).

11. Cantos annos aias cann’as imparatu a leghere su sardu? ________(11)
12. Prima de t’irmalaidare leghias su sardu?
 1) non meta vene 2) vene 3) meta vene 0 1 2 3 (12)
13. Issa vita ‘e d’ontzi die, prima de t’irmalaidare leghias su sardu...?
 1) d’ontzi die 2) carchi via sa chita 3) carchi via su mese
 4) carchi via as’annu 5) mancu una via as’annu 0 1 2 3 4 5 (13)
14. As’imparatu a iscrier is’ sardu? + - (10)

*** Si sa risposta este “nono”, colare a su LIMBATZU ISPONTANEU (18).

15. Cantos annos aias canno as imparatu a iscrier in sardu? ________(15)
16. Prima de t’irmalaidare iscrias is’ sardu?
 1) non meta vene 2) vene 3) meta vene 0 1 2 3 (16)
17. Issa vita ‘e d’ontzi die, prima de t’irmalaidare iscrias is’ sardu...?
 1) d’ontzi die 2) carchi via sa chita 3) carchi via su mese
 4) carchi via as’annu 5) mancu una via as’annu 0 1 2 3 4 5 (17)

LIMBATZU ISPONTANEU

***Registrare CHIMBE MINUTOS de limbatzu ispontaneu. S’iscopu de custa prova este: 1) ottennere dae su malaidu sa manera spontanea de su limbatzu e, 2) chircare de lu ponnere che canno chi siat in domo sua. Pro mantennere viu s’arrejonu, s’esaminatore potete d’ontzi tantu acher dimannas supra:

a) su male,
b) su travagliu,
c) viaggios aforas,
d) e sa vamiglia de su malaidu.

***Canno su malaidu a finitu de aeddare, morinche su registratore e fache unu tzirollu intunnu a su numeru chi currisponnete a sa risposta justa pro d’ontzi puntu dae su 18 a su 22. Inoche, s’iscopu es cussu de dare indicatziones pessonales pacu prezisasa supra de sas caratteristicas de su limbatzu registratu dae su malaidu. A pustis s’at a facher un’istudiu prus attentu.

18. cantitate
 1) nudda 2) prus pacu de 2 minutos 3) prus pacu de 5 minutos 4) 5 minutos
19. scioltezza
 1) povera 2) discreta 3) vona 4) normale
20. pronuntzia

1) povera	2) discreta	3) vona	4) normale

21. grammatica

1) povera	2) discreta	3) vona	4) normale

22. vocabolariu

1) poveru	2) discretu	3) vono	4) normale

COMPRENSIONE VERBALE

***In custa setzione su malaidu ammustrata de aes' cumpresu ubidinne a sos cumannos. Sos'ordines deven'essere meta craros: eneni lessos abellu abellu, ma chin d'un tonu naturale. Si su malaidu non risponnete intro de CHIMBE SICUNNOS, ache unu tzirollu intunnu a su "0" (pro su punteggiu) e colare a sa dimmana chi sichiti. Pro d'ontzi prova dimanna chi su malaidu tochete una cosa o una matzina e sinna (achenne unu tzirollu intunnu a su numeru) SOLU SA RISPOSTA CHI CURRISPONNETE ASSA PRIMA COSA TOCCATA DAE SU MALAIDU.

Sas rispostas de su malaidu cheren sinnatas ("+", "-" oppuru "0") in custa manera: ache unu tzirollu intunnu a su "+" si sa risposta es justa. Si sa risposta data dae su malaidu est'irbagliata, ache unu tzirollu intunnu a su "-". A sa ine, si su malaidu no risponnete innudda o risponnete noaenne cumpresu nudda, tanno ache unu tzirollu intunnu a su "0". Pro assempru, si si dimannata a su malaidu de toccare unu libru chi este issa mesa e isse imbetze toccata un'atera cosa, ache unu tzirollu intunnu a su "-". Si, imbetze, non toccat nudda (oppuru ocat sa limba), ache unu tzirollu intunnu a su "0".

DESIGNAZIONE

***Sas cosas iscrittas sutta dian dev'essere collocatas issa mesa dainnantisi a su malaidu in manera chi isselas potat toccare chene impedimentu perunu. Sas cosas annan postasa in s'ordine iscrittu josso (dae manca a destra): unu buttone, unu guantu, una ortiche, una busta, un'aneddu, un'ispatzula, una tassa, un' iscatula de luminos, una crae, unu rellotzu (de brussu).

***Cumintza a leghere a boche arta.

23. Pro piaghere, tocca s'aneddu.	+	-	0	(23)
24. Pro piaghere, tocca su buttone.	+	-	0	(24)
25. Pro piaghere, tocca sos luminos.	+	-	0	(25)
26. Pro piaghere, tocca su guantu.	+	-	0	(26)
27. Pro piaghere, tocca sa crae.	+	-	0	(27)
28. Pro piaghere, tocca sa ortiche.	+	-	0	(28)
29. Pro piaghere, tocca su rellotzu.	+	-	0	(29)
30. Pro piaghere, tocca sa busta.	+	-	0	(30)
31. Pro piaghere, tocca sa tassa.	+	-	0	(31)
32. Pro piaghere, tocca s'ispatzula.	+	-	0	(32)

ORDINES SEMPLICES E ATZICCHEDDU COMPLICATOS

***Leghe sos ordines de sutta a su malaidu e marca sas rispostas. Sos criterios pro su punteggiu ("+", "-", "0") sono uguales a cussos de sa setzione A (abaitare supra). Cosas issa mesa: un'aneddu, un' iscatula de luminos, una tassa, una urchetta.

***Cumintza a leghere a boche arta.

Como ti peto de achere carchi cosa. Ses prontu?

33. Pro piaghere tanca sos ocros.	+	-	0	(33)
34. Aberi sa uca.	+	-	0	(34)
35. Artzia sa manu.	+	-	0	(35)
36. Ammustra sa limba.	+	-	0	(36)
37. Corfedda sa manu issa mesa.	+	-	0	(37)
38. Pone s'aneddu issos luminos.	+	-	0	(38)
39. Pone sa tassa acurtzu a su lapis.	+	-	0	(39)
40. Pone sos luminos sutta de sa urchetta.	+	-	0	(40)
41. Pone su lapis dainnantis a s'aneddu.	+	-	0	(41)
42. Pone sa urchetta issa tassa.	+	-	0	(42)

ORDINES COMPLICATOS

***Sos numeros dae 43 a 47 rappresentana ordines complicatos. S'ordine cumpleto (chere' narrere chin tottu sos sottordines), anna lessu comente chi siata una vrase sola. Pro d'ontzi numeru, si dimannata a su malaidu de toccare tres cosas. Custas tres cosas si devene accattare in sa mesa acurtzu a sa manu de su malaidu. Cosas: tres cantos de papiru (minore, mediu, mannu); tres lapis (biaitu, grogu, ruiu); tres soddos (minore, mediu, mannu); tres rameddos (curtzu, mediu, longu); tres libros.

Si sa risposta es justa (d'ontzi sottordine currettu e sos tres sottordines attos issa successione justa), segnare "+". Si no este justa, segnare su totale de sos sottordines attos, chene riguardu perunu a sa successione. Duncas, unu "3" chere' narrare chi sos tres sottordines sono istatos attos, ma no in sa successione justa. Unu "2"chere' narrere chi duos sottordines sono istatos attos, ecc.

***Cumintza a leghere a boche arta.

43. Mi tres cantos de papiru. + 3 2 1 0 (43)
Mi dasa cussu minore, pone cussu mediu in sos grinucos e imbolanche cussu mannu.

44. Mi tres lapis. + 3 2 1 0 (44)
Mi das cussu biaitu, lassa rughere cussu grogu e picca cussu ruju.

45. Mi tres soddos. + 3 2 1 0 (45)

Ispinghe cussu mannu a s'ala mea, orta cussu mediu e cucutza cussu minoreddu chi sa manu.

46. Mi tres rameddos.	+	3	2	1	0	(46)

Pone cussu curtzu issa tassa, daemi cussu mediu, e corfedda cussu longu issa mesa.

47. Mi tre libros.	+	3	2	1	0	(47)

Aberi su primu, ortula su sicunnu, e artzia sue trese.

DESCRIMINAZIONE UDITIVA VERBALE

***In custa setzione su malaidu devet toccare sa pintura chi currisponnete mentzusu a sa paraula data dae s'esaminatore. Es possibile de connoschere una pintura dae su numeru chi b'est in s'angulu destru de supra de d'ontzuna. Pro d'ontzi numeru (48-65), ache unu tzirollu intunnu a su numeru (1-4 oppuru X) de sa pintura toccata. Si su malaidu non toccata peruna pintura, tanno ache unu tzirollu intunnu a su "0".
***Cumintza a leghere a boche arta.

Como asa intennere una paraula. Tocca sa pintura chin ammustrata su chi cheret narrere. Si mancuna pintura currisponnete assa paraula, tanno tocca sa "X". Pro assempru, si jeo ti naro "Bassu" (*Massu, Tassu, Grassu*) tocca custa pintura in oche. Si naro "lapis" imbetze, tocca custa "X" pruite non batta una pintura chi siata un "lapis". Prontu?

48. Pira (Tira, Lira, Mira)	X	1	2	3	4	0	(48)
49. Vinu (Linu, Sinu, Pinu)	X	1	2	3	4	0	(49)
50. Cucu	X	1	2	3	4	0	(50)
51. Vena (Chena, Pena, Rena)	X	1	2	3	4	0	(51)
52. Gama (Lama; Dama, Zama)	X	1	2	3	4	0	(52)
53. Riga (Diga, Biga, Liga)	X	1	2	3	4	0	(53)
54. Nasu (Casu, Basu, Vasu)	X	1	2	3	4	0	(54)
55. Brocu (Crocu, Vrocu, Trocu)	X	1	2	3	4	0	(55)
56. Rana (Jana, Tana, Lana)	X	1	2	3	4	0	(56)
57. Pratu	X	1	2	3	4	0	(57)
58. Ponte (Monte, Conte, Vronte)	X	1	2	3	4	0	(58)
59. Chitzu (Vitzu, Litzu, Pitzu)	X	1	2	3	4	0	(59)
60. Dente (Lente, Mente, Zente)	X	1	2	3	4	0	(60)
61. Rosa	X	1	2	3	4	0	(61)
62. Gherra (Perra, Serra, Terra)	X	1	2	3	4	0	(62)
63. Acu (Tacu, Pacu, Sacu)	X	1	2	3	4	0	(63)
64. Foca (Roca, Vroca, Broca)	X	1	2	3	4	0	(64)
65. Cupa (Pupa, Tupa, Supa)	X	1	2	3	4	0	(65)

COMPRENSIONES DE ISTRUTTURAS SINTATTICAS

***In custa setzione su malaidu devet toccare sa pintura chi mentzusu rappresentata su significatu de sa vrase chi li eniti lessa. Sas vrases annana lessas chin tonu naturale. Sinna sa risposta de su malaidu in su locu previstu achenne unu tzirollu intunnu a su numeru chi currisponnete a sa pintura mustrata dae su malaidu. Si, intro chimbe sicunnos dae sa lessa de sa vrase, su malaidu no a' galu dattu una risposta, ache unu tzirollu intunnu a su "0" e cola a sa vrase de dopo. Su malaidu devet aere indainnantisi su libreddu de pinturas intitolatu "Comprensiones de istrutturas sintatticas" in manera chi potat chin fatzilitate toccare chi' su poddiche d'ontzuna de sas battos' pinturas.

