International Journal of Human Movement and Sports Sciences 10(3): 384-395, 2022 http://www.hrpub.org
DOI: 10.13189/saj.2022.100304

Analysis of Verbal Language from the Theory of Human Movement as a Complex System

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Received February 28, 2022; Revised March 31, 2022; Accepted May 9, 2022

Cite This Paper in the following Citation Styles

(a): *[1] Julio Ernesto Pérez-Parra, Alexandra Suaza-Restrepo, Francia Restrepo-de-Mejía , "Analysis of Verbal Language from the Theory of Human Movement as a Complex System," International Journal of Human Movement and Sports Sciences, Vol. 10, No. 3, pp. 384 - 395, 2022. DOI: 10.13189/saj.2022.100304.*

(b): *Julio Ernesto Pérez-Parra, Alexandra Suaza-Restrepo, Francia Restrepo-de-Mejía (2022). Analysis of Verbal Language from the Theory of Human Movement as a Complex System. International Journal of Human Movement and Sports Sciences, 10(3), 384 - 395. DOI: 10.13189/saj.2022.100304.*

Abstract The objective of this manuscript is to carry out a conceptual analytical review of verbal language from the theory of Human Body Movement as a Complex System (HMCS). This theory is proposed by the Body-Movement Research Group from the Autonomous University of Manizales, Colombia. This model assumes that language production is essentially an embodied motor function. The analysis here presented involves postulates of both structural and functional theories of language, as well as cognitive linguistics, since the HMCS theory encompasses these multiple possibilities of approach. It is this conjecture of a holistic vision of language from its different approaches that leads to the proposition that, in effect, the different levels of linguistic analysis find several analogous components in the HMCS model. A conceptual analytical review is carried out, and structured in two main components. In the first part, the HMCS theory is exposed with its three levels of interaction: the objectified aspects of movement, the potentiality of movement and the external context of human movement. In the second part, an analysis of verbal language is carried out from this conceptual framework, also analyzed from the three levels of interaction: the objectified aspects of verbal language as a motor expression, the potentiality of verbal language and the context in the production of verbal language. Definitions, concepts, interactions and analogies are presented during the development of the article. In conclusion, body movement is language and language is, in essence, human movement. Both are intricate, integrated, indivisible, and inherently constitutive aspects of the same cognitive processes. The analogy achieved highlights the theory of the shared resource between motor control and cognitive control. In the same way that verbal language allows communication based on communicative intentions, body movement allows the exchange of information, constituting a bridge between cognition and the world.

Keywords Language Studies, Human Movement, Human Body, Systems Theory

1. Introduction: Verbal Language and Motor Action

Human language is a rational, inalienable and universal resource that allows communication in multiple situations. The development of linguistic and communicative competence gives rise to the expression and comprehension of past, present and future experiences, as well as concrete and abstract concepts, either orally or in written form. In this respect, human language has characteristics that are not found in their entirety in other communication systems, such as arbitrariness, productivity, semanticity and displacement [1, 2]. These characteristics make language not only an innate ability, but also a systematic and functional resource that allows the production and comprehension of meaning.

Indeed, verbal language becomes a mechanism of

human interaction that can be approached not only from traditional linguistic perspectives of a structuralist nature [3], but also from more dynamic and interactive approaches such as cognitive linguistics, from which language is conceived as an integrative and relational capacity of human cognitive tasks [4]. This vision of language gives rise to embodied conceptions of this resource for communication, in which contextual factors that induce comprehension and production of meanings intervene.

From this perspective, Baquero and Segovia [5] propose a close relationship between linguistic comprehension and motor activity in context, and the neurophysiology of action. In their theory of language as a motor function framed within embodied approaches, they argue that linguistic symbols make sense in a living system and are bodily situated in the world. In other words, "linguistic meaning originates in motor and perceptual states of the individual which coactivate with language and, furthermore, simulate previous perceptual experiences about the lived environment" (p. 125, our translation).

In their systematic review, the authors highlight the existence of a process of interference between language and motor action, which supposes an inherent neurophysiological functional relationship of these two processes (p. 128). This interference is consistent with the restricted action hypothesis exposed by other authors, which is based on the shared resource theory between motor and cognitive control [6-8]. This theory holds that cognitive demands affect the execution of motor tasks, and conversely, motor demands affect cognitive performance.

In this theoretical framework, Baquero and Segovia [5] refer to the phenomenon of action-sentence compatibility, in which a sentence is more easily understood when motor actions compatible with those implicit in the sentence are carried out. Therefore, there is a "scenario of mutual influence and bi-directional functional relationship between movement, the integral physiology that makes up the action, the different bodily dispositions and semantic comprehension" (p. 128, our translation). In this way, and citing Vega (2008), the authors present three levels of representation of meaning for semantic and linguistic comprehension: Online representation, displaced representation and unfolding representation.

