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LEON KACZMAREK'S THEORY OF SPEECH AND ITS SIGNIFICANCE FOR CONTEMPORARY NEUROPSYCHOLOGY

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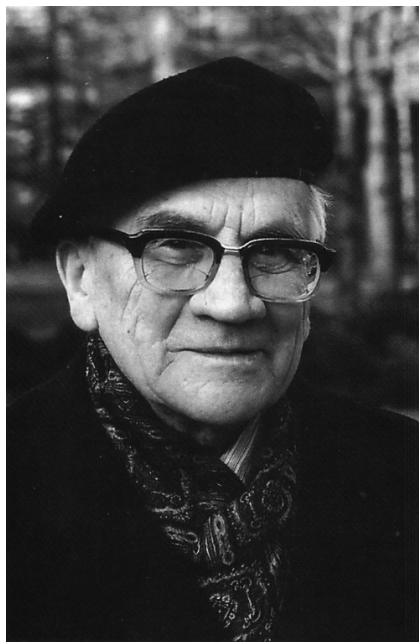
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SUMMARY

Leon Kaczmarek is the founder of modern logopaedics in Poland. His ideas have proved to be not only innovative but they are in agreement with contemporary outlooks within this branch of research and practice as well as with modern neuropsychology. He based his approach upon the theory of linguistic communication, which he presented in models. He also proposed an innovative classification of the signs and components of utterances (texts). All the above mentioned theoretical constructs enabled him to present a careful and precise analysis of language acquisition and its disorders both at the level of the peripheral and central nervous system. It has also proved to be very helpful in the assessment as well as the therapy of patients with various speech disorders observed not only in children but also in adults. His ideas were further developed by his collaborator and disciples. The best known are the models developed by B. Kaczmarek and M. Pačhalska that are used in neurolinguistic and neuropsychological theory and clinical practice. Hence, it is those models that are also described in the present paper.

Key words: brain, language, communication, speech disorders, child language



Leon Kaczmarek

Prof. Leon Kaczmarek (1911-1996)

INTRODUCTION

Leon Kaczmarek, the founder of modern logopaedics in Poland, developed his ideas on this in the 1960s. His ideas were very innovative and some researchers believed that he was going too far. Yet, if we take a look at recent definitions of this science offered by NetQues (**Network for Tuning Standards and Quality of Education Programmes in Speech and Language Therapy across Europe**), we shall note that his ideas are in agreement with contemporary outlooks:

... Logopaedics is both a scientific domain and an autonomous profession.

As a science, it is at the intersection of medical, linguistic, educational and psychological sciences and focuses on etiology (causes), assessment (detection, diagnosis and description) of and intervention for communication and swallowing disorders.

In the same vein run the definitions that can be found in Internet articles (downloaded 20 October, 2012). Yet, it is worth reminding oneself that in English speaking countries the term Speech and Language Therapy (SLT) is in common

use. It is not entirely synonymous with logopaedics as may be noted in the following description of the role of speech and language therapists:

“The role of a speech and language therapist (SLT) is to assess and treat speech, language and communication problems in people of all ages to enable them to communicate to the best of their ability. They may also work with people who have eating and swallowing problems”.

The above description comes from the National Health Service Careers Website, therefore it may be considered as representative (downloaded 1 July, 2012). We can further learn from the NetQues side that:

The science of Logopaedics was developed aiming to offer help to individuals that have lost their ability to communicate through the use of language or those individuals who never had this ability from birth. Taught clinical subjects include prognosis, diagnosis, evaluation and confrontation or treatment of communication problems in children and adults caused by a variety of different reasons (organic, environmental, psychological). Logopaedics is broadly applied in the field of rehabilitation (restoration of voice, speech and swallowing) and inclusion of individuals in social or school environment (downloaded 1.07.2012).

Again similar information can be gained from the institutions concerned with training logopaedists. They all stress the need to take into account all three aspects of linguistic communication: the medical, educational, and linguistic. Otherwise, as often was stressed by Leon Kaczmarek (1988, 1991) the logopaedists will not be able to help the patient with communication problems. And communication is believed to encompass all processes associated with the comprehension and production of spoken and written utterances as well as appropriate forms of non-verbal communication. It allows one to draw the conclusion that logopaedics in contradistinction to speech and language therapy encompasses a much broader spectrum of both practical as well as theoretical problems. Hence, logopaedists require a training that includes a broad spectrum of knowledge in all of the above mentioned scientific fields.