***Cumintzare a leghere a boche arta.

Como asa a intennere una vrase. Tocca sa pintura chi currisponnete a su sensu de sa vrase. Pro assempru, si ti naro, su pitzinnu es seitu, tue mi aches'idere sa pintura chi rappresentat unu pitzinnu seitu. Ses prontu?

***Pagina 1

66. Su pitzinnu mantenet sa pitzinna.	1	2	3	4	0	(66)
67. Sa pitzinna mantenet su pitzinnu.	1	2	3	4	0	(67)
68. Issa lu mantenet.	1	2	3	4	0	(68)
69. Issa la mantenet.	1	2	3	4	0	(69)
70. Issa los mantenet.	1	2	3	4	0	(70)

***Pagina 2

71. Su camiu tirat sa macchina.	1	2	3	4	0	(71)
72. Sa macchina tirat su camiu.	1	2	3	4	0	(72)
73. Isse la tirat.	1	2	3	4	0	(73)
74. Issa la tirat.	1	2	3	4	0	(74)
75. Isse lu tirat.	1	2	3	4	0	(75)
76. Issa lu tirat.	1	2	3	4	0	(76)

***Pagina 3

77. Su pitzinnu mantenet sas pitzinnas.	1	2	3	4	0	(77)
78. Isse lu mantenet.	1	2	3	4	0	(78)
79. Isse la mantenet.	1	2	3	4	0	(79)
80. Isse las mantenet.	1	2	3	4	0	(80)

***Pagina 4

81. Sa pitzinna ispinghet su pitzinnu.	1	2	3	4	0	(81)
82. Su pitzinnu ispinghet sa pitzinna.	1	2	3	4	0	(82)
83. Su pitzinnu est ispintu dae sa pitzinna.	1	2	3	4	0	(83)
84. Sa pitzinna est ispinta dae su pitzinnu.	1	2	3	4	0	(84)

85. Est su pitzinnu chi ispinghete sa pitzinna?	1	2	3	4	0	(85)
86. Est sa pitzinna chi ispinghet su pitzinnu?	1	2	3	4	0	(86)
87. Est su pitzinnu chi sa pitzinna ispinghet?	1	2	3	4	0	(87)
88. Est sa pitzinna chi su pitzinnu ispinghet?	1	2	3	4	0	(88)

***Pagina 5

89. Su cane mossicat su gattu.	1	2	3	4	0	(89)
90. Su gattu mossicat su cane.	1	2	3	4	0	(90)
91. Su cane est mossicatu dae su gattu.	1	2	3	4	0	(91)
92. Su gattu est mossicatu dae su cane.	1	2	3	4	0	(92)
93. Est su cane chi mossicat su gattu?	1	2	3	4	0	(93)
94. Est su gattu chi mossicat su cane?	1	2	3	4	0	(94)
95. Est su gattu chi su cane mossicat?	1	2	3	4	0	(95)
96. Est su cane chi su gattu mossicat?	1	2	3	4	0	(96)

***Pagina 6

97. Su pitzinnu ifunnet sa pitzinna.	1	2	3	4	0	(97)
98. Sa pitzinna est ifusta dae su pitzinnu.	1	2	3	4	0	(98)
99. Su pitzinnu est ifustu dae sa pitzinna.	1	2	3	4	0	(99)
100. Sa pitzinna ifunnet su pitzinnu.	1	2	3	4	0	(100)
101. Est su pitzinnu chi ifunnet sa pitzinna?	1	2	3	4	0	(101)
102. Est sa pitzinna chi su pitzinnu ifunnet?	1	2	3	4	0	(102)
103. Est sa pitzinna chi ifunnet su pitzinnu?	1	2	3	4	0	(103)
104. Est su pitzinnu chi sa pitzinna ifunnet?	1	2	3	4	0	(104)

***Pagina 7

105. Su postale sichit sa moto.	1	2	3	4	0	(105)
106. Sa moto sichit su postale.	1	2	3	4	0	(106)
107. Isse lu sichit.	1	2	3	4	0	(107)
108. Issa lu sichit.	1	2	3	4	0	(108)
109. Isse la sichit.	1	2	3	4	0	(109)
110. Issa la sichit.	1	2	3	4	0	(110)

***Pagina 8

111. Sa pitzinna no ispinghet su pitzinnu.	1	2	0	(111)
112. Su pitzinnu no ispinghet sa pitzinna.	1	2	0	(112)
113. Sa pitzinna no est ispinta dae su pitzinnu.	1	2	0	(113)
114. Su pitzinnu no est ispintu dae sa pitzinna.	1	2	0	(114)

***Pagina 9

115. Sa pitzinna no ifunnet su pitzinnu.	1	2	0	(115)
116. Su pitzinnu no ifunnet sa pitzinna.	1	2	0	(116)
117. Sa pitzinna est ifusta dae su pitzinnu.	1	2	0	(117)

118. Su pitzinnu no est ifustu dae sa pitzinna.	1	2	0	(118)
119. Sa pitzinna no est ifusta dae su pitzinnu.	1	2	0	(119)
120. Sa pitzinna est ifusta dae su pitzinnu.	1	2	0	(120)

***Pagina 10

121. Su camiu no tirat sa macchina.	1	2	0	(121)
122. Su camiu no este tiratu dae sa macchina.	1	2	0	(122)
123. Sa macchina no tirat su camiu.	1	2	0	(123)
124. Sa macchina no est tirata dae su camiu.	1	2	0	(124)

***Pagina 11

125. Su pitzinnu no ischitat sa mama.	1	2	0	(125)
126. Sa mama no ischitat su pitzinnu.	1	2	0	(126)
127. Su pitzinnu no est ischitatu dae sa mama.	1	2	0	(127)
128. Sa mama no est ischitata dae su pitzinnu.	1	2	0	(128)

***Pagina 12

129. Su cane no est mossicatu dae su gattu.	1	2	0	(129)
130. Su gattu no est mossicatu dae su cane.	1	2	0	(130)
131. Su cane no mossicat su gattu.	1	2	0	(131)
132. Su gattu no mossicat su cane.	1	2	0	(132)

***Pagina 13

133. S’omine non basat sa emina.	1	2	0	(133)
134. Sa emina no est vasata dae s’omine.	1	2	0	(134)
135. Sa emina no vasat s’omine.	1	2	0	(135)
136. S’omine no est vasatu dae sa emina.	1	2	0	(136)

***Pagina 14

137. Achemi idere su ristorante ‘e su mere.	1	2	0	(137)

***Pagina 15

138. Achemi idere sa mastra ‘e iscola.	1	2	0	(138)

***Pagina 16

139. Achemi idere su camiu ‘e su garagiu.	1	2	0	(139)

***Pagina 17

140. Achemi idere sa mannedda ‘e sa neta.	1	2	0	(140)

***Pagina 18

141. Achemi idere su cinema ‘e su regista.	1	2	0	(141)

***Pagina 19

142. Achemi idere sa malaida ‘e s’infermiera.	1	2	0	(142)

***Pagina 20

143. Achemi idere su cane ‘e su mere.	1	2	0	(143)

***Pagina 21

144. Achemi idere sa catenedda ‘e sa medagliedda.	1	2	0	(144)

***Pagina 22

145. Achemi idere su mere ‘e su ristorante.	1	2	0	(145)

***Pagina 23

146. Achemi idere s’iscola ‘e sa mastra.	1	2	0	(146)

***Pagina 24

147. Achemi idere su garagiu ‘e su camiu.	1	2	0	(147)

***Pagina 25

148. Achemi idere sa neta ‘e sa mannedda.	1	2	0	(148)

***Pagina 26

149. Achemi idere su regista ‘e su cinema.	1	2	0	(149)

***Pagina 27

150. Achemi idere s’infermiera ‘e sa malaida.	1	2	0	(150)

***Pagina 28

151. Achemi idere su mere ‘e su cane.	1	2	0	(151)

***Pagina 29

152. Achemi idere sa medagliedda ‘e sa catenedda.	1	2	0	(152)

CATEGORIE SEMANTICHE

***Pro tottu sas dimannas chi poten aer prus rispostas: non deve leghere su numeru chi essiti prima de d'ontzi paraula; si devet leghere d'ontzi paraula, una pro una, chind'una pausa minore tra una paraula e cuss'iffattu.

***Cumintza a leghere a boche arta.

Como asa intennere una lista de battos paraulas. Narami cale paraula no est de custu gruppu. Pro assempru, si ti naro "bonette, guantu, elefante, camisa", sa paraula justa est "elefante", pruite no est un'estimenta. Prontu?

153. 1) gravegliu 2) litzu 3) soriche 4) iscralea	1	2	3	4	0	(153)
154. 1) caule 2) meledda 3) cariasa 4) prunischedda	1	2	3	4	0	(154)
155. 1) manu 2) pede 3) cartzinu 4) uricra	1	2	3	4	0	(155)
156. 1) cratea 2) mesa 3) lettu 4) carru	1	2	3	4	0	(156)
157. 1) merula 2) ambidda 3) culumbu 4) avila	1	2	3	4	0	(157)

SINONIMI

***Cumintza a leghere a boche arta.

Como asa intennere una paraula. T'apo a dimannare de ischerriare tra ateras battos paraulas chi ti naro, una chi ata guasi su mantessi significatu. Pro assempru, si ti naro "cappotto" e poi ti dó sas ateras: "mesa", "domo", "pastranu", "carru"; mi deves narrere "pastranu" pruite s'assimitzata meta a su "cappotto". Prontu?

158. Cratea: 1) vasette 2) pinu 3) crateone 4) aneddu	1	2	3	4	0	(158)
159. Patedda: 1) iscarpa 2) calassu 3) cariasa 4) cassarola	1	2	3	4	0	(159)
160. Lapis: 1) pinna 2) bonette 3) chisineri 4) meledda	1	2	3	4	0	(160)
161. Iscarpa: 1) libru 2) tzavatta 3) littera 4) giardinu	1	2	3	4	0	(161)
162. barca: 1) luminos 2) nave 3) giornale 4) alvore	1	2	3	4	0	(162)

CONTRARI

***Cumintza a leghere a boche arta.

Como ti dó una paraula e boscasa battoro de ischerriare. Custa via devese ischerriare sa paraula chi atta su significatu contrariu; pro assempru, si ti naro "vigliacu" e sa ischerritasa sono "codardu", "balente", "debile" e "timecaca", mi devese risponerre "balente". Prontu?