The level of *online representation* corresponds to the direct relationship between language and the present or felt motor action. It is the pragmatic domain or first field of human social communication, associated with the use of socially shared gestures that refer to world events in an imperative or declarative way. "The learning of words and language is associated, in all cases, with the triggering of a special type of communicative gestures in childhood" (p. 126, our translation). The level of *displaced representation* talks about nonpresent, but real situations (past experiences), that imply the corporal presence of the interpreter. "They include the comprehension of narrations, metaphors, memories and irony" (p. 127, our translation). Finally, the level of *unfolding representation* refers to the "comprehension of imaginary and non-factual events, which involve abstract concepts about reality and others" (p. 127, our translation). This level refers to mental and psychological states associated with human behavior.

Now, these three levels of representation of meaning for semantic and linguistic comprehension are compatible with the levels of interaction of the conceptual model of Human Body Movement as a Complex System of the Autonomous University of Manizales (hereinafter, the HMCS model). Thus, an analysis that is based on the aforementioned and that postulates an analogy relationship between components of verbal language and human body movement as resources for communication is proposed. Before doing so, the HMCS model referring to human movement[1] is briefly presented.

2. Methodology

A conceptual analytical review is carried out, structured in two main components. In the first part, the HMCS theory is exposed with its three levels of interaction: the objectified aspects of movement, the potentiality of movement and the external context of human movement. In the second part, an analysis of verbal language is carried out from this conceptual framework, also analyzed from the three levels of interaction: the objectified aspects of verbal language as a motor expression, the potentiality of verbal language and the context in the production of verbal language. Definitions, concepts, interactions and analogies are presented during the development of the article.

"The goal in using conceptual analysis as a method of inquiry into a given field of interest is to improve our understanding of the ways in which particular concepts are (or could be) used for communicating ideas about that field" [9] and to apply them to other theoretical constructs. Seen in this way, concepts, as an object of study, are treated as classes of objects, events, properties or relationships [9].

[1] This section is taken from the still unpublished doctoral thesis of Julio Ernesto Pérez-Parra (2021), co-author of this article: "Working memory and motor control in adults with sensorimotor disorders - Study of interactions from the perspective of embodied cognition" [in spanish], from the Ph.D. in Cognitive Sciences, Autonomous University of Manizales, Colombia.