The main idea of L. Kaczmarek was to study linguistic communication in all of its aspects: the embryological, pathological, social, and artistic. In consequence, he distinguished eight main research areas: theory of linguistic communication, language acquisition in a healthy child, language acquisition in a child with hearing impairment, linguistic communication of the deaf and blind, perception of verbal utterances (auditory and visual) as well as written (visual and haptic), phonetics (articulatory, acoustic, auditive, and visual), disorders of verbal and written communication, word of mouth (L. Kaczmarek, 1961/4, 1962, 1967,

1991). As far as clinical practice is concerned he distinguished four specialities within logopaedics, which constituted four occupational specialities:

1. *Educational logopaedics* – prevention of speech and voice disorders
2. *Surdologopaedics* – the teaching of speech to the deaf and deaf and blind
3. *Logotherapy* – the treatment of persons with speech and voice disorders as well as reading and writing difficulties
4. *Artistic logopaedics* – promotion of a word of mouth culture in everyday and medial languages as well as in singing and recitation.

In consequence L. Kaczmarek believed logopaedics to be of an interdisciplinary nature. That idea, however, has proved difficult to fulfill in practice since logopaedists are trained for their work in various institutions such as university linguistic or educational departments, medical centers, and special institutions for education and rehabilitation. Each of the above mentioned institutions puts emphasis upon the linguistic, educational or medical aspects of language and the consequent therapy of patients with communication problems. Regardless, they all include at least some courses of all three disciplines.

At the basis of the theoretical and practical facets of logopaedics lay the theory of language and linguistic communication. In accordance with Bühler's (1934/2004) original notion, language is considered to be a complex dual system consisting of symbols and rules that enable a combining of the symbols into greater meaningful entities. In other words, language is a system consisting of two classes: linguistic symbols (phonemes, morphemes, and words) as well as grammar. It is worth pointing out that in contrast to the structural linguistics, which prevailed at that time, L. Kaczmarek (1962, 1988) believed language to be a dynamic flexible system that undergoes continuous changes due to the appearance of differing social requirements.

It means that he did not understand language in a narrow sense as it was understood by the structural linguistics that prevailed at that time. And certainly he did not adopt the biological point of view promoted by Chomsky (1965), which means that L. Kaczmarek's understanding of linguistic communication (which in Polish is labelled as speech) was closer to our contemporary views. It might be also worthy to remind oneself that the transformational grammar of Chomsky flourished in the 1960s and 1970s, and it certainly came to Poland much later, when in the West it had ceased to be in fashion. The main reason was that the model proposed by Chomsky has proved to be simplistic and mechanical in contrast to the real nature of living natural language. It was so despite the complex mathematical wording. Paradoxically, although Chomsky was speaking of the creative nature of language, he treated it as a big warehouse of ready-made "biological bounded" structures which are chosen by the speaker in accordance with their needs and wishes (see: Sampson, 1980; B. Kaczmarek, 2012). The idea of "language instinct" is not valid any longer and Chomsky himself no longer deals with such things rather with political issues.

It is worth pointing out that Leon Kaczmarek emphasised both the individual and social aspects of language. The individual aspect of language is of particular

significance since it takes into account the difficulties encountered by a person with communication disorders. As shown in Figure 1, a single act of linguistic communication (the act of speech) consists of four basic components: speaking, utterance (verbal text), listening, and language, which has to be known by both the sender of messages and the receiver in order to come to a mutual understanding. It may be observed that messages can be transferred in a variety of ways: by speaking, in the case of the auditory channel, by writing – via the visual channel or by signalling. In consequence, verbal, written or signalled texts are produced. In the last case the messages (texts) can be sent either via auditory, visual or haptic channels. For example, the haptic channel is used in the case of a text written in Braille. The channel used to deliver a given text has an influence on the manner of text reception, and on its substance. It might be worthy to recall that the term substance was introduced by Ferdinand de Saussure (1961) to denote medium of sending messages (phonic or graphic).

Those structures in the form of a word or a sentence (i.e. utterances or texts) are then uttered aloud, which makes it possible for them to be received by the speaker. All these four components (language, speaking, text, and listening) have to be in order in each individual person to allow him/her to be able to communicate. It needs to be stressed that the above mentioned components consist of other constituents. The above is represented in Figure 2, which exemplifies the social aspect of an act of linguistic communication, i.e. speech according to the terminology used in European linguistics.