163. Allegru: 1) cuntentu 2) tristu 3) caru 4) macu	1	2	3	4	0	(163)
164. Iscuru: 1) tontu 2) malu 3) craru 4) tranquillu	1	2	3	4	0	(164)

165. Tzovanu: 1) mannu 2) vetzu 3) virde 4) minore	1	2	3	4	0	(165)
166. Poveru: 1) amittu 2) bruttu 3) calmu 4) riccu	1	2	3	4	0	(166)
167. Veru: 1) vartzu 2) vonu 3) puru 4) bellu	1	2	3	4	0	(167)

***Leghe custas istrutziones a su malaidu.

Pro sas paraulas chi sichini, sas ischerriatasas s'assimitzana meta. Solu una però este su contrariu de sa paraula chi ti dò. Pro assempru, si jeo ti naro "biancu" e sas ischerriatas sono "nieddu", "nieddesa" e "innieddare", tue mi dias dever risponner "nieddu". Semus prontos?

168. Bruttu: 1) bellu 2) imbellire 3) bellesa	1	2	3	0(168)
169. Craru: 1) iscuritate 2) iscuricare 3) iscuru	1	2	3	0(169)
170. Lisciu: 1) grispesa 2) ingrispare 3) grispu	1	2	3	0(170)
171. Ranchidu: 1) durche 2) durchesa 3) indurcare	1	2	3	0(171)
172. Ifustu: 1) siccu 2) sichesa 3) issicare	1	2	3	0(172)

GIUDISSU D'ACCETTABILITÀ

***Issas provas chi como sichini, ache unu tzirollu intunnu a su "+" si su malaidu narata chi sa vrase-istimulu li paret justa. Si narata chi no este justa, ache unu tzirollu intunnu a su "-". Si su malaidu non data una risposta intro 'e chimbe sicunnos, e/o narata chi nol'ischiti, ache unu tzirollu intunnu a su "0".

***Cumintza a leghere a boche arta.

Ti legho custa vrase: tue mi deves narrere si d'ontzi vrase este una vrase justa. Pro assempru, si naro "su pitzinnu iscriete in su otzolu", sa vrase este justa, duncas mi deves risponnere "embo". Si naro imbetze "sa valigia sono pesantes", sa vrase no este justa, duncas tue mi dias devere risponnere "nono". Prontu?

173. Issa l'ispinghete.	giudissu	+	-	0 (173)
174. Sa pitzinna este bellu.	giudissu	+	-	0 (174)
175. Su gattu este mossicanne dae su cane.	giudissu	+	-	0 (175)
176. Este su pitzinnu sa pitzinna vasa.	giudissu	+	-	0 (176)
177. Sa macchina este tirata dae su camiu.	giudissu	+	-	0 (177)
178. Este camiu chi tira macchina.	giudissu	+	-	0 (178)
179. Sa pitzinna este ispinta su pitzinnu.	giudissu	+	-	0 (179)
180. Su pitzinnu ischittata sa mama nono.	giudissu	+	-	0 (180)
181. Este su postale chi sichiti sa moto.	giudissu	+	-	0 (181)
182. Su cane este non mossicatu dae su gattu.	giudissu	+	-	0 (182)

ACCETTABILITÀ SEMANTICA

***Leghe custas istrutziones a su malaidu.

Sas vrases chi lego como sono tottu vrases vene attasa. Carcuna de issas, però no at sensu. Pro assempru, si naro “sa signora si secata sos pilos chissu lapis”, sa vrase este vene atta ma no atta sensu; imbetze sa vrase “sa signora si secata sos pilos chissa ortiche”, tanno atta sensu. Tanno narami “embo” si sa vrase atta sensu e “nono” si non’atta. Prontu?

183. Su sole luchet a de notte.	giudissu	+	-	0 (183)
184. Su gattu dormiti in su lettu.	giudissu	+	-	0 (184)
185. Sos vrorese creschene in sa bagna.	giudissu	+	-	0 (185)
186. S’istaione essiti dae s’umaiolu.	giudissu	+	-	0 (186)
187. Isse estiti unu cumpletu novu oje.	giudissu	+	-	0 (187)
188. Sas macchinas natana in su caminu.	giudissu	+	-	0 (188)
189. Sa sarditza atta mannicatu su cane.	giudissu	+	-	0 (189)
190. Issoso ana mannicatu un televisore pro irmutzu.	giudissu	+	-	0 (190)
191. Issa s’ispitzata in dainnantis de s’ispreccu.	giudissu	+	-	0 (191)
192. Isse viete rena canno bata calore.	giudissu	+	-	0 (192)

RIPETIZIONES DE PARAULAS LOGATOMI, E DECISIONES LESSICALES

***In custa setzione, duas capacitates sono postasa a sa prova: (1) sae de ripitere paraulas e sae (2) detzidere si’istimulu este, aberu, una paraula o nono. Pro d’ontzi istimulu, leghe sa paraula e aspetta chi su malaidu la ripitata. Su malaidu devete ripitere su chi l’este istatu lessu. Ache unu tzirollu intunnu a su “+” si sa ripetizione este justa (ammentanneti sas differentzias dialettales, o de pronuntzia). Si sa risposta no este justa, ache unu tzirollu intunnu a su “-”. Si su malaidu non data una risposta intro chimbe sicunnos, ache unu tzirollu intunnu a su “0”. No appenas isse risponnete (oppuru dopo chimbe sicunnos si non da risposta), dimannali si sa paraula este vera (si isistiti). Pro carculare su punteggiu, unu “+” est’uguale a una risposta justa (“embo” oppuru “est una paraula”) e “-” a una risposta irbagliata (“nono” oppuru “no est una paraula”). Si su malaidu non risponnete intro chimbe sicunnos, ache unu tzirollu intunnu a su “0” e cola a s’istimulu dopo. Atzetta comente risposta su sinnu currisponnente de conca.

***Allughe su registratore, assicurati chi siata alluttu e chi siete registranne, e comintza a leghere a boche arta.

Como t’apo a dimannare de ripitere tzertas paraulas. Carcuna este paraula chi no esistiti in sardu. No atta sensu. Pro piaghere, ripiti dopo de mene e narami si sa paraula este aberu sarda o no. Prontu?

193. Pira	ripetizione	+	-	0 (193)
	giudissu	+	-	0 (194)
195. Terra	ripetizione	+	-	0 (195)

	giudissu	+	-	0 (196)
197. Trocu	ripetizione	+	-	0 (197)
	giudissu	+	-	0 (198)
199. Pama	ripetizione	+	-	0 (199)
	giudissu	+	-	0 (200)
201. Monte	ripetizione	+	-	0 (201)
	giudissu	+	-	0 (202)
203. Neba	ripetizione	+	-	0 (203)
	giudissu	+	-	0 (204)
205. Dibo	ripetizione	+	-	0 (205)
	giudissu	+	-	0 (206)
207. Foca	ripetizione	+	-	0 (207)
	giudissu	+	-	0 (208)
209. Firo	ripetizione	+	-	0 (209)
	giudissu	+	-	0 (210)
211. Lama	ripetizione	+	-	0 (211)
	giudissu	+	-	0 (212)
213. Vinu	ripetizione	+	-	0 (213)
	giudissu	+	-	0 (214)
215. Chitzu	ripetizione	+	-	0 (215)
	giudissu	+	-	0 (216)
217. Cupa	ripetizione	+	-	0 (217)
	giudissu	+	-	0 (218)
219. Strala	ripetizione	+	-	0 (219)
	giudissu	+	-	0 (220)
221. Lente	ripetizione	+	-	0 (221)
	giudissu	+	-	0 (222)
223. Alvore	ripetizione	+	-	0 (223)
	giudissu	+	-	0 (224)
225. Custume	ripetizione	+	-	0 (225)
	giudissu	+	-	0 (226)
227. Bumato	ripetizione	+	-	0 (227)
	giudissu	+	-	0 (228)
229. Manteddu	ripetizione	+	-	0 (229)
	giudissu	+	-	0 (230)
231. Pabete	ripetizione	+	-	0 (231)
	giudissu	+	-	0 (232)
233. Rusore	ripetizione	+	-	0 (233)
	giudissu	+	-	0 (234)
235. Terrinu	ripetizione	+	-	0 (235)
	giudissu	+	-	0 (236)
237. Voresta	ripetizione	+	-	0 (237)
	giudissu	+	-	0 (238)
239. Lotanda	ripetizione	+	-	0 (239)
	giudissu	+	-	0 (240)
241. Patedda	ripetizione	+	-	0 (241)
	giudissu	+	-	0 (242)
243. Buttone	ripetizione	+	-	0 (243)

	giudissu	+	-	0 (244)
245. Angulu	ripetizione	+	-	0 (245)
	giudissu	+	-	0 (246)
247. Merazza	ripetizione	+	-	0 (247)
	giudissu	+	-	0 (248)
249. Metallu	ripetizione	+	-	0 (249)
	giudissu	+	-	0 (250)
251. Urmicca	ripetizione	+	-	0 (251)
	giudissu	+	-	0 (252)

RIPETIZIONE DE VRASES

***Leghe a boche arta custas istruziones.

Como asa intennere vrases che devese ripitere dopo de mene. Prontu?

253. Su pitzinnu ispinghete sa pitzinna.	+	-	0 (253)
254. Isse la mantenete.	+	-	0 (254)
255. Este su cane chi mossicata su gattu.	+	-	0 (255)
256. Este su pitzinnu chi sa pitzinna mantenete.	+	-	0 (256)
257. Su camiu no este tiratu dae sa macchina.	+	-	0 (257)
258. Issa lu sichiti.	+	-	0 (258)
259. Su pitzinnu no ischittata sa mama.	+	-	0 (259)

SERIAS

***In custa setzione si dimannata a su malaidu de retzitare carchi serie imparata a memoria. Pro d’ontzuna de sas tre serias ache unu tzirollu intunnu a su “+” solu si sa serie retzitata dae su malaidu est cumpleta e sichiti s’ordine justu. Ache unu tzirollu intunnu a su “-” si su malaidu achete errores o irmeticantziasa, oppuru cambia s’ordine de sos elementos de sa lista. Si non risponnete pro nudda, ache unu tzirollu intunnu a su “0”.

***Cumintza a leghere a boche arta.

260. Cale sono sas dies de sa chitta?	+	-	0 (260)
261. Potese contare dae unu a bintichimbe?	+	-	0 (261)
262. Cales sono sos meses dess’annu?	+	-	0 (262)

FLUENZA VERBALE

***Custa setzione misurata sa capatzitate de ammentare paraulas chi cumintzana chin d'unu certu sonu. Su chi contata este su numeru de paraulas chi su malaidu resessiti a fachere in d'UNU MINUTU.

***Cumintza a leghere a boche arta.

Como ti dimanno de mi dare su numeru prus mannu de paraulas chi cumintzana chin d'unu tzertu sonu. Pro assempru, si ti naro, narami paraulas chi cumintzana chi sa "s", mi devese risponnere "sapone", "sarta", "suegliu", "sonette", "sole", "sicunnu" etc.