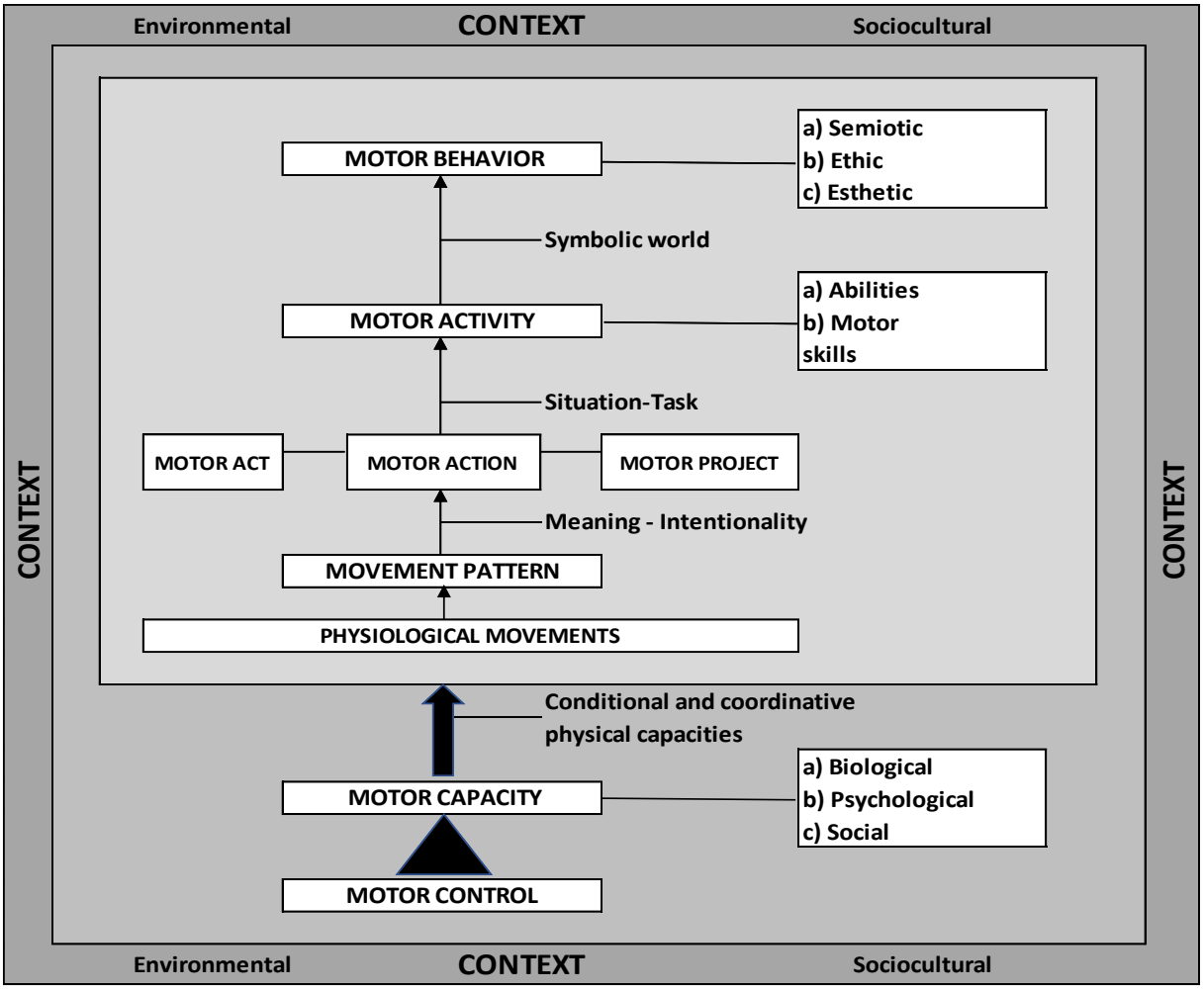

Figure 1. Human Movement as a Complex System (HMCS) according to the Body-Movement Academic Community of the Autonomous University of Manizales, Colombia. Levels of interaction with its components: 1. The objectified aspect of movement, in pink; 2. The potentiality of movement, in yellow; and 3. The external context of movement, in blue. (Own elaboration based on Agámez *et al.*, p. 87 [13].

Based on the manuscripts of the academic community that proposes the MHSC theory, an updated bibliographic review is carried out to develop the proposed analogy between human movement and verbal language. The following steps were followed in the analysis:

a Theoretical identification of the HMCS model.
b Contextualization of its main epistemological assumptions.
c Review of conceptual categories, both for human movement and for verbal language.
d Use of knowledge and theoretical, practical and experiential knowledge related to the model and verbal language.
e Planning, application and consistency of the analogy between the HMCS model and verbal language. The basic underlying premise is that certain relationships and analogies can reasonably be expected to exist and continue over time in the absence of known conditions to the contrary.
f Proposal for the analysis of verbal language from the three levels of interaction of the HMCS model.

3. Human Movement as a Complex System (HMCS)

In the notion of movement as a complex system proposed by the Body-Movement Academic Community of the Autonomous University of Manizales[2], the human body movement is assumed analytically and comprehensively from a functional and phenomenological perspective, as a *system* with levels of interaction, subsystems and components [10, 11] (Figure 1). The notion of system can be approached from different fields or disciplines, including education, mathematics, politics and biology. In fact, there exists a General Systems Theory [12], in which a system is understood as mental models that represent processes and sub-processes. However, as regards the interest of this article, a system is understood as "a set of elements that maintain certain relationships among themselves and that are separated from a specific

[2] Research group of the Autonomous University of Manizales, whose main objective is to reflect around the relation between body and movement, as well as its application in the areas of health, philosophy and education, among others.

environment" [13] (p. 88, our translation), whose main characteristics are the interaction of elements, self-referencing, autopoiesis and differentiation.

From these characteristics, the HMCS model states that:

> *Human movement does not exist as the sum of physical, motor and cognitive areas, on the contrary, human movement as a complex system exists insofar as it is possible to read the interweaving between the subjective and the objective, the historical and the cultural, the particular and the collective, the qualitative and the quantitative, the analytical and the comprehensive, for which the complex system self-structures in relation to levels, subsystems and components that establish multiple relationships in different degrees of complexity* [13].

Next, the main components of the HMCS model, organized in three levels of interaction, are defined: In the first place, *the objectified aspect of movement*, which includes physiological movements, movement pattern, motor action, motor activity and motor behavior; second, the *potentiality of movement*, which includes motor control and motor capacity; and finally, the *external context of movement*, which encompasses the environment and the sociocultural setting (Figure 1).

3.1. First Level of Interaction: The Objectified Aspect of Movement

Physiological Movements: Physiological movements are normal, natural or spontaneous osteoarticular movements of the different body segments. Also known as osteokinematic movements, they can occur reflexively, automatically, passively or actively. They are determined by the phylogeny or evolutionary history of the human species, that is to say, by its anatomical and biomechanical configuration, and by an adequate control of the nervous system. As an example, we could cite the physiological movements of the shoulder: flexion, extension, abduction, adduction, and lateral and medial rotations. A conjugation of these movements leads to shoulder circumduction. The movements that result from these physiological conditions are called pathological movements or movement disorders. In the production of verbal language, physiological movements in the face, tongue, temporo-mandibular articulation and vocal cords can be identified.

Movement Pattern: The movement pattern, or motor pattern, is the biological or organic component of motor action, considered the structural unit of motor activity. It is defined as the combination of movements organized according to a specific spatio-temporal arrangement, and ranges from simple combinations of movements in two segments, to highly structured and complex body sequences (Wickstrom, 1990, cited by Pérez-Parra and González-Marín, 2005 [14]). The movement pattern is observable and is named in terms of the physiological movements that compose it. These can be described as selective upper and lower limb patterns or as basic mobility patterns or total movement patterns.