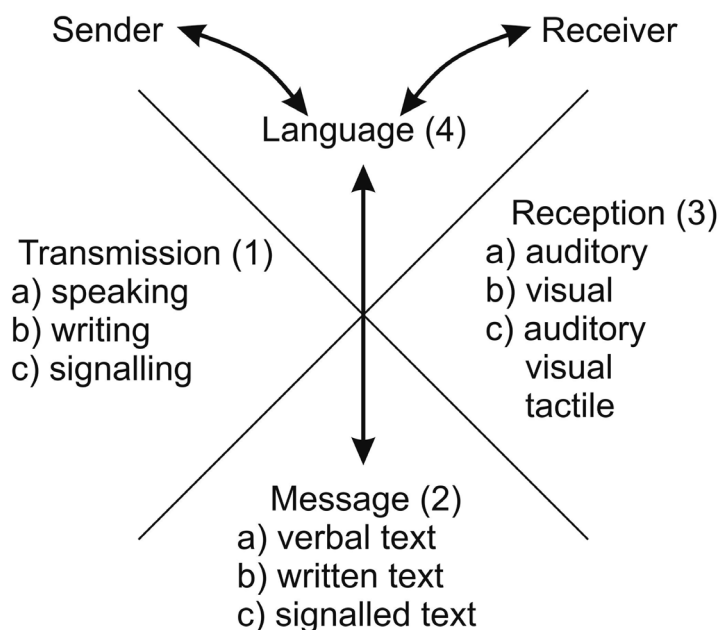


Fig. 1. A single communication act (speech, writing or signalling) from an individual point of view (modified after L. Kaczmarek, 1991)

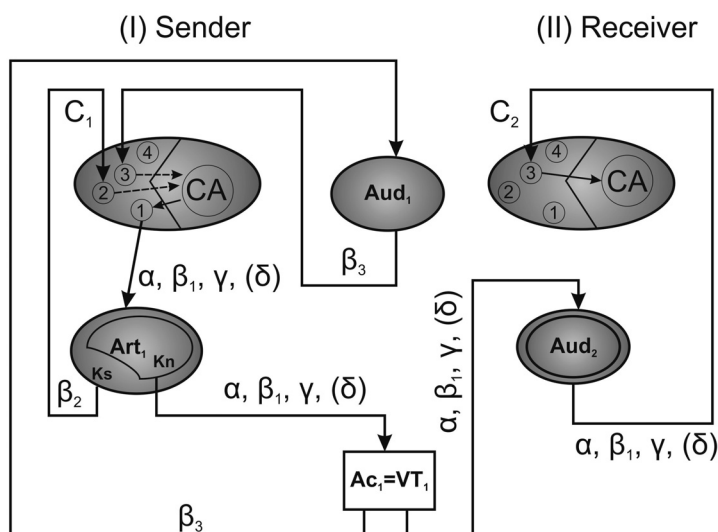


Fig. 2. Social aspects of speech (modified after L. Kaczmarek, 1988: 48)

According to Leon Kaczmarek the first stage of creating utterances occurs in the cognitive area (CA) within the central transformation knot (C1 = the brain) of the sender, and then such a mentally formulated message is sent to the motor centre (1), which produces a sequence of impulses to the articulatory muscles. This results in bringing on the appropriate sequence of articulations performed at the articulatory transformation knot (Art1).

It should be noted that that knot includes a kinaesthetic (ks) component besides a kinetic (kn) one. The kinetic component enables articulatory movements that allows for the production of acoustic waves (Ac2), which take the form of a verbal text (VT), i.e. an utterance. In other words, a phonic substance (or medium) is added there, which makes possible the receiving of the utterance on the part of the listener (receiver).

The proper production of an utterance is provided by the kinaesthetic component, which feeds back to the kinaesthetic centre (2), while the additional – acoustic – control is secured by the auditory knot (Aud 1) of the sender from where the information on the structure of the text uttered is sent to the acoustic centre within the speaker's brain (C 1). The receiver transforms the acoustic waves (Ac1) produced by the sender into nervous impulses in the auditory knot (Aud 2), which are then transformed into auditory sensations in his/her auditory knot (Aud 2), and sent to the auditory centre (3).

In order to be able to understand what the sender is saying the receiver must know the same language to decode the perceived sequence of sensations into a meaningful message in his/her cognitive area (CA). Naturally, this takes place only if the sender formulates his utterances in accordance with the rules of a given language.

In the above described case (i.e. speech) the vocal-auditory channel is used for the required information, while in the case of writing the graphic-visual channel is in use. In both channels, however, four circuits of information flow can be distinguished: α – the nuclear information circuit, β – the control circuit, γ – the control circuit as well as δ – the circuit of language acquisition, which in adults may serve as a device of language refinement or of learning a new language. As mentioned earlier there are three types of controlling the production of utterances: β_1 – supplies the information if the message has reached the receiver, β_2 secures the correct articulation monitoring, while β_3 provides for the auditory monitoring.