Narami, pru lestu possibile, tottu sas paraulas chi potese chi cumintzana chi sa "t".

263. Tottu sas paraulas cumintzana chi sa "t" + - 0 (263)
264. Numeru de paraulas chi si potene atzettare. ________ (264)

Anna bene. Como sas paraulas chi cumintzana chi sa "m".

265. Tottu sas paraulas cumintzana chi sa "m". + - 0 (265)
266. Numeru de paraulas chi si potene atzettare. ________ (266)

Anna bene. Como sas paraulas chi cumintzana chi sa "p".

267. Tottu sas paraulas cumintzana chi sa "p". + - 0 (267)
268. Numeru de paraulas chi si potene atzettare. ________ (268)

DENOMINAZIONE

***In custa prova, su malaidu devete numenare cosas chi li enini ammustratasa dae tantu in tantu. Pone d'ontzi cosa, una iffatu as'atera, chi la potata bidere su malaidu. Sas cosas non devene essere vistasa prima de bi las ammustrare.
***Cumintza a leghere a boche arta.

Como t'ammustro cosas. Narami su numene de d'ontzunu. Prontu?

269. Libru + - 0 (269)
270. Crae + - 0 (270)
271. Leputzu + - 0 (271)
272. Tassa/ Tzicaredda + - 0 (272)
273. Gravatta + - 0 (273)
274. Ortiches + - 0 (274)
275. Cugliera + - 0 (275)
276. Guantu + - 0 (276)
277. Lapis + - 0 (277)

278. Cartas de joccu	+	-	0 (278)
299. Righedda	+	-	0 (299)
280. Buttone	+	-	0 (280)
281. Sigaretta	+	-	0 (281)
282. Urchetta	+	-	0 (282)
283. Piuma/ Pia	+	-	0 (283)
284. Aneddu	+	-	0 (284)
285. Cannela	+	-	0 (285)
286. Busta	+	-	0 (286)
287. Spatzolinu (pro sas dentes)	+	-	0 (287)
288. Rellotzu (de brussu)	+	-	0 (288)

COSTRUTZIONES DE VRASES

***In custa prova su malaidu diat dever'achere vrases usanne sas praulas chi li enini datas. Pro d'ontzi vrase idere: 1) si su malaidu atta rispostu o nono; 2) si sa vrase este justa seccunnu sa grammatica; 3) si sa vrase atta sensu o nono; 4) si tottu sas paraulas datas sono istatas usatas; e 5) su numeru totale de paraulas usatas.

***Cumintza a leghere a boche arta.

Como ti naro paraulas. Chin custas paraulas devese achere sa vrase prus vatzile e prus curtza possibile. Pro assempru, si ti naro "janna/aberrere/infermiera", tue mi devese risponnere "S'infermiera aberiti sa janna". Prontu?

289. Domo/ gattu	Risposta data?	+	-	0 (289)
	Justa pro sa grammatica?	+	-	0 (290)
	Atta sensu?	+	-	0 (291)
	Tottu sas paraulas usatas?	________		(292)
	Numeru de paraulas?	________		(293)
294. Crateone/ dottore/ sédere	Risposta data?	+	-	0 (294)
	Justa pro sa grammatica?	+	-	0 (295)
	Atta sensu?	+	-	0 (296)
	Tottu sas paraulas usatas?	________		(297)
	Numeru de paraulas?	________		(298)
299. Iscrivania/ abberrere/ calasseddu	Risposta data?	+	-	0 (299)
	Justa pro sa grammatica?	+	-	0 (300)
	Atta sensu?	+	-	0 (301)
	Tottu sas paraulas usatas?	________		(302)
	Numeru de paraulas?	________		(303)
304. Alvore/ virde/ otza/ idere	Risposta data?	+	-	0 (304)
	Justa pro sa grammatica?	+	-	0 (305)
	Atta sensu?	+	-	0 (306)

	Tottu sas paraulas usatas?	________ (307)
	Numeru de paraulas?	________ (308)
309. Lapis/ iscriere/ biaitu/ otzolu	Risposta data?	+ - 0 (309)
	Justa pro sa grammatica?	+ - 0 (310)
	Atta sensu?	+ - 0 (311)
	Tottu sas paraulas usatas?	________ (312)
	Numeru de paraulas?	________ (313)

***Issas prossimas provas su malaidu devete dare una risposta a s' istimulu. Pro d'ontzi istimulu sa risposta prus assimitzante s'acatata a destra tra parentisi. A d'ontzi modu si su malaidu data sa risposta justa, ache unu tzirollu intunnu a su "+" e cola a s'istimulu iffattu. Si su malaidu data un'attera risposta chi siat justa pro s'esaminatore ache unu tzirollu intunnu a su "1" (e annotta sa risposta matessi acurtzu a custa numeru). Si sa risposta no este justa (sos criterios sono datos in d'ontzi setzione), ache unu tzirollu intunnu a su "-". Si su malaidu non data peruna risposta intro chimbe sicunnos, ache unu tzirollu intunnu a su "0" e cola a su stimulu iffattu.

SEMANTICOS CONTRARIOS

***In custa setzione su malaidu devete narrere una paraula chi siata su contrariu de sa paraula chi li eniti nata. Duncas, sa risposta este justa si sa paraula (chi s'accattata in mesusu a metas paraulas) atta su sensu contrariu.

***Cumintza a leghere a boche arta.

Como t'apo a narrere una paraula e tue mi devese risponnere chin d'una de significatatu contrariu. Pro assempru, si jeo ti naro "malu", tue mi narasa "vonu". Prontu?

314. Veru	+ Vartzu	o _______________	+ - 0 (314)
315. Poveru	+ Riccu	o _______________	+ - 0 (315)
316. Mannu	+ Minore	o _______________	+ - 0 (316)
317. Leppiu	+ Pesante	o _______________	+ - 0 (317)
318. Modde	+ Tostu	o _______________	+ - 0 (318)
319. Largu	+ Astrintu	o _______________	+ - 0 (319)
320. Lestru	+ Lentu	o _______________	+ - 0 (320)
321. Aberrere	+ Tancare	o _______________	+ - 0 (321)
322. Sedere	+ Artziare	o _______________	+ - 0 (322)
323. Romasu	+ Grassu	o _______________	+ - 0 (323)

MORFOLOGIA DERIVAZIONALE

***In custa setzione, ache unu tzirollu: (1) intunnu a su "+" si su malaidu mustrata sa paraula tra parentisi; (2) intunnu a su "-" si data una risposta irbagliata; (3) intunnu a su "0" si non data peruna risposta intro chimbe sicunnos.

***Cumintza a leghere a boche arta.

Como ti do un paraula e tue mi devese dare su diminutivu. Pro assempru, si naro "bellu", tue risponne "belleddu", si imbetze naro "poveru", risponne "poverittu". Prontu?

324. Campu	+ campeddu	o _______________	+	-	0 (324)
325. Bancu	+ banchittu	o _______________	+	-	0 (325)
326. Preta	+ pretichina	o _______________	+	-	0 (326)
327. Cane	+ caneddu	o _______________	+	-	0 (327)
328. Idda	+ iddedda	o _______________	+	-	0 (328)
329. Trumba	+ trumbedda	o _______________	+	-	0 (329)
330. Conca	+ conchedda	o _______________	+	-	0 (330)
331. Ruche	+ ruchedda	o _______________	+	-	0 (331)
332. Pudda	+ puddichina	o _______________	+	-	0 (332)
333. Pala	+ palitta	o _______________	+	-	0 (333)

CONTRARIOS MORFOLOGICOS

***In custa setzione su malaidu devete narrere su contrariu de una paraula, anannghenneli unu prefissu negativu. Ache unu tzirollu intunnu a su "+" si sa risposta este justa, intunnu a su "-" si sa risposta no este justa, oppuru intunnu a su "0" si su malaidu non data peruna risposta intro chimbe sicunnos.

***Cumintza a leghere a boche arta.

Como ti naro carchi paraula. Narami su contrariu de d'ontzi paraula annanghenneli solu unu prefissu. Pro assempru, si ti naro "cuntentu", tue deves risponnere "discontentu". Prontu?

334. Justu	+ injustu	o _______________	+	-	0 (334)
335. Comudu	+ iscomudu	o _______________	+	-	0 (335)
336. Pretzisu	+ impretzisu	o _______________	+	-	0 (336)
337. Detzisu	+ indetzisu	o _______________	+	-	0 (337)
338. Finitu	+ infinitu	o _______________	+	-	0 (338)
339. Cumpostu	+ iscumpostu	o _______________	+	-	0 (339)
340. Accropatu	+ iscroppatu	o _______________	+	-	0 (340)
341. Abitatu	+ disabitatu	o _______________	+	-	0 (341)
342. Cuncordu	+ iscuncordu	o _______________	+	-	0 (342)
343. Interratu	+ isterratu	o _______________	+	-	0 (343)

DESCRITZIONES

***In custa setzione s'ammustrata a su malaidu un'istoria illustrata (unu vumette) chene paraulas. Sa pagina de su vumette eniti appompiata dae su malaidu pro tottu sa durata de sa prova. Su malaidu devete contare s'istoria in duos minutos. Canno su malaidu atta initu, ache unu tzirollu intunnu a sa risposta justa pro d'ontzuna de sa vrases dae 344 a 346.

***Cumintza a leghere a boche arta.

Como ti do un'istoria a vumettes chene paraulas. Appompia vene sas pinturas e poi mi contas s'istoria.

344. Cantitate de produtzione 0 1 2 3 (344)
0) mancuna 1) pacu 2) prus pacu de su normale 3) normale
345. Este arrivatu vinas a sa ine? + - 0 (345)
346. Su malaidu:
1) s'este acuntentatu de contare d'ontzi pintura abanna,
2) atta contatu un'istoria cuntinua
3) no atta attu nè s'una nè s'atera, 1 2 3 (346)

CARCULU MENTALE

***In custa setzione su malaidu devete achere operatziones (addizione, sottrazione, ecc) a mente. D'ontzi dimanna anna lessa propriu comente este inoche. Sa risposta justa este posta a destra; si su malaidu risponnete justu, ache unu tzirollu intunnu a su "+". Si imbetze data una risposta isbagliata, ache unu tzirollu intunnu a su "-". Si su malaidu non data peruna risposta intro deche sicunnos ache unu tzirollu intunnu a su "0" e cola a s'operatzione iffattu. Non bisontzata de annare a dainnantisi dopo chimbe vallimentos iffat'apare; ache unu tzirollu intunnu a su "0" pro d'ontzi risposta chi bi restata, e cola a sa prova imbeniente (Comprensiones uditivas).

***Cumintza a leghere a boche arta.

Como ti acco carchi dimanna de aritmetica. Chirca de mi dare sa risposta justa, su prus lestru possibile.