Motor Action: Motor action is constituted by the interweaving of different movement patterns, which make sense or have intentionality. In this way, motor action is the functional unit of motor activity, which is why it is defined as the "acting or doing of man in the world of life" [11,13] (p. 127, our translation). Unlike movement patterns, motor action is regulated by learning and is presented as the objective manifestation of motor capacity (observable aspect of human movement). It differs from the motor act and motor project, since the motor action is the execution of movement in the present time, while the motor act is the lived action, the previous experiences that fill the movement pattern with significance. The motor project is built based on actions. Its essential characteristic is given by its feasibility; it is the tension between expertise and experience that is built in the motor planning process. Thus, there is an interweaving of the past, present and future in a given context.

Motor Activity: Motor activity is understood as the "integration of multiple motor actions in a given context, dependent on a situation task, characterized by motor skill in its execution. The context is the setting that determines the situation to which the task responds and where the action is executed" [13] (p. 96, our translation). The motor task is the "organized set of material conditions, of particular and collective needs, which determine the objective, the intentions and the motivation that condition the execution of different motor actions" [11,13] (p. 96, our translation). Finally, motor skill is assumed as the capacity acquired by learning to achieve previously set results with maximum success and often minimum time, energy, or both; early motor skills underpin the more complex and specialized movements required for physical activity [13, 14].

Motor Behavior: Motor behavior is defined as "motor activity that occurs in a specific spatial-temporal context and in a comprehensive explanatory system that the social group gives to that activity under processes of normality and abnormality" [11,13] (p 98, our translation). It includes motor conduct, understood as the response of living organisms to a given stimulus. There are three components in motor behavior:

- The semiotic or communicative component: It is the possibility of construction of meanings in relation to motor activity.
- The ethical or moral component: It makes reference to norms, rules and limits that determine what is good, what is bad and what is socially and historically legitimized.
- The aesthetic or expressive component: It is the assessment parameter of motor activity according to the systemic harmony between movement-body-environment.

3.2. Second Level of Interaction: The Potentiality of Movement

Motor Control: Motor control is defined by Newton [16], from classical theory, as the process by which the central nervous system receives, assimilates and integrates sensory information with experience to plan and execute appropriate postural and motor responses. As a discipline of study, Latash (2012), cited by Low (2018), conceives motor control as "an area of science exploring how the nervous system interacts with the rest of the body and the environment in order to produce purposeful, coordinated movement" (p. 833) [17]. In the framework of the HMCS model, motor control is the regulatory process that allows the planning, structuring and reorganization of motor activity, necessary and essential for motor capacity to be targeted in motor action [13].

Motor Capacity: Motor capacity is the "potential of man to bring into play the biological, psychological and social components in the execution of motor action. It is a possibility of manifestation of the functional capacity of man" [13] (p. 91, our translation). It includes physical capacity, understood as physical-physiological faculties that allow learning and the execution of motor actions [13]. Motor capacity is divided into conditional and coordinative: Conditional motor capacity refers to the organic-muscular capacities (strength, resistance, speed and flexibility); and coordinative motor capacity refers to body control and regulation (orientation, balance, differentiation, coupling, rhythm). Motor capacity is constituted by the biological component, which integrates the organic, hereditary and functional elements, and is expressed through the physical capacity; the psychological component, which includes the affective, emotional and cognitive part; and the social component, which includes conditions, style and quality of life [14].

3.3. Third Level of Interaction: The External Context of Movement

The external context of movement is defined as a "temporal-spatial setting, determined by social norms and rules, which condition the motor capacity where action, activity and motor behavior are performed and transformed" [13] (p. 90, our translation). It comprises:

The Environment: It is the natural setting or habitat, the space-time territory.

The Socio-cultural Setting: It is the stage where the subject interacts with others in different forms of participation. Symbolic construction of men as a collective that is manifested in the set of historically constructed rules and norms, and in the social systems that condition and determine motor activity and legitimize it as socially accepted behavior [13].

Another valuable contribution of the aforementioned Academic Community from a phenomenological perspective, which is compatible with the object of study of cognitive sciences proposed by Rossi, Grasso-Caldera, Luarte, Riillo and Parada [19], is the concept of *body-being in the world*, a category that gives meaning to the theoretical construct of "movement as a complex system". The body is assumed as a unified conception between the knowing subject and the spatial physical object (body as an instrument); being as the symbolic self that names and determines what exists in its environment; and the world as the dwelling of man (environment and socio-cultural environment). In this way, the *body-being in the world* is mind and body as a single identity in the world of life, that is, an intersubjective, subjective and objective intertwining. "The body is kinesically expressive of consciousness, of normative, ethical, and aesthetic expressibility; the body is language, it is communication, it is a vital expression" [13] (p. 83, our translation).