The model was further developed by Bożydar Kaczmarek (1995) in the form of a neurocybernetic model of linguistic communication (see Fig. 3). As the name implies the neuropsychological data was taken into account in its construction. Hence, the amendments concern mainly the boxes representing the brain B1 and B2, which originally were named central knots (C1 and C2) by Leon Kaczmarek. First of all the general idea of the cognitive area was further elaborated with reference to the discoveries of contemporary neuroscience. It is noted there that the knowledge of language as well as the general knowledge and experience are stored in the memory storage (MS) of both the sender and the receiver. This makes possible the formulation and decoding of linguistic messages (L.M), which are carried through cerebration, the term proposed by Baudouin de Courtenay (1974).

Cerebration means processing information with the use of language to produce a linguistic message, i.e. the formulation of ideas into linguistically meaningful entities in accordance with grammatical rules. At that stage the message takes a mental form and needs to be transformed into a design of movements necessary to produce the utterance-to-be. In other words, a motor programme (MP) of the utterance is formulated, and it finds its realization in an ordered sequence of impulses in the motor centre (1), which pass to the articulatory knot where they are transformed into appropriately made articulatory movements. Those movements enable one to produce a linguistic message (L.M) that can be received by the listener (receiver).

The articulatory knots include two equally important components: a kinetic and kinaesthetic one. The kinetic component is responsible for the proper stimulation of the articulatory muscles, while the kinaesthetic one secures control of its movements. As noted by Luria, disturbances of the kinetic component result in kinetic (efferent) aphasia, and the lack of kinaesthetic control leads to kinaesthetic (afferent) aphasia. In his other works B. Kaczmarek (1995, 2012) proposed the name kinemic aphasia for the Lurian kinaesthetic type since the articulatory model of the world is disrupted here. The name refers to Baudouin de Courtenay's (1984) discrimination of two components of the phoneme: the acoustic and the kinetic one, which accordingly were labelled as 'akusma' and 'kinema'. Akusma is the vocal model of the speech sound, while kinema is the articulatory model. It requires only a moment of consideration to realize that both models are equally important for producing the correct substance of utterances.

If we take into account the linguistic mechanisms of the disorders described then the kinemic aphasia would belong to paradigmatic disruption since the selection of appropriate speech sounds is impaired there. On the other hand, the kinetic aphasia should be named syntagmatic in accordance with the above mentioned mechanisms (B. Kaczmarek 1995, 2003).

Kinetic aphasia can be further divided into phonotactic, morphological, and syntactic depending upon which rules of combining linguistic entities (phonemes, morphemes or words) are disrupted.

As mentioned earlier, linguistic messages (L_1M), which take the form of acoustic waves, are perceived by the receiver (listener), and transformed into nervous impulses in his/her auditory knot (Aud_2). Next, these impulses are transformed into sensations in the brain auditory centre of the receiver (3), analyzed at the perceptive centre (P), and decoded in the process of celebration (C). The process of decoding takes place due to the information preserved in the memory storage (MS) of the listener.

Both the process of producing (encoding) utterances and of decoding them depends to a considerable extent upon the emotional state of the speaker and the listener. Therefore, the emotional filter was included in the model discussed. Another important addition presented in Figure 3 are visual knots of the sender (Vis_1) and the receiver (Vis_2). The visual knot of the sender (Vis_1) enables her/him to observe the nonlinguistic (motor) reactions of the listener, which via knot Kin_2 are formed into nonverbal messages (N_2M). At the same time, the speaker (sender) produces a number of nonlinguistic messages (N_1M) such as facial expressions and gestures, which are created due to the motor programmes in his/her brain (MP). The programmes pass to the motor centre to be next transformed into appropriate movements in the speaker's kinetic knot (Kin_1). Those