347. Cantu achete	chimbe prus battoro?	Nove	+	-	0	(347)
348. Cantu achete	sette mancu duos?	Chimbe	+	-	0	(348)
349. Cantu achete	duos pro tres?	Sese	+	-	0	(349)
350. Cantu achete	nove divisu tres?	Trese	+	-	0	(350)
351. Cantu achete	sese prus sette?	Treichi	+	-	0	(351)
352. Cantu achete	vintunu mancu nove?	Doichi	+	-	0	(352)
353. Cantu achete	battoro pro sese?	Vintibattoro	+	-	0	(353)
354. Cantu achete	doichi divisu battoro?	Trese	+	-	0	(354)
355. Cantu achete	battordichi prus vintiduos?	Trintasese	+	-	0	(355)

356. Cantu achete	barantasese mancu vintunu?	Vintichimbe+ - 0 (356)
357. Cantu achete	tres pro doichi?	Trintasese + - 0 (357)
358. Cantu achete	sessanta divisu battoro?	Binnichi + - 0 (358)
359. Cantu achete	dechessette prus decheotto?	Trintachimbe+ - 0(359)
360. Cantu achete	trintaduos mancu binnichi?	Dechessette+ - 0 (360)
361. Cantu achete	tres pro battordichi?	Barantaduos+ - 0(361)

COMPRENSIONE UDITIVA

***Dopo aere lessu a su malaidu sas istrutziones e s'istoria chi sichiti, ache chimbe dimannas (362-366) e marca unu tzirollu intunnu a su simbulu justu ("+" este uguale ad una risposta justa e "-" a una risposta isbagliata; "0" si non data una risposta oppuru narata chi no l'ischiti).

***Cumintza a leghere a boche arta.

Como ti conto unu contu. Ascurta vene pruite dopo ti aco carchi dimanna. Prontu?.

Unu mantzanu de veranu, unu piscatore e su vitzu ini in si spiaggia. A sero inini de piscare ca ini istracos. Ma non potiana torrare a domo ca unu ladru sinc'aiata uratu sa machina.

362. Uve ini su piscatore e su vitzu? + - 0 (362)
363. De cale istaione s'aeddata in s'istoria? + - 0 (363)
364. Ite ana attu su piscatore e su vitzu? + - 0 (364)
365. Pruite ana lassatu su piscare? + - 0 (365)
366. Pruite no ana poitu torrare a domo? + - 0 (366)

LETTURA (a boche arta)

***Issas duas provas chi sichini su malaidu devete leghere s'istimulu a boche arta. Pro d'ontzi stimulu marca un "+" pro unu istimulu lessu vene, unu "-" pro unu istimulu lessu male, e unu "0" si su malaidu non narata nudda.

***Cumintza a leghere a boche arta.

Como ti aco idere carchi paraula. Leghemi d'ontzi paraula a boche arta. Prontu?

367. Gherra + - 0 (367)
368. Vronte + - 0 (368)
369. Pacu + - 0 (369)
370. Lira + - 0 (370)
371. Pupa + - 0 (371)
372. Casu + - 0 (372)
373. Rena + - 0 (373)
374. Dente + - 0 (374)

375. Rana + - 0 (375)
376. Diga + - 0 (376)

***Leghe (a boche arta) s'istruzione de sutta a su malaidu.

Como ti do carchi vrase de leghere a boche arta. Prontu?

377. Su pitzinnu mantenete sa pitzinna. + - 0 (377)
378. Issa l'ispinghete. + - 0 (378)
379. Su gattu este mossicatu dae su cane. + - 0 (379)
380. Este su camiu chi tira sa macchina. + - 0 (380)
381. Su pitzinnu no ispinghete sa pitzinna. + - 0 (381)
382. Su camiu no este tiratu dae sa macchina. + - 0 (382)
383. Este su cane chi su gattu mossicata. + - 0 (383)
384. Issa lu mantenete. + - 0 (384)
385. Sa pitzinna este ispinta dae su pitzinnu. + - 0 (385)
386. Su pitzinnu no este iffustu dae sa pitzinna. + - 0 (386)

LETTURA A SA MUTA

***In custa prova su malaidu devete leghere una vrase a sa muta e poi risponnere a dimannas supra de su paragrafu chi atta lessu. Daeli 90 sicunnos pro leghere s'istoria.

***Cumintza a leghere a boche arta.

Como ti aco leghere una vrase. Leghela a sa muta. Canno asa initu naramilu, ca gai ti aco carchi dimanna. Prontu?

Unu catzìatore este annatu a catza chi su vrate. In su buscu ana isparatu duos sirvones. Ghiranne a domo si sono virmatos da unu cumpantzu e ana cambiatu sos sirvones pro unu crapolu.

387. Chin chie este annatu su catziatore? + - 0 (387)
388. A uve sono annatos su catziatore e su vrate? + - 0 (388)
389. Ite ana attu in su buscu? + - 0 (389)
390. A uve ana picatu sos sirvones? + - 0 (390)
391. Ite ana attu de sos sirvones? + - 0 (391)
392. Ite ana apitu in cambiu de sos sirvones? + - 0 (392)

MORRERE SU REGISTRATORE

COPIATURA

***Dae unu otzolu a su malaidu chi cumintzet a leghere a boche arta.

Como ti do una lista de paraulas. Mi, una pinna. Iscrie d'ontzuna de custas paraulas in s'otzolu.

393. Pena	+	-	0 (393)
394. Serra	+	-	0 (394)
395. Lana	+	-	0 (395)
396. Supa	+	-	0 (396)
397. Litzu	+	-	0 (397)

DETTATU

***Leghere s'istrutzione a su malaidu.

Como ti lego carchi paraula chi tue mi devese iscriere. Prontu?

398. Gama	+	-	0 (398)
399. Brocu	+	-	0 (399)
400. Ponte	+	-	0 (400)
401. Tira	+	-	0 (401)
402. Broca	+	-	0 (402)

***Leghere sas istrutziones iffattu a su malaidu. Si sa vrase este iscritta chene imbaglios, achere unu tzirollu intunnu a su "+", si nono iscriere su numeru de paraulas justas in su locu cussitzatu. Si su malaidu non iscriete nudda, achere unu tzirollu intunnu a su "0".

Como ti detto carchi vrase. Iscrielasa. Prontu?

403. Isse l'iffunnete.	+	__________	0	(403)
404. Issa lu mantenete.	+	__________	0	(404)
405. Su pitzinnu este tiratu dae su cane.	+	__________	0	(405)
406. Sa pitzinna no ispinghete sa macchina.	+	__________	0	(406)
407. Este mama sua chi sichiti su camiu.	+	__________	0	(407)

COMPRENSIONE DE TESTU ISCRITTU (VOCABULOS)

***In custa setzione, ammustrare a su malaidu una paraula a sa via. Isse devete accroppare una pintura a d'ontzi paraula. Achere unu tzirollu intunnu a su numeru chi currisponnete a sa pintura ischerriata dae su malaidu.

***Cumintza a leghere a boche arta.

Como ti aco idere carchi paraula. Ammustrami sa pintura chi currisponnete a su significatu de sa paraula. Prontu?

408. Gherra	1	2	3	4	0	(408)
409. Vronte	1	2	3	4	0	(409)
410. Pacu	1	2	3	4	0	(410)
411. Lira	1	2	3	4	0	(411)
412. Pupa	1	2	3	4	0	(412)
413. Casu	1	2	3	4	0	(413)
414. Rena	1	2	3	4	0	(414)
415. Dente	1	2	3	4	0	(415)
416. Rana	1	2	3	4	0	(416)
417. Diga	1	2	3	4	0	(417)

CUMPRENSIONE DE TESTU ISCRITTU (VRASES)

***Leghere a su malaidu custas istrutziones.

Como ti aco idere carchi vrase. Tocca sa pintura chi currisponnete a su significatu de d'ontzuna. Prontu?

418. Su pitzinnu mantente sa pitzinna.	1	2	3	4	0	(418)
419. Issa l'ispinghete.	1	2	3	4	0	(419)
420. Su cane este mossicatu dae su gattu.	1	2	3	4	0	(420)
421. Este su camiu chi tirata sa macchina.	1	2	3	4	0	(421)
422. Su pitzinnu no ispinghete sa pitzinna.	1	2	3	4	0	(422)
423. Su camiu no este tiratu dae sa macchina.	1	2	3	4	0	(423)
424. Este su cane chi su gattu mossicata.	1	2	3	4	0	(424)
425. Isse la mantenete.	1	2	3	4	0	(425)
426. Sa pitzinna este ispinta dae su pitzinnu.	1	2	3	4	0	(426)
427. Sa pitzinna no este iffusta dae su pitzinnu.	1	2	3	4	0	(427)

ISCRITTURA ISPONTANEA

***Dare un'ateru otzolu a su malaidu e cuncordare 5 minutos pro iscriere in libertate.

***Cumintzare a leghere a boche arta.

Cheria chi tue como iscriasa in custu otzolu carchi cosa supra de sa malattia tua.

Impressiones imprusu supra sa calitate de sa prestatzione de su malaidu no ammustratas dae sas dimannas.

ESAME DE’AFASIA IN SOS CHI AEDDANA DUAS LIMBAS

ESAME DI AFASIA NEI BILINGUI

PARTE C

Bilinguismu sardu-Italianu | Bilinguismo italiano-sardo

RICONOSCIMENTU DE PARAULAS/RICONOSCIMENTO DI PAROLE

***Mustra sas paraulas a una una a su malaidu e a su mantessi tempus bi las leghese a boche arta. Isse devete narrere e/o ammustrare sa paraula de sa lista de deche paraulas chi rapresentana sas matessi in italianu. Ache unu tzirollu intunnu a su numeru chi currisponnete a sa chi atta issepperatu su malaidu. Si dopo deche sicunnos no a datu una risposta, ache unu tzirollu intunnu a su “0” e cola a sa paraula/ istimulu imbenniente. Si su malaidu no este capatze de leghere, li leghese sas deche paraulas a una una, vintzas a canno no atta ischerriatu. Si dopo tres lessas una in fattu as’atera su malaidu no atta galu ischerriatu, ache unu tzirollu intunnu a su “0” e cola a sa paraula/ istimulu imbeniente.

***Cumintza a leghere a boche arta.

Como t’ammustro una paraula in sardu e tue mi devese narrere cale paraula in custa lista cherete narrere sa mantessi cosa in italianu. Prontu?

428. alvore	1. mela	0	1	2	3	4	5	6	7	8	9	10	(428)
429. cariasa	2. ciliegia	0	1	2	3	4	5	6	7	8	9	10	(429)
430. barcone	3. lampo	0	1	2	3	4	5	6	7	8	9	10	(430)
431. marteddu	4. martello	0	1	2	3	4	5	6	7	8	9	10	(431)
432. astore	5. porta	0	1	2	3	4	5	6	7	8	9	10	(432)
	6. falco												
	7. finestra												
	8. pieghe												
	9. albero												
	10. pecora												

***Cominciare a leggere ad alta voce.

Ora Le mostrerò una parola in italiano e Lei mi dira quale parola in questa lista vuole dire la stessa cosa in sardo. È pronto?

