A broader social approach to aphasia through language theory: prioritizing subjectivity to the detriment of the individual as an abstract construction

Abstract

Background: Aphasia is an intellectual disability that provokes language impairment. Among its various nuances, we chose dysgraphia, which affects writing skills. As language is not separate from the body, our interdisciplinary approach brings a perspective that transforms research into effective social work, developing methods to interfere in the language process, helping the aphasic individual to build the meaning of what he intends to express. The standardization aspect of the language controls the lexation through a process in which words combine into constituents in a hierarchical manner referred to grammar mechanism to form a more complex linguistic unit.

Methods: We intend to deal with the neuro-linguistic phenomenon that reflects on the language functioning as a dynamic power giving neuroplasticity to the brain. The fourth-generation methodological approach is used to develop methods and practices to improve the quality of life of the subject instead of just finding a deficiency and its causes.

Results: In this way we deepen the study of dysgraphia to interfere with the cognition process of aphasic individuals. Brain uses experience and learning to reshape its circuits in a long-term empowerment. Based on this we studied the aphasic individual’s mental processes in a longitudinal follow-up by means of a challenge-type training directed at certain tasks in order to improve specific performances.

Conclusion: Cognitive development was achieved through training-induced learning, giving quality of life to him. This reflects the need to provide training to health and education workers in order to enable them to interfere in the rehabilitation of the subject with dysgraphia.
Keywords: Language, Intellectual Disabilities, Aphasia, Neuro-plasticity, Fourth Generation Methodology

Introduction

This article deals with intellectual disability using a fourth-generation methodological approach (Campos and Furtado, 2011), in which there is a concern to develop methods and practices that improve the quality of life of the subject instead of just finding a deficiency and its generic causes. Our intention is to deepen the study of dyslexia, and some cases of dysgraphia, seeking their roots to interfere with the development of skills of the subject so that he is able to overcome the obstacles and communicate better; in another words, we intend to understand the structure of natural language to interfere with the cognition process of individuals with aphasia. This effort can be considered a health care workforce that may have not a place in the complex health needs but reflects an appropriate training and skills for capacity building for both, workers and patients. Health policies should seriously consider allocating professionals of different areas to collaborate and effectively meet the care needs of people with aphasia (dysgraphia). This kind of policy has its important role of enhancing health and well-being.

There is a difference between assessment, rehabilitation and the fourth-generation approach. The latter is a more refined form of evaluation that enables more effective rehabilitation making it possible to find a solution to a situation that often occurs with stroke sufferers: the problem of how they, despite brain damage, can translate knowledge into meaning structures that have suffered damage to convey a message, to share experiences, to describe these experiences in language. In the scope of Neurolinguistics, we bet (Monte-Serrat, 2017) on the fact that obstacles in the narrative will interfere with the meaning not only of the words, but of the subject himself.

The language and its unconscious standardization

The individual exercises a faculty of symbolization, consciously or unconsciously, when using language. Lacan (1936) seeks the concept of symbolic function in anthropology to give language phenomenon the role of a system of representation closely related to the self (that designates the person as himself, as conscious of himself and object of thought, as defined by psychoanalysis) (Roudinesco & Plon, 2011, p 1137). Based on the Lévi-Strauss’ (2012 [1949]) concept of structure, Lacan states that there is a regulating principle, with regards to the human being, which can be previously established. This principle would reside in the whole of the structure and not in its elements, that is, in a logical structure that involves relations and interchangeable terms.

According to Lacan (1936, 1949), there are unconscious factors derived from a certain autonomy of the symbolic function, which governs a multiplicity of particular situations of each subject producing an efficacy in the registration of the language (Roudinesco & Plon, 2011, p. 1026-1027).

These facts make the language phenomena very complex and must be considered when seeking the solution to a specific language disorder, as is the case of aphasia, in which we take into account the context of the universe of the aphasic subject: Aphasia is a language disruption due to the improper brain functioning that affects the comprehension (Damasio, 2005); there is interference of intricate patterns of language in the meaning understanding, once this process is broken, it provokes a language impairment and hinders the meaning formation. According to Jakobson (1956, p. 119) the language has a two-fold character: combinatorial and selection aspects such as concatenation/syntagma and concurrence/paradigm). Related to the syntagma, Whorf ([1942]2017, n.p.) states: “the linguistic order embraces all
symbolism, all symbolic processes, all processes of reference and logic”, turning the mind into the belief that “the patterns of sentence structure that guide words are more important than the words themselves”. Those perspectives are restrictive concepts of logic leading language to an ideal signification with a technical structure that forgets other layers of meaning.