4. Verbal Language within the Framework of the HMCS Model

Assuming the diversity of viewpoints regarding language as a resource for communication implies assuming its evolution and conceptual diversity. From a structuralist point of view, languages are conceived as systems of interrelated elements at each of the different levels of linguistic analysis [20]. From Chomskian generativism and Halliday's functionalism, not only the description of linguistic structures is considered, but also their biolinguistics [21] or sociolinguistic nature [22]. From cognitive linguistics and its embodied, situated and enactive theories of human cognition [23-25], linguistic symbols themselves do not mean anything, unless they are part of a living system, bodily situated in the world. Therefore, symbols acquire meaning in their interaction with the environment. All these approaches to language, rather than being exclusive, are complementary to understand it as a rich and complex phenomenon.

It is this conjecture of a holistic vision of language from different perspectives that leads to the proposition that, in effect, the different levels of linguistic analysis find several analogous components in the HMCS model. In Figure 2, verbal language is presented within the framework of the HMCS model expressed in Figure 1. The same systematic structure with levels of interaction, subsystems and components is maintained. Consistent with this model, three levels of interaction adapted to the particularities of language are proposed: 1) The objectified aspect of verbal language as motor expression; 2). The potentiality of verbal language; and 3). The context in the production of verbal language. Next, the components with their respective analogies with respect to human movement are presented.

4.1. The Objectified Aspect of Verbal Language as a Motor Expression

Phonemes, Allophones and Syllables: Within the

framework of verbal language, physiological bodily movements find their analogous form in phonemes, allophones, and syllables. The phoneme is an abstract linguistic unit that has in each case a concrete realization - its variants or *allophones* - determined by various social or geographical factors of variation. The phoneme is the minimal unit of sound that allows us to distinguish words in a language [27, 28], while the allophone is a particular acoustic realization of a phoneme, which is usually a positional variety [29, 30]. Both can make up a syllable, understood as a sound or set of articulated sounds that occur between two brief and almost imperceptible interruptions in the exit of air from the lungs in the emission of voice. Together, they are conceived as fundamental units of phonological structure in verbal language, analogous to physiological body movements, therefore, products of human body motor skills. From a linguistic perspective, these microstructural components of verbal language are studied by phonetics and phonology, just as physiological movements are studied by anatomy and physiology.

Lexemes, Morphemes and Words: Lexemes, morphemes and words are equivalent to movement patterns in the HMCS model. The lexeme, or root of a word, is the unit that contains its base meaning, while the morpheme is the unit that is joined to the lexeme to add grammatical meanings to the word, such as gender, number and time. The morpheme provides the grammatical value and is associated with the lexeme, which has a semantic value [31]. From a grammatical point of view, words are constituted by the articulation of different lexemes and morphemes, as well as motor patterns are constituted by the temporal and spatial articulation of different physiological movements. In this way, words, in the equivalent model, are the structural unit of language. This level of language is studied by morphology, while motor patterns are studied analogously by biomechanics.