433. formaggio	1. crateone	0	1	2	3	4	5	6	7	8	9	10	(433)
434. cavallo	2. casu	0	1	2	3	4	5	6	7	8	9	10	(434)
435. volpe	3. mattzone	0	1	2	3	4	5	6	7	8	9	10	(435)
436. fiore	4. mesa	0	1	2	3	4	5	6	7	8	9	10	(436)

437. poltrona	5. vrore 6. abba 7. lapis 8. caddu 9. otzolu 10. ainu	0 1 2 3 4 5 6 7 8 9 10	(437)

TRADUTZIONE DE PARAULAS/TRADUZIONE DI PAROLE

***Leghe sas paraulas chi sichini a boche arta, a una una. Si sa risposta de su malaidu currisponnete a sa paraula data vra parentisi, ache unu tzirollu intunnu a su "+"; si sa paraula este diversa, ma si potete atzettare, ache unu tzirollu intunnu a su numeru "1"; si sa tradutzione est isbagliata, ache unu tzirollu intunnu a su "0" e cola a sa paraula chi sichiti.

***Cumintza a leghere a boche arta.

Como ti naro una paraula in sardu e tue mi devese achere sa tradutzione in italianu. Prontu?

438. leputzu	(coltello)	+ 1 - 0 (438)
439. janna	(porta)	+ 1 - 0 (439)
440. uricra	(orecchio)	+ 1 - 0 (440)
441. rena	(sabbia)	+ 1 - 0 (441)
442. valigia	(valigia)	+ 1 - 0 (442)
443. amore	(amore)	+ 1 - 0 (443)
444. malesa	(bruttezza)	+ 1 - 0 (444)
445. coraggiu	(coraggio)	+ 1 - 0 (445)
446. tristura	(tristezza)	+ 1 - 0 (446)
447. rajone	(ragione)	+ 1 - 0 (447)

***Leggere le seguenti parole ad alta voce, una per una. Se la risposta del paziente corrisponde alla parola data fra parentesi, fare un cerchio attorno al segno "+"; se la parola è diversa, ma accettabile, fare un cerchio attomo alla cifra "1"; se la traduzione è sbagliata, fare un cerchio attrno allo "0" e passare alla parola seguente.

***Cominciare a leggere ad alta voce.

Ora Le dirò una parola in italiano e Lei mi darà la traduzione in sardo. Pronto?

448. rasoio	(rasoiu, resoglia de achere arva)	+	1	-	0	(448)
449. muro	(muru)	+	1	-	0	(449)
450. collo	(tzucru)	+	1	-	0	(450)
451. burro	(butiru)	+	1	-	0	(451)
452. cappello	(bonette)	+	1	-	0	(452)
453. odio	(odiu)	+	1	-	0	(453)
454. gioia	(gioia)	+	1	-	0	(454)
455. paura	(timoria)	+	1	-	0	(455)
456. follia	(machine)	+	1	-	0	(456)
457. bellezza	(bellesa)	+	1	-	0	(457)

TRADUTZIONE DE VRASES/TRADUZIONE DI FRASI

***Sas vrases de traduchere enini lessas a boche arta. Si li si potene narrere metas vias cantas ne cherete su malaidu, vintzas a unu massimu de tres vias; ache unu tzirollu intunnu a su numeru de sas vias chi sa vrase est istata lessa. Su punteggiu currisponnete a su numeru de gruppu de paraulas (chi este ammustratu issa tradutzione cossitzata vra parentisi) currettamente tradottas. Ache unu tzirollu intunnu a su numeru chi currisponnete a su numeru de gruppos chene errores; un'irmenticantzia contata comente un'isbagliu. Si d'ontzi gruppu atta unu o prus imbaglioso, oppuru si su malaidu non narata nudda dopo tres vias, ache unu tzirollu intunnu a su "0". Si, imbetze, sa tradutzione no est cussa cossitzata (vra parentisi), ma si potete atzettare, ache unu tzirollu intunnu a su "+". Su punteggiu de una vrase ammustrata vra parentisi atta essere uguale a su numeru des sos gruppos in sa vrase.

***Cumintza a leghere a boche arta.

Como t'appo a dare vrases in sardu e tue mi achese sa tradutzione in italianu.

458. Juanna ata aspetatu a Piero pro 20 minutos.	testu lessu	1	2	3	volte		(458)
(Giovanna ha <u>aspettato Piero</u> per 20 minuti)	gruppos chene errores	+	0	1	2	3	(459)
460. Ierisi l'appo telefonatu a domo.	testu lessu	1	2	3	volte		(460)
(Ieri <u>gli ho telefonato</u> a casa)	gruppos chene errores	+	0	1	2	3	(461)
462. Jorgia ha postu sutta a sa cratea una cassetta de arantzu.	testu lessu	1	2	3	volte		(462)
(Giorgia ha messo <u>sotto la sedia</u> una cassetta <u>di arance</u>)	gruppos chene errores	+	0	1	2	3	(463)
464. Su mantzanu de 2 de vreagliu babbu meu no este annatu a travagliare.	testu lessu	1	2	3	volte		(464)
(<u>La mattina</u> del 2 febbraio <u>mio padre</u> non è andato a lavorare)	gruppos chene errores	+	0	1	2	3	(465)
466. Maria este istudianne dirittu, pro custu non si cheret isturbata prima de sero.	testu lessu	1	2	3	volte		(466)
(Maria <u>sta studiando</u> diritto, perciò <u>non vuole essere disturbata</u> prima <u>di sera</u>)	gruppos chene errores	+	0	1	2	3	(467)
468. Babbu meu este abbaitanne sa televisione, su vrate puru.	testu lessu	1	2	3	volte		(468)
(<u>Mio padre</u> <u>stà guardando</u> la televisione, <u>anche il fratello</u>)	gruppos chene errores	+	0	1	2	3	(469)

***Le frasi da tradurre vanno lette ad alta voce. La si può ripetere tante volte quante il paziente domanderà, fino ad un massimo di tre volte; fare un cerchio attorno al numero di volte che la frase sarà letta. II punteggio corrisponde al numero di gruppi di parole (il quale è indicato nella traduzione suggerita fra parentesi) correttamente tradotti. Fare un cerchio attorno alla cifra che corrisponde al numero di gruppi senza errori; un'omissione conta ugualmente come un errore. Se ogni gruppo contiene uno o più errori, oppure se il paziente non dice niente dopo tre ripetizioni successive, fare un cerchio attorno allo "0". Se, invece, la traduzione del paziente non è quella suggerita fra parentesi, ma è tuttavia accettabile, fare un cerchio attorno al "+". II punteggio di una frase indica alla traduzione data fra parentesi sarà uguale al numero di gruppi nella frase.

***Cominciare a leggere ad alta voce.

Ora Le darò delle frasi in italiano e Lei mi darà la traduzione in sardo. Pronto?

470. Mario ha visto Giovanni in via Roma.	testo letto	1 2 3 volte	(470)
(Mariu a bistu a Juanne in via Roma)	gruppi senza errori	+ 0 1 2 3	(471)
472. Avantieri gli ho parlato in ufficio.	testo letto	1 2 3 volte	(472)
(Janterisi l'appo aeddatu in ufissu)	gruppi senza errori	+ 0 1 2 3	(473)
474. Baingo ha messo sopra il tavolo una bisaccia di pere.	testo letto	1 2 3 volte	(474)
(Baintzu ha postu supra a sa mesa una bertula de pira)	gruppi senza errori	+ 0 1 2 3	(475)
476. La sera del 22 aprile tua sorella non è venuta a casa.	testo letto	1 2 3 volte	(476)
(Su seru de su 22 aprile sorre tua no este ennita a domo)	gruppi senza errori	+ 0 1 2 3	(477)
478. Baingio sta intagliando dell'olivo, e perciò non vuole essere cercato prima di sera.	testo letto	1 2 3 volte	(478)
(Baingo este intarsianne un'ulia, e pro custu non si cheret chircatu prima de sero)	gruppi senza errori	+ 0 1 2 3	(479)
480. Mia madre stà mangiando una mela, anche la figlia.	testo letto	1 2 3 volte	(480)
(Mama mea este mannicanne una meledda, sa itza puru)	gruppi senza errori	+ 0 1 2 3	(481)

GIUDISSOS DE GRAMMATICALITÀ/GIUDIZI DI GRAMMATICALITÀ

***In custa setzione, su malaidu devete achere idere si una vrase chi li eniti lessa este justa o nono. Si narata chi sa vrase no este grammaticale, li dimannasa de la curretzire e de la achere atzetabile. Pro su giuditziu de su malaidu: ache unu tzirollu intunnu a su segno "+", si su malaidu narata sa vrase justa, oppuru intunnu a su "-" si est cussiderata isbagliata, chene contare si su giudissu siata aberu justu o isbagliatu; si su malaidu non data peruna risposta, ache unu tzirollu intunnu a su "0". Poi, pro sa curretzione: ache unu tzirollu intunnu a su "+" si sa vrase curretzita dae su malaidu est atzetabile; intunnu a su "-" si no este atzetabile; oppuru intunnu a su "0" si narata chi no bil'achete de la curretzire, si atta natu pro imbagliu sa vrase comente che canno sia justa (in cussu casu no bata manera de la curretzire), oppuru si su malaidu non narata nudda. Canno una vrase justa (486, 492) eniti carculata isbagliata dae su malaidu, e est atta isbagliata tentanne de la curretzire, ache unu tzirollu intunnu a su "-" pro tottas duas sas rubricas. Si su malaidu cambiata sa vrase chene l' isbagliare, ache unu tzirollu intunnu a su "+" pro sa curretzione.

***Cumintza a leghere a boche arta.

Como ti apo a dare vrases in sardu e tue mi devese narrere si custas vrases sono justas o nono. Pro assempru, si naro “non cheglio che faghedas abolottu”, tue mi risponnese isbagliata, e poi curretzi sa vrase nannemi “non cheglio a faghere abolottu”. Prontu?