Based on these premises, we will try to deepen Jakobson’s conceptions using Mathematics to explain the intricacy of the language structure. We aim to find a way to circumvent the difficulties the aphasic meet to express their ideas through syntactic and semantic ways (Monte-Serrat et al, 2018) since Lacan (1961-1962) takes the signifier with the role of not marking a thing, but only pointing a difference in the speech, which triggers a way of thinking. Such debate seeks to discuss the language phenomena as a theory understood within a broader social scientific domain to prevent the individual remains an abstract construct and so that his subjectivity takes shape in the language functioning.

Analysis of language disruption
In order to investigate the causes of aphasia, this analysis of language disruption involves: 1) the language structure; 2) a medical methodology to understand the misfunctioning in the disrupted brain; 3) methods from cognitive linguistic to separate the common language skill from the pathological evidence of aphasia; 4) interdisciplinary methods from semantics and abstract logics to clarify the correct formation of a meaningful (logical) expression.

1. The language structure
The linguistic domain proceeds from an order of standardization: the letters are formed; these in proper sequence form words that, aligned in columns, classify entities, and so on, continually crossing themselves. Before that linguistic plane, happen neuro-linguistic phenomena in which sound waves are standardized in undulating muscles and organs of the speech located in the physiological-phonetic plane (Whorf, 1942). Then there is the phonemic plane, which standardizes consonants, vowels, accents, tones, etc. so that phonemes combine in morphemes until everything is unconsciously standardized through syntax (op. cit.). The fact that Whorf (1942, np) states the linguistic order is related to logic and depends on anthropological and sociological aspects, made us involve some more general perspectives in our analysis of aphasia.

1.1 Linguistic patterns and the intrinsic geometry of language
Language reflects a manifestation of force putting new patterns in the states of the nervous system, incapable, per se, of a dynamic power. The result of an adequate standard produces properties that amplify and activate latent forces (Whorf, 1942). This feature of language functioning translates what neuroscientists call neuroplasticity of the brain (Dehaene, 2007; Dehaene et al., 2015).

There is still much to discover about man’s communication process that does not belong to this process itself. How the body provides words for thought, their pronunciation imply a choice tied to the individual’s social needs. According to Whorf (1942, np) the fact that language determines thinking is not an obvious activity.

[...] the forms of a person’s thoughts are controlled by inexorable laws of pattern of which he is-unconscious. These patterns are the unperceived intricate systematizations of his own language—shown readily enough by a candid comparison and contrast with other languages, especially those of a different linguistic family. His thinking itself is in a language—in English, in Sanskrit, in Chinese. [...] And every language is a vast pattern-system, different from others, in which are culturally ordained the forms and categories by which the personality not only
communicates, but also analyzes nature, notices or neglects types of relationship and phenomena, channels his reasoning, and builds the house of his consciousness. [...] Much thinking never brings in words at all, but manipulates whole paradigms, word-classes, and such grammatical orders "behind" or, "above" the focus of personal consciousness.

We found an agreement between Whorf (1942, n.p.), Jakobson (1956, p. 119), Chomsky (1957, p. 15), and Ding’s (Ding et al. 2016, p. 158) findings that language structure and neurophysiological findings describe a process in which words combine into constituents in a hierarchical manner referred to grammar mechanism and logic in order to form a more complex linguistic unit. There are patterns that affect how meanings appear related to words, something that underlies what was said or written, which is in the very structure of the sentence and the individual is not able to identify (Whorf, 1942). Aphasia breaks these bonds, this language geometry (Whorf, 1942), interrupting the systematization and mathematization that characterize the unconscious principles of each language. In this case, there is a historical and subjective structure interacting with a technical structure of the language. That is, there is a reality of the history of the aphasic that overlaps an objective reality of the language. This reveals that there are other layers of meanings formed through organic networks in the relational interaction (or the historical processes) of the aphasic deconstructing meanings imposed by the geometry of the language. In other words, dysgraphia shows that the objective aspects of language geometry fail to hold the individual's biological, physical, and chemical aspects, which are the basis for the formation of other meanings in the functioning of language. The relations of the aphasic bring to surface many concealed features.

2. A medical methodology to understand the misfunctioning in the disrupted brain

The aphasic disintegration of verbal structures may open up to the linguist (Jakobson, 2010:44)

In this topic we make a medical approach of aphasia in order to compare with the neurolinguistics approach given by Jakobson (1956) to, in the end, try to establish the basis of a science on the structure and functions of language that is common to several languages. This task becomes less difficult when we observe, from a contrary perspective, language impairments like aphasia.