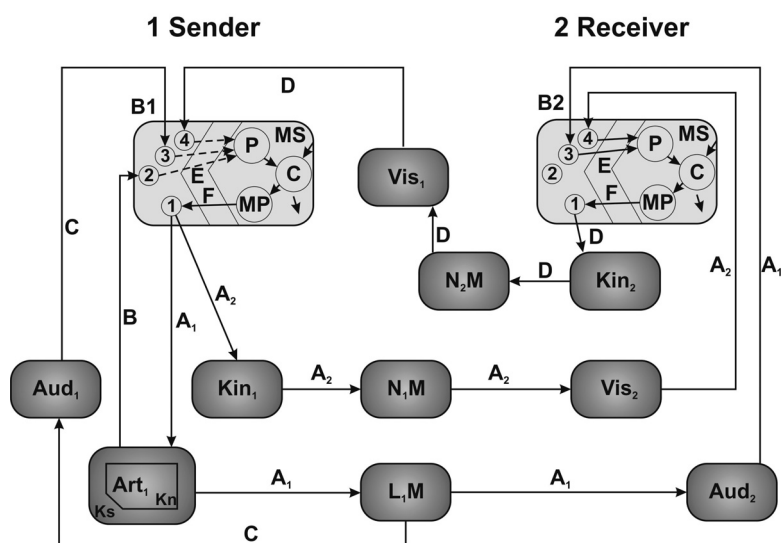


Fig. 3. Neurocybernetic model of speech act (modified after Kaczmarek, 1984, 1995).

movements, which take the form of nonlinguistic messages are received by the listener (receiver), and they make possible better understanding of linguistic messages (L:M). Quite often the linguistic messages (utterances) are difficult to understand without accompanying gestures. Thus, we are often exemplifying the size or movements of a devise we are talking about or pointing to a person or a thing of interest.

From the above it follows that there are two kinetic channels of data flow: A₁ – connected with articulatory movements and creating linguistic messages as well as A₂ – which enables producing nonlinguistic (nonverbal) messages. Besides, there are also channels C and D. Channel C provides for the auditory monitoring of linguistic messages, while channel D secures visual monitoring of nonlinguistic messages. It means they both play a significant role in making the course of conversation as smooth as possible.

Naturally, language remains the main component of any conversation. Yet, both models point to the fact that speaking includes cerebation and articulation, listening consists of perception, decoding and understanding, while the produced texts are structured into content, form, and substance (see L. Kaczmarek, 1977, 1988).

As exemplified in Table 1, content is the semantic structure of a given text (utterance in the case of speech). Its formulation can be disturbed as a consequence of thought disorders observed in such clinical syndromes as schizophrenia, damages to the prefrontal area of the brain or simply by mental retardation.

The formulation of utterances may be also, and quite often is, disturbed at the next linguistic stage. It will result in the deformations of verbal (or written) texts. Some of the deformations may occur in utterances of healthy subjects in the form of slips of the tongue. In the same vain the agrammatical utterances produced by young children are natural in the process of acquiring speech, hence they are classified as idiopathic. On the other hand, agrammatisms, i.e. the inability to form grammatically correct utterances, observed in brain-damaged patients suffering from aphasia belong to the non-idiopathic because they were caused by external factors.

Table 1. Types of language disorders

PROCESS Speech disturbances	PRODUCT Text deformations	SPECIFIC DISTURBANCES Syndromes
Information processing (thinking)	Semantic structure (content)	<ul style="list-style-type: none"> ✓ schizophrenia ✓ frontal syndrome ✓ mental retardation
Linguistic formulation of the message	Grammatical structure (form)	<p>a) Idiopathic</p> <ul style="list-style-type: none"> ✓ agrammatism ✓ slip of the tongue <p>b) Nonidiopathic</p>
Verbal output (producing the substance)	Medium (substance) a) segmental b) suprasegmental	<ul style="list-style-type: none"> ✓ dyslalia (segmental)
		<ul style="list-style-type: none"> ✓ stuttering, rhinolalia (suprasegmental)
		<ul style="list-style-type: none"> ✓ mutism, palatolalia (segmental & suprasegmental)

The third type of text disruptions are deformations of its substance (L. Kaczmarek, 1988) or medium (Lyons, 1977). They may be divided into two types depending on which part of the substance becomes disrupted. The deformations of its segmental component, i.e. speech sounds, are usually classified as dyslalia, while the deformations of the suprasegmental components may result in stuttering or rhinolalia. Stuttering is due to the disorders of fluency of speaking and rhinolalia means nasalization of each speech sound caused by a cleft palate, which makes the air to pass from the mouth cavity to the nasal cavity. When both dysfluency and nasalization of sounds occur we are dealing with palatolalia, while the lack of any substance results in mutism since such a person is able to formulate sentences but does not utter them.

A special type of substance impairment is autism. As a rule autistic persons do not produce phonemic substance, i.e. they do not speak but do understand what is spoken to them, which implies that they know the language (words and grammatical rules). Some of them prove to be able to communicate with the use of another medium as was the case of Damian who typed his messages out on a computer keyboard (Markiewicz, 2008; Markiewicz and MacQueen, 2007). He was able to converse with his father on various, often quite abstract, topics. Even though his conversations were limited only to his father it revealed that an autistic person does have a theory of mind in contradistinction to the beliefs of some "scientifically" disposed researchers (see: Baron-Cohen, 1995; Pisula, 2001). It shows once more that an individual "clinical" approach to the patient provides much more information than the experiments performed by the above mentioned authors. Despite communication problems, which may cause difficulties with understanding instructions and not the task itself, also misleading may be the dynamics (changeability) of the observed symptoms (Brown and Paçhalska, 2003).