482. In vetzesa minche ghiro a Vitzi.	giudissu	+	-	0	(482)
	vrase curretta	+	-	0	(483)
484. L’ischisi chi est colatu issara?	giudissu	+	-	0	(484)
	vrase curretta	+	-	0	(485)
486. Sedela acara a su barcone.	giudissu	+	-	0	(486)
	vrase curretta	+	-	0	(487)
488. Tua sorre no est bennida a domo.	giudissu	+	-	0	(488)
	vrase curretta	+	-	0	(489)
490. Totas sas erveghes sono malaidas.	giudissu	+	-	0	(490)
	vrase curretta	+	-	0	(491)
492. A sa gara de natare so issitu su e tres.	giudissu	+	-	0	(492)
	vrase curretta	+	-	0	(493)
494. Apo leatu unu saccu de castantzas.	giudissu	+	-	0	(494)
	vrase curretta	+	-	0	(495)
496. Mario este currenne lestramente.	giudissu	+	-	0	(496)
	vrase curretta	+	-	0	(497)

***In questa sezione, il paziente deve indicare se una frase che gli viene letta è corretta o no. Se il paziente giudica la frase non grammaticale, gli si chiede di correggerla e di renderla pertanto accettabile. Per il giudizio del paziente: fare un cerchio attorno al segno “+” se il paziente dichiara la frase corretta, oppure attorno al “-” se la considera scorretta, a prescindere dal fatto che il suo giudizio sia effettivamente giusto o errato; se non da nessuna risposta, fare un cerchio attorno allo “0”. In seguito, per la correzione: fare un cerchio attorno al “+” se la frase corretta dal paziente è accettabile; attorno al “-“ se non è accettabile; oppure attorno allo “0” se si dichiara incapace di correggerla, se ha dichiarato erroneamente la frase come corretta (nel qual caso non ci sarebbe modo di correggerla) oppure se il paziente non dice niente. Quando una frase corretta (500, 504) viene giudicata scorretta dal paziente, ed è in seguito resa scorretta nel tentativo di correzione, fare un cerchio attorno al “-“ per tutte e due le rubriche. Se il paziente cambia la frase senza renderla scorretta, fare un cerchio attorno al “+” per la correzione.
***Cominciare a leggere ad alta voce.

Ora Le darò delle frasi in Italiano. Lei mi dovrebbe dire se queste frasi sono corrette o no. Se non sono corrette, Le chiederò di corregerle. Per esempio, se dico, “È una donna operosa molto”, Lei mi risponderà “scorretta” e poi correggerà la frase, dicendomi, “È una donna molto operosa”. Pronto?

498. A bambino giocavo con la palla.	giudizio	+	-	0	(498)
	frase corretta	+	-	0	(499)
500. Falla sedere accanto al caminetto.	giudizio	+	-	0	(500)
	frase corretta	+	-	0	(501)
502. A ci torni domani?	giudizio	+	-	0	(502)
	frase corretta	+	-	0	(503)
504. Mario è risultato undicesimo nella graduatoria.	giudizio	+	-	0	(504)
	frase corretta	+	-	0	(505)
506. Fratello tuo non è venuto a pranzo.	giudizio	+	-	0	(506)
	frase corretta	+	-	0	(507)
508. Tutto le galline sono morte.	giudizio	+	-	0	(508)
	frase corretta	+	-	0	(509)

510. Ho raccolto una cesta di mela.	giudizio	+	-	0	(510)
	frase corretta	+	-	0	(511)
512. Maria guida alla veloce.	giudizio	+	-	0	(512)
	frase corretta	+	-	0	(513)

UNIVERSITÀ DEGLI STUDI DI SASSARI
FACOLTÀ DI MEDICINA E CHIRURGIA

DIPARTIMENTO DI NEUROSCIENZE E SCIENZE MATERNO INFANTILI
(Direttore: Prof. Maria Speranza Desole)

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DOTTORATO DI RICERCA IN NEUROSCIENZE – XX CICLO

(*Coordinatore: Prof. Egidio Miele*)

"Studio neurolinguistico su pazienti afasici bilingui sardo-italiano."

- Informazioni per i partecipanti allo studio
- Spiegazione del consenso informato

Direttore scientifico della ricerca: Dott.ssa Maria Rita Piras

Dottorando: Dott. Dario Zanetti

Laboratorio di Neuropsicologia Clinica & Ambulatorio per le Demenze
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Informazioni per i partecipanti allo studio

1. INTRODUZIONE

Qual è lo scopo degli studi del Laboratorio di Neuropsicologia Clinica & Ambulatrio per le Demenze?
Il Laboratorio di Neuropsicologia Clinica & Ambulatrio per le Demenze, prevede un programma di sviluppo per la ricerca in campo medico sanitario in e per la Sardegna e si occupa di studi neurologici, neuroscientifici (neuropsicologici e neurolinguistici), epidemiologici e genetici. Il programma di sviluppo per la ricerca in campo medico sanitario è condotto nel Laboratorio di Neuropsicologia Clinica & Ambulatorio per le Demenze del Dipartimento di Neuroscienze e Scienze Materno Infantili dell'Università degli Studi di Sassari.

Qual è lo scopo di questo studio?
Lo scopo di questo lavoro scientifico è quello di studiare da un punto di vista neurolinguistico e neuropsicologico pazienti afasici bilingui sardo-italiano. Inoltre, questo studio neuroscientifico è la base di una ricerca ampia che potrà portare in futuro ad una migliore conoscenza di come i neuroni si organizzano in gruppi all'interno del cervello ed in che modo è possibile far risalire i processi intellettuali, come il linguaggio alle caratteristiche di particolari neuroni ed alle connessioni tra di loro.

Dove viene fatto lo studio e chi è chiamato a partecipare allo studio?
Gli studi sono condotti nel Laboratorio di Neuropsicologia Clinica & Ambulatorio per le Demenze presso la Facoltà di Medicina e Chirurgia dell'Università degli Studi di Sassari sotto la direzione scientifica della dott.ssa Maria Rita Piras e del dottorando dott. Dario Zanetti.
Per svolgere tale ricerca abbiamo bisogno della collaborazione e della disponibilità di persone che, come Lei, soddisfino i requisiti scientifici e risultino idonei alla valutazione che verrà eseguita, per questo Le proponiamo di partecipare alla presente ricerca.
Prima di decidere, qualora lo desiderasse, può chiedere un parere sia ai Suoi familiari sia al Suo medico di fiducia.

2. PROGRAMMA DI RICERCA

Il programma di ricerca prevede:
- intervista generale sulla salute (anamnesi, MMSE, ADL e IADL)
- acquisizione immagini T.C. o R.M o S.P.E.C.T
- valutazione neurolinguistica e neuropsicologica (Esame del Linguaggio, Esame dei gettoni e B.A.T.)

Nell'intervista generale si raccoglieranno informazioni sulla Sua salute e sulle abitudini di vita, mentre la fase successiva riguarderà la valutazione neurolinguistica e neuropsicologica.

Otterrò i risultati della valutazione neurolinguistica e neuropsicologica?
I referti della valutazione neurolinguistica e neuropsicologica Le verranno comunicati e spiegati alla conclusione dell'indagine.

Quale tipo di ricerca sarà condotto e che ruolo avrà la Sua partecipazione?
I dati estrapolati dalla Sua valutazione neurolinguistica e neuropsicologica veranno confrontati con quelli ottenuti dallo studio di altri soggetti afasici da noi valutati precedentemente ed, inoltre, veranno successivamente confrontati con i dati conseguiti da altri gruppi di ricerca sparsi nel mondo.
Questi dati, per noi così preziosi, ci permetteranno di avvalorare le nostre ipotesi e ci aiuteranno a sviluppare un quadro sempre più completo del funzionamento del nostro cervello, ed in particolare ci permetteranno di capire come il cervello ellabori e produca il "linguaggio".

Si corrono dei rischi?
In questo studio viene svolto solo un'intervista generale sulla Sua salute ed una valutazione neurolinguistica e neuropsicologica che non comportano per Lei rischi fisici di nessun tipo.

Consenso informato e volontario
La partecipazione allo studio è volontaria. Dopo aver letto e capito in ogni sua parte la spiegazione dello scopo e della conduzione dello studio, il partecipante darà il consenso scritto alla partecipazione. Il consenso può essere revocato in ogni momento. La revoca dovrà avvenire attraverso una comunicazione, scritta o telefonica, al direttore scientifico della ricerca e non comporterà nessuno svantaggio per il partecipante. La cura medica di un'eventuale malattia avverrà indipendentemente dalla partecipazione a questo studio e non sarà da questa influenzata.

3. CONSERVAZIONE E USO DEI DATI OTTENUTI

I dati ottenuti veranno conservati secondo la normativa nazionale vigente presso l'archivio del Laboratorio di Neuropsicologia Clinica & Ambulatorio per le Demenze e veranno usati in forma anonima per la stesura della tesi di dottorato di ricerca del dottorando dott. Dario Zanetti. Qualora i risultati dello studio fossero riportati su riviste o comunicati a convegni medici, le informazioni relative all'identità del soggetto verranno omesse e rese non identificabili.

4. PROTEZIONE DEI DATI PERSONALI E POSSIBILITÁ DI STUDI SUCCESSIVI

Com'è assicurato il mantenimento della tutela della sicurezza e della privacy?
Ai sensi del Decreto Legge n. 196/03 relativo alla tutela della persona per il trattamento dei dati personali, La informiamo che i Suoi dati personali verranno raccolti ed archiviati in modo adeguato e saranno utilizzati esclusivamente per scopi di ricerca scientifica.
La connessione tra i dati personali e i risultati della ricerca sarà possibile solo al direttore di ricerca e a chi da lei delegato. Ogni informazione raccolta è considerata strettamente confidenziale e legata al segreto professionale. I dati potranno essere inviati o condivisi con collaboratori solamente in forma codificata.

Lei ha diritto, se lo desidera, di conoscere quali informazioni saranno archiviate ed in quale modo. I Suoi dati personali saranno preservati unicamente nell'archivio del Laboratorio di Neuropsicologia Clinica & Ambulatorio per le Demenze in modo da permettere eventuali domande chiarificatrici o per consentire l'invito a partecipare a studi successivi.
L'accesso a tali dati sarà consentito solo a personale autorizzato.

5. BENEFICI E RISULTATI DELLA RICERCA

Per la partecipazione allo studio non sarà corrisposto nessun tipo di compenso. A lungo termine c'è da aspettarsi che questi studi neuroscientifici portino ad una miglore conoscenza del funzionamento del nostro cervello, e di conseguenza anche ad una miglore conoscenza delle patologie che colpiscono questo organo.

In caso i risultati di questo studio dovessero essere la base di scoperte scientifiche importanti o la base per lo sviluppo di nuovi test diagnostici, il partecipante allo studio rinuncia a rivendicarli.
Possibili profitti materiali derivanti da questo studio serviranno esclusivamente per finanziare altre ricerche in campo neuroscientifico in Sardegna.

6. DIRITTI DELL'INTERESSATO

1. Il partecipante ha il diritto di ritirarsi dallo studio in qualsiasi momento: questo non comporterà alcuna conseguenza per l'interessato. I dati conservati per lo studio relativi alla sua persona verranno distrutti.
2. L'interessato ha in ogni momento diritto di ottenere la conferma dell'esistenza o meno di dati personali che lo riguardano.
3. L'interessato ha diritto di ottenere la modifica, rettifica e cancellazione parziale o totale dei dati che lo riguardano, come previsto dalla normativa sulla privacy art. 7.
4. In caso di dubbi o domande in merito al progetto il partecipante potrà rivolgersi in qualsiasi momento al personale, che provvederà a rispondere nel modo più adeguato.