Kennison (2013) states that language processing takes place at Broca area, in frontal lobe of the brain, since a discovery on impairments in Pierre Paul’s patients. According to Braddy and Colleagues (2016, p. 1), “aphasia is an acquired language impairment following brain damage that affects some or all language modalities: expression and understanding of speech, reading, and writing”. American Stroke Association (2019) classifies: Wernicke’s Aphasia (receptive aphasia) in which words do not make sense, or string together but in a meaningless way; Broca’s Aphasia (expressive aphasia) affects on how words appear together to form complete sentences; Global Aphasia in which there is difficulty to form and understand words and sentences. According to Brocks Academy (2013) aphasia can be expanded in:

**Dyslexia** – [...] chronic neurological disorder causing inability or great difficulty in learning to read or spell, despite normal intelligence. It inhibits recognition and processing of graphic symbols, particularly those pertaining to language. Symptoms, including very poor reading skill [...] 

**Dysgraphia** – [...] learning disability that affects writing, which requires a complex set of motor and information processing
skills. Dysgraphia makes the act of writing difficult. It can lead to problems with spelling, poor handwriting and putting thoughts on paper. [...] 

**Dyscalculia** – [...] a wide range of lifelong learning disabilities involving math. There is no single type of math disability. [...] And, it can affect people differently at different stages of life. People with dyscalculia can have visual-spatial difficulties and language processing difficulties. This means they have trouble processing and understanding what they hear.

**Dyspraxia** – [...] an impairment or immaturity of the organization of movement. It is an immaturity in the way that the brain processes information, which results in messages not being properly or fully transmitted. [...] affects the planning of what to do and how to do it. It is associated with problems of perception, language and thought [...] 

According to Jakobson (2010, p.11), language has a "hierarchy of functions within which sound is linked to meaning". The author (op. cit., p. 11-12) focused on the relationship between sound and meaning, which goes beyond the level of the phoneme, proposing that sound and meaning constitute two basic poles of natural language. When observing speech disorders, Jakobson (2010, p.14) distinguished between different types of aphasia and, in doing so, he found “the very mechanism of language formation”. The author (op. cit., pp. 34-35) clarifies that there are "universal laws governing phonological and grammatical systems" and that "all linguistic significance is differential". He (op.cit.) adds that "at the semantic level [there are] contextual meanings and situational significations. For him (op. cit.), only the existence of invariant elements allows one to recognize variations; "the problem of invariants is a crucial problem" he says. Regarding to the difference between syntax and semantics, Jakobson (2010, p.37) states that "syntax deals with the relations of the signs to each other" in the metonymic chain, and "semantics deals with the relations between signs and things." Thus he (op. cit.) affirms that language has two axes: the axis of syntax, of threads (concatenation); and the axis of semantics, of substitutions. According to White ([1980] 1991, p.16) the structure of writing inserts in the sentence structure a content of a social-political order (rational laws and customs) in spite of the will of the individual. This content comes as something more than mere chance and it is distinct from feelings like love or religious intuition, for example. The legal system of writing draws, suggests, how the subject can express his ideas. 

After making these considerations we question what are the implications of dysgraphia on getting supposed wrong "errors" in writing tasks? What can an underlying process tell us that is not revealed when there are no problems in the speech of the individual and from the point of view of dysgraphia, there are "inaccuracies" over processes that overlap until they reach writing? 

3. Methods from cognitive linguistic to separate the common language skill from the pathological evidence of aphasia

Rohde et al. 2018 state that an accurate aphasia (generic term that encompasses the term dysgraphia) diagnosis can be made through a wide range of language tests including commercial, informal, and developed by healthcare institutions tests. The tests the authors (op.cit.) reviewed (4,571) end with a psychometrics report that give diagnostic capabilities in differentiating non-aphasic population from the aphasic one. Some of them meet the clinical need of some speech pathologists and similar professions. The authors confirm in their research that these tests have not been systematically evaluated: “not all tests were intended to be diagnostic instruments. Despite this, the
review found that the psychometrics of many measures, irrespective of the tests’ aims were still often lacking with a number of measures not reporting analysis of test validity (of any form)

3.1 Dysgraphia

Among the various nuances of aphasia, we chose dysgraphia because we emphasize in this article the syntactic chain. Dysgraphia is a condition in which there is trouble with written expression, organizing letters, putting thoughts into language (Patino, 2019, np). “The Diagnostic and Statistical Manual of Mental Disorders-5 (DSM-5) doesn’t use the term dysgraphia but uses the phrase “an impairment in written expression” under the category of ‘specific learning disorder’ (Patino, 2019, np). It is suggested special education services for Individuals with Disabilities Education Act (IDEA) who have “difficult to listen, think, speak, read, write, spell or to do mathematical calculations” (Patino, 2019).

Diagnosed by Neurodevelopmental Disorder, DSM-5 and ICD-10, the individual may have difficult in school tasks (Ferdous et al., 2019).