Another innovative idea of Leon Kaczmarek (1988) was the classification of signs as presented in Figure 4. It can be noted there that the first distinctions concern appeals and semantic signals. Appeals are meaningless signals that draw our attention to a specific thing or event such as interjections and the first cries of a child prompting an appropriate reaction from the parents. Semantic signals may be iconic or arbitrary. Typical iconic signals are onomatopoeic words, and arbitrary are all other words since they are different in each language, e.g. dog, hund or sobaka in English, German, and Russian accordingly. The arbitrary signal may be further classified into one-class and two-class. A one-class signal are utterances consisting of a number of words put together without applying grammatical rules. The two-class are utterances that have the form of a sentence or statement since the words are connected there in accordance with the rules of grammar. They belong to non-dual signs since separate elements such as phonemes and words (lexemes) can be discriminated. Dual signs are those in which no such separate components can be distinguished. In the case of speech those are the gestures and facial expressions accompanying speech. As mentioned above those non-dual signs enable the listener to better understand verbal utterances.

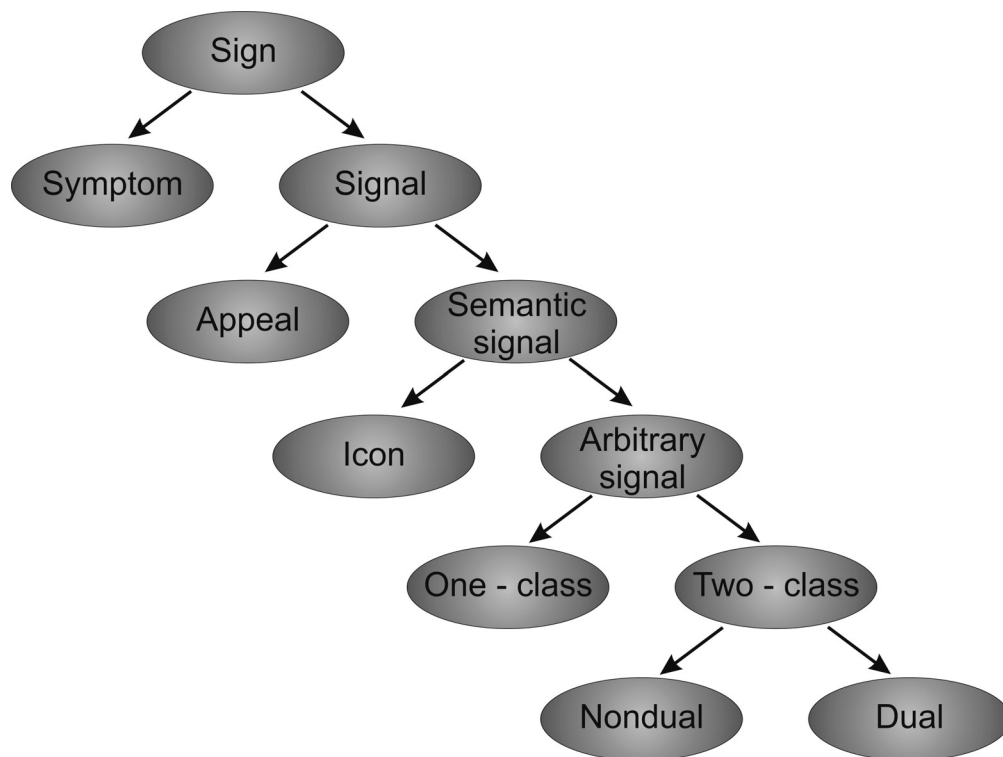


Figure 4. Classification of signs in accordance with their function (modified after B. Kaczmarek 1998)

The theory of signs enabled Leon Kaczmarek (1988) to develop a precise description of the stages of language acquisition by a child. As can be noted in Figure 4, the first stage is the melody period since the child communicates with the closets in non-linguistic signals, while the intonation and the context accompanying them make those signals comprehensible for them. At the next stage the child uses words s/he has already required but does not apply grammatical rules. It is worth pointing out that contrary to the classifications offered by some authors (Braine, 1971; Kurcz, 2000) it is not the number of words that matters but the fact of applying grammatical rules that reflects the real mastering of language by the child.