7. ESTREMI IDENTIFICATIVI DEL TITOLARE E DEL RESPONSABILE DEI DATI PERSONALI

Il Laboratorio di Neuropsicologia Clinica & Ambulatorio per le Demenze in persona del Responsabile dott.ssa Maria Rita Piras è "*titolare per il trattamento dei dati personali*".
Per ulteriori informazioni, per far valere il proprio diritto alla cancellazione o alla modifica di dati personali o per revocare il proprio consenso, può contattare direttamente il "*responsabile per il trattamento dei dati personali*", il direttore scientifico della ricerca dott.ssa Maria Rita Piras ed il dottorando di ricerca dott. Dario Zanetti, all'indirizzo e numero telefonico riportato sulla prima pagina.

Consenso informato

Come partecipante allo studio, o come tutore di un partecipante, mi è stato spiegato e mi è chiaro lo svolgimento, lo scopo ed i rischi connessi a questo studio, così come per quanto riguarda le aspettative di chi vi avrà partecipato. Ho letto e capito le informazioni per i partecipanti. Per eventuali dubbi e domande potrò rivolgermi in qualsiasi momento al personale interessato che provvederà a rispondere nel modo più adeguato.

1. Parteciperò al seguente programma di ricerca che prevede:
   - intervista generale sulla salute (anamnesi, MMSE, ADL e IADL)
   - acquisizione immagini T.C. o R.M o S.P.E.C.T
   - valutazione neurolinguistica e neuropsicologica (Esame del Linguaggio, Esame dei gettoni e B.A.T.)

2. Sono d'accordo che i miei dati siano mantenuti in forma anonimizzata e separata, tra dati personali e medici, e che siano impiegati a scopo di ricerca in accordo con le leggi vigenti (legge sulla TUTELA DEI DATI PERSONALI, Decreto legislativo 30 giugno 2003, n. 196).

3. Le comunico il nome del mio medico curante. Approvo che vi siano trasmesse dal mio medico curante informazioni contenute nelle cartelle mediche concernenti questo studio e che vengano utilizzate scientificamente in forma codificata.

4. Sono d'accordo che i dati ottenuti dalla valutazione neurolinguistica e neuropsicologica vengano utilizzati per la ricerca e per la stesura della tesi di dottorato di ricerca del dott. Zanetti. Mi è conosciuto che questo studio è condotto a scopo di ricerca e che non sarò messo a conoscenza dei suoi risultati.

5. Sono d'accordo che i dati siano utilizzati dal Laboratorio di Neuropsicologia Clinica & Ambulatorio per le Demenze dell'Università degli Studi di Sassari ed eventualmente trasmessi in forma codificata ad altre istituzioni di ricerca.

6. Sono d'accordo che i miei dati personali saranno preservati unicamente nel Laboratorio di Neuropsicologia Clinica & Ambulatorio per le Demenze dell'Università degli Studi di Sassari e che verrò ricontattato eventualmente per domande chiarificatrici o invitato a partecipare a studi successivi.

7. Ho preso visione e sono a conoscenza delle informazioni riguardanti questo studio, sono preparato a sostenerlo con la mia partecipazione. Concedo a chi lavora in questo studio a trattare i dati e a procedere con l'intervista generale sulla salute e la valutazione neurolinguistica e neuropsicologica.

8. Sono a conoscenza che dalla partecipazione a questo studio non verrà un vantaggio personale e immediato.

9. Mi dichiaro d'accordo con tutti i punti sopraindicati.

☐ Si ☐ No

Non sono d’accordo (esprima qui il suo dissenso in merito al punto specifico o ai punti con i quali non concorda)

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Sono a conoscenza del fatto che la presente ricerca non ha scopo diagnostico e che non riceverò alcuna informazione specifica sui risultati di questo progetto.

Posso revocare in ogni momento il mio consenso, senza alcun bisogno di specificare la motivazione, comunicandolo per iscritto o per telefono all’indirizzo riportato, e confermando la mia intenzione per iscritto.

La Sua disponibilità a partecipare a questo studio è un importante contributo per il progresso della scienza medica. Per questo motivo Le siamo riconoscenti e La ringraziamo calorosamente.

Nome: ______________________________ Data di nascita: _________________
(Partecipante allo studio)

Firma: ______________________________ Firma: ________________________
(Partecipante allo studio o eventuali tutori)

Data: _________________________

Il sottoscritto certifica di aver eseguito un’informazione al paziente dettagliata e completa sul tipo di studio che sarà condotto.

Nome: ______________________________ Firma: ________________________
(personale specializzato) (personale specializzato)

Data: _________________________

Tables control group (Standardization BAT)

	Subject	Age	Gender	Handedness	RSA	NL/CL	MMSE (RS)	MMSE (AS)
1	DMP	51	♀	RH	13 years	NL	30	27.2
2	LM	51	♀	RH	16 years	NL	30	27.2
3	ME	52	♀	RH	13 years	NL	30	27.2
4	PM	52	♀	RH	16 years	CL	30	27.2
5	TV	53	♀	RH	13 years	NL	30	27.2
6	CP	54	♀	RH	13 years	CL	30	27.2
7	SMC	55	♀	RH	16 years	CL	30	27.2
8	PB	56	♀	RH	16 years	CL	30	27.2
9	MG	60	♀	RH	17 years	CL	30	27.2
10	ZG	60	♀	RH	13 years	CL	29	26.2
Average		54.4			14.6 years	4NL/6CL	29.9	27.1

Tab 1.: Control group females – age 51-60 (RH: right-handed; LH: left-handed; RSA: rate of school attendance; NL: Northern Logudorese; CL: Central Logudorese; MMSE (RS): MMSE raw-score; MMSE (AS): MMSE adjusted score).

	Subject	Age	Gender	Handedness	RSA	NL/CL	MMSE (RS)	MMSE (AS)
1	CF	61	♀	RH	8 years	CL	30	28
2	SG	61	♀	RH	9 years	NL	30	28
3	MF	62	♀	RH	5 years	CL	27	25.9
4	ZM	63	♀	RH	13 years	CL	30	27.2
5	MP	63	♀	RH	13 years	CL	30	27.2
6	CGT	64	♀	RH	5 years	NL	28	26.9
7	TIAR	64	♀	RH	17 years	CL	30	27.2
8	FC	64	♀	RH	4 years	CL	29	29.4
9	PMG	65	♀	RH	24 years	NL	30	27.2
10	ZD	66	♀	RH	5 years	CL	29	27.9
Average		63.3			10.3 years	3NL/7CL	29.3	27.49

Tab 2.: Control group females – age 61-70 (RH: right-handed; LH: left-handed; RSA: rate of school attendance; NL: Northern Logudorese; CL: Central Logudorese; MMSE (RS): MMSE raw-score; MMSE (AS): MMSE adjusted score).

	Subject	Age	Gender	Handedness	RSA	NL/CL	MMSE (RS)	MMSE (AS)
1	BMA	71	♀	RH	2 years	CL	25	25.7
2	SA	71	♀	RH	1 year	NL	27	27.7
3	CA	72	♀	RH	14 years	CL	30	27.7
4	MG	73	♀	RH	5 years	CL	28	27.3
5	PG	74	♀	RH	17 years	NL	30	27.7
6	NB	75	♀	RH	24 years	CL	30	28.3
7	PMV	76	♀	RH	13 years	CL	28	26.3
8	TA	77	♀	RH	5 years	CL	26	25.7
9	CM	80	♀	RH	17 years	CL	28	27.1
10	CGA	81	♀	RH	3 years	CL	26	27.5
Average		75			10.1 years	2NL/8CL	27.8	27.1

Tab 3.: Control group females – age over 71 (RH: right-handed; LH: left-handed; RSA: rate of school attendance; NL: Northern Logudorese; CL: Central Logudorese; MMSE (RS): MMSE raw-score; MMSE (AS): MMSE adjusted score).

	Subject	Age	Gender	Handedness	RSA	NL/CL	MMSE (RS)	MMSE (AS)
1	LS	51	♂	RH	12 years	CL	29	27
2	PS	51	♂	RH	5 years	NL	27	25.9
3	GA	52	♂	RH/LH	5 years	CL	30	28.9
4	SP	53	♂	RH	8 years	NL	30	28
5	ZG	54	♂	RH	8 years	NL	30	28
6	MVM	55	♂	RH	18 years	CL	30	27.2
7	ZS	55	♂	RH	23 years	CL	30	27.2
8	MG	56	♂	RH	19 years	CL	30	27.2
9	TG	58	♂	RH	10 years	CL	29	27
10	CG	59	♂	RH	18 years	CL	30	27.2
Average		54.4			12.6 years	3NL/7CL	29.5	27.36

Tab 4.: Control group males – age 51-60 (RH: right-handed; LH: left-handed; RSA: rate of school attendance; NL: Northern Logudorese; CL: Central Logudorese; MMSE (RS): MMSE raw-score; MMSE (AS): MMSE adjusted score).

	Subject	Age	Gender	Handedness	RSA	NL/CL	MMSE (RS)	MMSE (AS)
1	ZR	61	♂	RH	12 years	CL	30	28
2	NP	61	♂	RH	10 years	NL	30	28
3	DM	64	♂	RH	6 years	CL	27	25.9
4	BG	64	♂	RH	8 years	CL	29	27
5	TG	66	♂	RH	5 years	NL	27	25.9
6	MG	66	♂	RH	5 years	NL	29	27.9
7	CM	67	♂	RH	8 years	CL	29	27.9
8	BF	67	♂	RH	8 years	CL	29	27
9	FD	68	♂	LH	23 years	CL	30	27.2
10	CA	69	♂	RH	5 years	NL	29	27.9
Average		65.3			9 years	4NL/6CL	28.9	27.27

Tab 5.: Control group males – age 61-70 (RH: right-handed; LH: left-handed; RSA: rate of school attendance; NL: Northern Logudorese; CL: Central Logudorese; MMSE (RS): MMSE raw-score; MMSE (AS): MMSE adjusted score).

	Subject	Age	Gender	Handedness	RSA	NL/CL	MMSE (RS)	MMSE (AS)
1	LG	71	♂	RH	17 years	CL	29	26.7
2	BS	72	♂	RH	8 years	CL	30	28.4
3	CV	72	♂	RH	18 years	CL	29	26.7
4	CM	73	♂	RH	2 years	CL	29	29.7
5	SGO	73	♂	RH	5 years	CL	26	25.3
6	NSA	74	♂	LH	13 years	NL	29	26.7
7	CG	75	♂	RH/LH	5 years	NL	29	28.3
8	ZV	76	♂	RH	8 years	CL	30	29
9	CD	77	♂	RH	13 years	NL	28	26.3
10	FL	78	♂	RH	5 years	CL	27	26.7
Average		74.1			9.4 years	3NL/7CL	28.6	27.38

Tab 6.: Control group males – age over 70 (RH: right-handed; LH: left-handed; RSA: rate of school attendance; NL: Northern Logudorese; CL: Central Logudorese; MMSE (RS): MMSE raw-score; MMSE (AS): MMSE adjusted score).