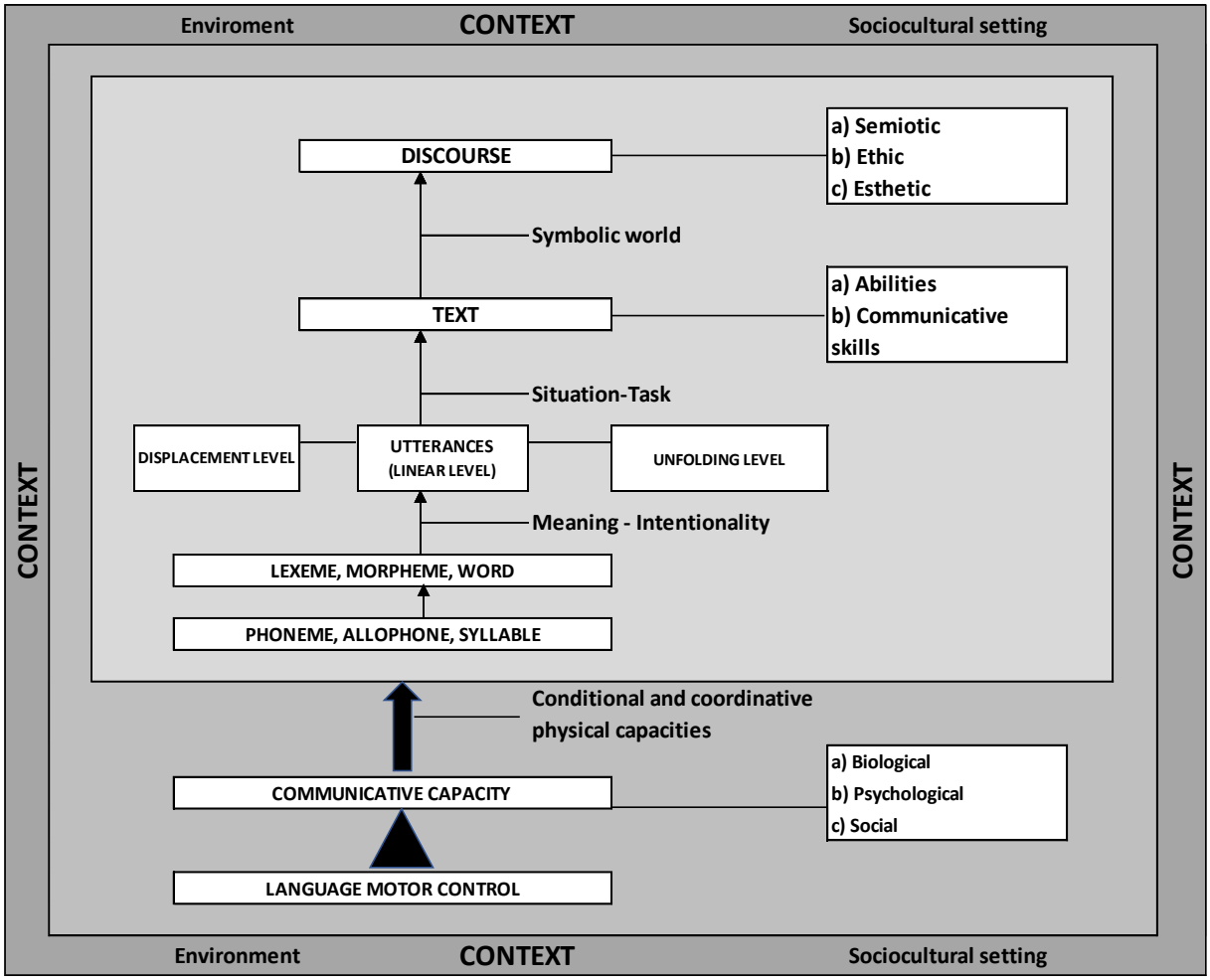

Figure 2. Verbal language within the framework of the Human Movement as a Complex System model (HMCS). Levels of interaction with its components: 1. The objectified aspect of verbal language, in pink; 2. The potentiality of verbal language as a motor expression, in yellow; and 3. The context in the production of verbal language, in blue. (Our elaboration).

Phrases, Sentences, Utterances: In verbal language, phrases, sentences and utterances are found as homologous levels to motor action. From a pragmatic perspective, an utterance is a word or group of words which express meaning in a particular situation, in other words, a complete, communicative unit of speech [20, 32]. Some of the forms an utterance can take are sentences, linguistic structures with complete meaning containing a subject and a predicate; and phrases, which, in spite of being linguistic structures with complete meaning, lack a subject and a verb. Sentences and phrases are studied by syntax; just as motor action is studied by neuroscience. Utterances result from the organized and intentional articulation of sounds and words, just as motor action results from the interweaving of different patterns of movement to give meaning to the act of a person in the world of life. Analogous to motor action, the main characteristic of an utterance is the meaning and intentionality expressed through verbal language, hence, it is regulated by acquisition and constitutes a functional unit of text and speech [33].

Now, from a grammatical perspective, and in line with Vega's proposal (cited by Baquero and Segovia) [5], the three levels of representation of meaning for semantic and linguistic comprehension are manifested through the verb tenses in which sentences and, generally, utterances are produced. In the first place, at the level of online or linear representation, linguistic referents correspond to immediate perceptual and active experiences, socially shared. They refer to linguistic units in the present tense, the first area of human social communication. Second, the level of displaced representation includes meanings that refer to entities or situations that are not present, but that imply the possibility of the interpreter's bodily presence. They represent the action lived, the previous experiences that are manifested in communicative units in the past tense. Finally, the level of unfolding representation expresses intentions, non-factual, abstract, non-lived facts, which could be homologated to imaginary events and facts to come, that is, to a future time. In this way, a communicative unit of speech in its three levels, linear, displaced and unfolding, is homologous to the motor act, the motor action and the motor project of the HMCS model respectively, worth saying, past, present and future of man's actions in the world of life, manifested in the use of language.

Just as a physiological movement can itself be a movement pattern, a syllable can itself be a word. Similarly, just as a motor pattern can itself be a motor action, a word can itself be an utterance with intentionality. This occurs when that mere word makes sense or has a purpose in a given context, for example "*stop*" or "*go*", which has a whole meaning for interlocutors in the communicative act of vehicular mobility. Similarly, a movement pattern such as "shoulder flexion to 90 degrees, extended elbow, pronated forearm, wrist in neutral position, extended and adducted fingers" makes sense in a specific context and becomes motor action in the context of a Nazi salute. It is then, from the perspective of motor action, where movement becomes gestural language, just as verbal language becomes communication through syllables that can be words, and words that can constitute utterances in different pragmatic situations.

Text: From the perspective of verbal language, text corresponds to motor activity in the HMCS model. The text is the highest unit of communication and organizational competence of a speaker. Its extension is variable and corresponds to an understandable whole, to a series of oral or written sentences linked by different lexical, grammatical and logical links, which have a communicative purpose in a given context. Therefore, its communicative, pragmatic and structural features are characteristic of a text.