Naturally, the mastering of language, especially the rules of its grammar goes solely step by step. Hence, the two class signals (sentences) produced by 2-3 years old children are often elliptic and apt to undergo various changes even in a single course of conversation. That is why they are called transitory. At the age of about 5 the child's language becomes more or less the same as the language of adults. To acquire this the child passes through a stage of specific linguistic forms. This is due to the fact the s/he is consequent in the applying of language rules, and does not take into account departures so frequently as in the adult language. The best example is starting to use regular forms of the simple past

Table 2. The stages of language acquisition by children (modified after L. Kaczmarek 1988)

Period	Evolution of the child utterances	
	Age span	Types of signals
(1) Melody	0 –1	Nonlinguistic signals: situational, semantic (stable and changeable) Nonlinguistic appeals: weeping, crying
(2) Word	1–2	Linguistic appeals: vocatives, interjections Linguistic one-class semantic: partial, one symbol, multi-symbol
(3) Sentence	2–3	Linguistic two-class semantic: transitory, complete, elliptic
a) Specific child language	3–5	Linguistic two-class semantic: specific linguistic forms

tense in place of irregular forms, such as 'goed' instead of went. They also tend to use 'no' or 'not' without a word as in the statements:

"Not a teddy bear" or „Wear mitten no" (see: Brown and Bellugi, 1964).

Leon Kaczmarek emphasized the fact that such forms that are frequently produced by patients should not be treated as serious mistakes but as stages in language restoration. For that reason he invented a special device, which he called a lalometer, to help the speech therapist to note the progress in the course of rehabilitation. Another idea of great significance for any therapist was pointing out that it is not sufficient to train the patient to communicate only in the therapist's room but he has to acquire an ability to enter into dialogue in various social situations.

The emphasis put on communication, and its variations in different social settings, has proved to be the most significant heritage of Leon Kaczmarek. His theory of communication is further developed by his disciples and collaborators. In the field of neuropsychology the best known model is the neurobehavioral model created in the Cracow School of Neurorehabilitation (Paçhalska 1999; 1986, 2003,2007) presented in Figure 5.

This has been found to be especially helpful in the field of aphasiology. As noted by Paçhalska (1999) not only one but more or even all of the communication channels shown in the model may be disrupted in the case of aphasic disorders due to damage to the auditory (temporal lobe), visual (occipital lobe), and sensory (parietal lobe) systems. Accordingly the aphasic symptoms differ depending on whether auditory, acoustic, optic or thermo-mechanic sensations are processed, these relating to both linguistic and nonlinguistic data.

The interhemispheric connections (wavy arrows) were included in the model to emphasize the importance of both hemispheres in language processing. It is worth recalling here that both hemispheres play an important role in this process. The left hemisphere appears to play a more significant role in processing linguistic data, while the right one in processing the non-linguistic data. At least in the case of right-handed persons (see Kaczmarek 1998, 2012). Both types of

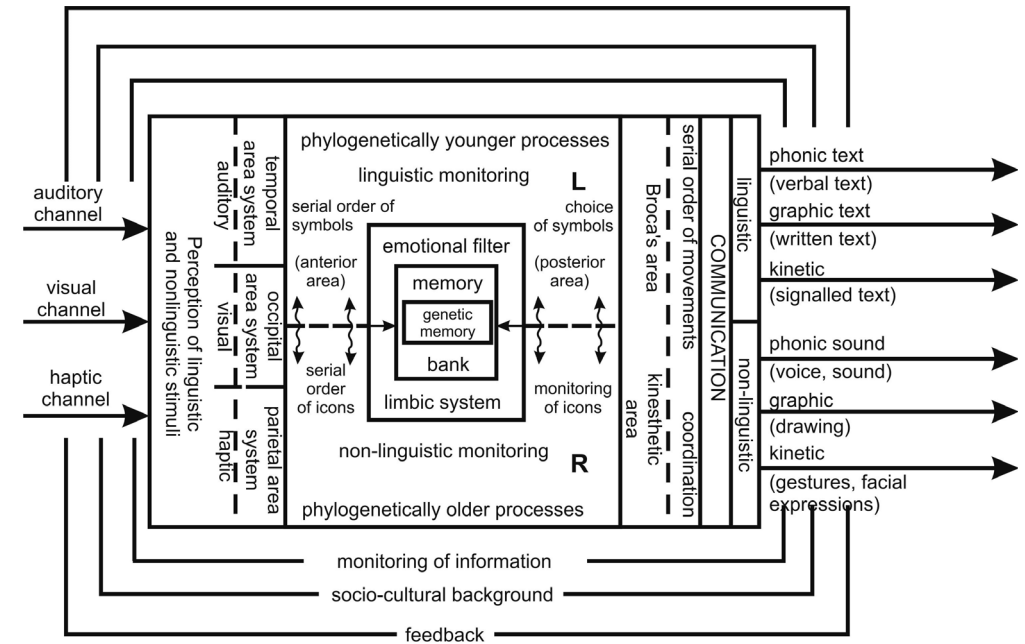


Fig. 5. Neurobehavioral model of communication. L – left brain hemisphere; R – right brain hemisphere; the arrows reflect the intersystemic and interhemispheric exchange of information (Modified after M. Pačalska, 1986).

processing are important for the right comprehension of utterances. Accordingly, the gesture accompanying the statement “It is quite a piece of cake” makes it possible to see how big that cake really is. As mentioned earlier, we are not able to understand some utterances without accompanying gestures, which illustrate the movement or shape of an subject described. Hence, those gesture are called illustrators (see Kaczmarek 2009; Pačalska et al. 2013).

Interhemispheric cooperation is secured to a considerable degree by the limbic system (see Lamendella 1977; Kaczmarek 1995, 1998, 2012; Kaczmarek i Pačalska 1987). Moreover, the limbic system plays the role of an emotional filter, which makes possible the transition of information both out and into the brain. That is the reason why we cannot find proper words in states of high emotional agitation, and we might also be not able to understand what is said to us (see: Kaczmarek 1984, 1995, 2009, 2012).

In other words we cannot select appropriate linguistic symbols and rules out of our memory storage. The sound and semantic associations seem to be of great importance here (Kolb and Wishaw 2003). The significance of semantic associations finds its confirmation in the pathology of language (Kaczmarek and Pačalska 1987). This may be best observed in semantic dementia (Pačalska 2008).

A genetic memory bank was inverted into memory storage to emphasize the significance of the innate factors of human communication, which had already

been pointed out by Leon Kaczmarek (1988). While speaking about memory storage we should remember that numerous attempts to localize memory were not successful. It was aptly stated by Lashley (1950) in his paper "In search for the engram. Thirty years of frustration". In order to stress the holistic nature of memory storage Pribram (1971) proposed a holographic model of memory. Yet, the name holographic does not take into consideration the dynamic character of memory, therefore, B. Kaczmarek (1995) proposed the term: a holokinegraphic model of memory.

Leon Kaczmarek always stressed the significance of linguistic rules in the formulating of correct linguistic texts (utterances). The neurolinguistic (Kaczmarek 1984, 1995, 1998, 2012) as well as neuropsychological data (Pačhalska 1999) point to the importance of the associative cortex in this respect. The posterior speech area is responsible for the proper selection of words, while the anterior area with their linear organization. The program of appropriate articulatory movements is created in Broca's area, and their coordination is secured by the kinesthetic area of the parietal lobe, and a number of extrapyramidal connections. The somesthetic monitoring of the information flow is provided here by feedback loops; both kinaesthetic and haptic. Additional, auditory, feedback is provided by connections with Wernicke's area.

Lebrun (1995) has proved that all those feedback loops are of equal importance since they monitor different aspects of formulating utterances. Additional control of the information flow is also provided by the frontal lobes (Kaczmarek 1995, 2012; Łuria 1976; Pačhalska 2007), which enable both mental and emotional monitoring. The perception and processing of sensations is determined to a considerable degree by the socio-cultural background, closely connected with the norms that are held in a given group or country. Naturally, individual difference may be observed there. They are due mainly to the differences in the experience of individual persons, even in the same culture. Such differences result both in functional and structural variations in the brain, which is closely connected with neuroplasticity (see: Doidge 2007). In consequence, the same localization of brain damage may lead to the ppearance of different dysfunctions. This should be, therefore, taken into account in carrying out diagnosis in brain-damaged patients (Pačhalska 2011; Pačhalska, Kaczmarek, Kropotov 2014; Pačhalska, MacQueen, Brown 2012).

To sum up, the theory of linguistic communication formulated by Leon Kaczmarek is still alive and has been further developed by his followers. It allows one to draw the conclusion that the level of enthusiasm for his theory among the best and brightest of the next generation of neuropsychologists, neurolinguists and logopedists in Poland gives ground to the hope that the scientific edifice Leon Kaczmarek constructed will be, to borrow Horace's famous motto: *Monumentum exegit aere perennius more lasting than bronze.*

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