The text, constituted by statements, is produced by the conjunction of different phrases and sentences properly linked and coherent around a particular topic, a topic that is the task situation to which the HMCS model refers. Its study is in charge, among other disciplines, of text linguistics [34, 35], whose objective is to account for the cohesion and coherence of the text, going beyond the limits of the sentence. At this level, context becomes more relevant, since its impact on the elaboration of the discourse is valued.

Correspondingly, motor activity results from the articulation of several motor actions in a given context and based on a task situation. Its analysis is in charge of motor learning theories. Just as motor activity is conditioned by motor skills and abilities, textual construction is conditioned by communication skills. Paraphrasing the definition of motor skill above, communicative skill is the ability of verbal language, acquired and learned, to achieve pre-set communicative results with maximum success and often minimum time, energy, or both. It could be said, then, that the text is a superior unit of communication of verbal language, just as motor activity is the total unit of movement.

Discourse: The term discourse refers to the use of language in various communicative activities. Discourse in verbal language, whether oral or written, is equivalent to motor behavior in the HMCS model. Unlike other levels of linguistic analysis of a more abstract nature, several contextual factors are taken into consideration in discourse comprehension and production, since they account for its meaning, its function and the social and cultural conventions that regulate it. A text is considered exclusively a linguistic product, while a discourse is seen as a contextualized text [36-38]. In this sense, the discourse is a "stage" of the text, just as motor behavior is a stage for motor activity, both involved in a symbolic world, immersed in a comprehensive explanatory system given by a social group under processes of normality and abnormality in a specific spatial and temporal context.

As stated in the HMCS model, this level is determined by semiotic, ethical and aesthetic aspects, referred respectively to the meanings, the moral and the expressive.

From a linguistic perspective, discourse also includes communicative, referential and expressive aspects respectively, as regards stereotyped forms of discourse that have been fixed by use and are repeated with relative stability in the same communicative situations. These semiotic, ethical and aesthetic aspects of the original model constitute external and contextual parameters that pragmatically define the so-called discursive genres.

Both discourse and motor behavior are object of study of disciplines such as anthropology, ethnography and sociology. In the case of language, specifically, disciplines such as ethnolinguistics and sociolinguistics find an interest, respectively: language-culture relations (traditions, customs, habits, ways of life, values, behavior patterns, among others), and language-society relations (socio-demographic variables, socio-economic conditions, legal or customary rules of coexistence, among others). Indeed, the use of language in different communicative situations and activities constitutes the central interest of the discipline known as discourse analysis, considered a convergence of currents interested in discourse, such as those already mentioned.

4.2. The Potentiality of Verbal Language

Language motor control: The motor control component of language refers to its neurophysiological, cognitive and biomechanical processing, and is the equivalent of motor control in the HMCS model. This component includes all the systems that facilitate and promote the production of verbal language: respiration, phonation, articulation of words, gestures, etc. Paraphrasing Newton (1991) [16], language motor control could be defined as the process by which the central nervous system receives, assimilates and integrates sensory information with experience to plan and produce adequate communicative responses.

In the context of Latash's definition of motor control, cited por Low [17], control of spoken language refers to how the nervous system interacts with the rest of the body and the environment to produce coordinated and purposeful verbal responses. In the framework of the HMCS model, motor control of language would be the regulatory process that allows the planning, structuring and reorganization of discourse, essential for communicative capacity to be targeted in the production of verbal language.

Communicative Capacity: On the other hand, communicative capacity is equivalent to motor capacity in the HMCS model. Both communication and motor skills are manifestations of people's functional capacity, in addition to occupational, social and psycho-affective capacities. Functional capacity is related to the potential of an individual to perform daily tasks and play regular roles in daily activities without fatigue, safely and independently [18]. Analogous to motor capacity, communicative capacity, in the context of the HMCS, can be defined as the potential to bring into play biological, psychological and social components in the execution of communicative actions (listening, expressing ideas and concepts, asking questions, locating information sources, understanding various manifestations of verbal and non-verbal language, among others). In this way, communicative capacity, similar to the motor one, involves organic, hereditary, functional, affective, emotional, cognitive and lifestyle aspects.

4.3. Context in the Production of Verbal Language

For all intents and purposes, at the third and final level of context-related interaction, the same considerations made in the HMCS model are homologated for the verbal communication process. In general terms, the context in the production of language is defined as the temporo-spatial scenario, determined by social norms and rules, which condition the communicative capacity. Therefore, the importance of the environmental and socio-cultural setting in the production of verbal language is highlighted, since this context conditions the way in which utterances, texts and discourse are produced and understood.

The different conditions that sociocultural contexts exert on the forms and effectiveness of communication lead to the so-called linguistic variation. This variation can occur at different language levels, or in a specific part of it such as the lexicon or pronunciation, and can be produced by age, geographical, social and situational factors. In addition to these conditions associated with the context, there is a need to adapt language according to the characteristics of the communicative situation. Therefore, in formal situations more standardized expressions of the language are used, while in informal or colloquial situations, a less anticipated and even more unstructured use emerges. These forms of adaptation of discourse according to the situational context are called register.

In this way, it is clear that the environmental and sociocultural contexts are also part of the verbal communication process, finding its analog in the framework of the HMCS model. Therefore, similarly to the external context of movement, the context in the production of verbal language exerts a strong influence on the nature of this process, and on the way in which discourse is created and assumed. In sum, Table 1 presents a parallel between human movement and verbal language within the framework of the *Human Movement as a Complex System* model (HMCS).

5. Concluding Remarks

The present reflection made it possible to establish a relationship of analogy between components of verbal language and components of human body movement, both of them considered resources for communication. In this regard, their organization at different levels allows to

account for their belonging to functional and complex systems that are articulated with human cognition. Indeed, cognitive linguistics and its embodied, extended, situated and enactive theories [23-26], confirm that linguistic symbols acquire meaning as long as they are part of a living system, bodily situated in the world, through its interaction with the environment.

Within the framework of this analogy, it can be stated that phonemes, allophones and syllables are equivalent to physiological movements, while words, made up of lexemes and morphemes, are comparable to movement patterns, representing microstructural and structural units of language, respectively. Likewise, it is concluded that the utterance is the basic communicative action, representing the functional unit of verbal language that is produced by the intentional combination of phrases and sentences. In turn, the text is the communicative activity or total unit of verbal language, which is given by the coherent combination of statements and utterances in a task situation. Finally, in text linguistics and discourse analysis, the communicative behavior that involves the symbolic analysis of the communicative act from the semiotic, ethical and aesthetic aspects is revealed, as well as from the communicative, referential and expressive aspects that pragmatically define discursive genres. All of the above framed in a particular environmental and socio-cultural context, determined by spatial and temporal aspects, and on the basis of motor control evidenced in the motor and communication skills of the functional capacity. Movement and language, in an articulated and independent way, constitute communication.

In this sense, it seems correct to conclude that body movement is language and language is, in essence, human movement. Both are intricate, integrated, indivisible, and inherently constitutive aspects of the same cognitive processes. The analogy achieved highlights the theory of the shared resource between motor control and cognitive control. In the same way that verbal language allows communication based on communicative intentions, body movement allows the exchange of information, constituting a bridge between cognition and the world. Both resources allow not only the expression of individuals, but also the comprehension of the environment in which they inhabit. In the words of Agámez *et al.*, "the body is language, it is communication, it is a vital expression" (p. 83, our translation) [13].

The practical implications of this analysis from the perspective of linguistics are multiple. Considering that language is a means to express and understand reality, it is applicable in fields such as education, language teaching, in the understanding of abstract concepts through metaphors, as well as in the understanding of semiotic and visual languages [39]. All of them are benefited by a conception of language from an embodied perspective, considering the physical environment, the nature and functioning of the embodied mind, as well as the sociocultural dimension that, together, constitute a dynamic and complex system, just like language itself. In this order of ideas, language and human movement, as integrated cognitive processes, constitute the means for the expression of ideas and understanding of intentions, and in general, for communication at all levels.

Other practical implications are found in the sciences of rehabilitation and human movement. Human movement has a potential mediator in the rehabilitation of language disorders in its different modalities [40, 41], just as language expressions have the potential to mediate in the rehabilitation of human movement deficiencies [42, 43], and aspects supported by the shared resource theory between motor and cognitive control [6-8]. Likewise, this analytical approach offers inputs for physical education and conditioning processes with the participation of language [44, 45].

Table 1. Parallel between human body movement and verbal language within the framework of the *Human Movement as a Complex System* (HMCS) model of the Autonomous University of Manizales, Colombia

Level	Dimension		Component	Discipline	Unit
The objectified aspects	1.	Body movement	Physiological movements	Anatomy and Physiology	Micro-structural
		Verbal language	Phonemes, allophones and syllables	Phonetics and Phonology	
	2.	Body movement	Motor pattern	Biomechanics	Structural
		Verbal language	Lexemes, morphemes and words	Morphology	
	3.	Body movement	Motor action	Neuroscience	Functional
		Verbal language	Phrases, sentences and utterances	Syntax	
	4.	Body movement	Motor activity	Motor learning theories	Total
		Verbal language	Text	Text linguistics	
	5.	Body movement	Motor behavior	Socio-anthropology of movement	Symbolic world
		Verbal language	Discourse	Ethnolinguistics and socio-linguistics (discourse analysis)	
The potentiality	6.	Body movement	Motor control	Neurophysiology	
		Verbal language	Language motor control	Neurophysiology of language	
	7.	Body movement	Motor ability	Kinesiology	
		Verbal language	Communicative Capacity	Sociolinguistics and Pragmatics	
The Context	8.	Body movement	Environmental and socio-cultural	Ecology, Sociology, Anthropology	
		Verbal language	Environmental and socio-cultural		

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