On a case study of a child (male, 6 years old, in Bangladesh) (Ferdous et al. 2019) with Dysgraphia, it was verified the existence of a disturbance in writing skills, which are substantially below the expected level given the chronological age of the child. This child has difficulty expressing written thoughts and partial inability to remember how to write certain symbols of the alphabet or arithmetic. He was diagnosed by Neurodevelopmental Disorder, DSM-5 and ICD-10. Cognitive development researchers tend to use the term dysgraphia to apply only to the cognitive aspects of spelling. It is estimated that 5 to 20% of all children exhibit some form of optimal motor behavior, including writing disorders (Smits-Engelsman & Van Galen, 1997).

4. Interdisciplinary methods from semantics and abstract logics to clarify the correct formation of a meaningful (logical) expression

We intend to broaden the questions about the language structure mentioned in the previous items. In this article we did not choose quantitative methodological practice so we can approach fourth-generation methodological methods (Campos & Furtado, 2011). In general, data collected describe fragments of language functioning regardless the evaluation tests chosen for it. Our research introduces a perspective in which we are able to capture realities of language that are discarded by a scientific look that regularly cover up discontinuities in order to portray realities of language in a supposed completeness of its moment, putting in relevance only what “matters”. When there is no method previously established that works as an organizing center for ideas, it becomes possible to formulate new concepts about experiences with natural language and its cognitive process (meaning process). This is our aim in this article.

The methodology we use is the fourth-generation qualitative assessment (Campos & Furtado, 2011, p.143), which not only assesses writing difficulties, but also assesses the body of the child with a disability. We put in evidence that language is not separate from the body. It is necessary, during the assessment of the impairment, to consider the body and its functioning as something that is part of a single process. Many papers point to brain regions on one side and the language problem on the other. But what happens in the course of the translinguistic processes? What exists before the sentence is written by the child with dysgraphia? How are pre-syntactic relationships formed? Language is the result of a synchronic process that also is linked to the quality of life of the individual. The body integrates the process of language: impulses of different orders combine indistinctly in
practice involving meaning (Monte-Serrat, 2017, 2018). Our interdisciplinary approach brings a perspective that transforms research into effective social work, in the sense of developing methods that interfere with the process of language, helping the individual with language impairment to build the meaning of what he intends to express.

Escaping from the methodological strategies that put hypotheses beforehand, we give our research an argumentative approach with an inferential weaving. Semantic inferences allow to establish a relation between the explicit and implicit, confronting them in order to suggest new ways of understanding the language functioning.

According to Perelman (1969, apud Eemeren & Grootendorst, 2004, p. 49), the arguments can be classified according to their persuasive effectiveness in: 1- quasi-logical argumentation; 2- arguments based on the structure of reality; 3- arguments that grounds the structure of the reality. The first one covers the principle of incompatibility, which is not adequate to our objectives in this research. The second refers to the way the arguments are based on the structure of reality, using this structure to establish a causal relationship in order to find one or several determinant causes that preceded it. This causal structure is found in the syntactic structure of the language (Whorf, 1942, n.p.; Jakobson, 1956, p. 119; Chomsky, 1957, p. 15). Lastly, the arguments that ground the structure of the reality, are those in which the analogy is used as a reasoning procedure to establish a relationship of similarity between two situations. We chose this third argument to make an analogy between: the language’s syntactic structure, and the corresponding mathematical sentence. It is not a question of establishing a similarity between the syntax and the mathematical formula, but rather of establishing a similarity between

the relations: "it is not a relation of similarity, but a similarity of relation" (Cardoso e Cunha, 1998, p. 32). This argumentative reasoning displaces the “adherence of the spirit of something that is known to that which is unknown” (Cardoso e Cunha, 1998, p. 32) allowing us to make inferences about the intrinsic geometry of language in its processes of reference and logic (Whorf, 1942, np) and about aphasic’s breakdown in the structure of language due to a brain injury.

The formation of a meaningful expression depends on the “patterment aspect of the language” which, according to Whorf (1942, np.), “overrides and controls the ‘lexation’ [...] or name-giving aspect [...]” Sentences, not words, are the essence of speech, just as equations and functions, and not bare numbers, are the real meat of mathematics”. The author (op. cit.) gives an advice about our mistake in believing “that any word has an ‘exact meaning’” due to the fact that “the higher mind deals in symbols that have no fixed reference to anything, but are like blank checks, to be filled in as required, that stand for ‘any value’ of a given variable”.

There is a system of connections underlying the structure of language that works to form units of meaning (Whorf, 1942, np.). This system dictates a pattern through grammar which functions unconsciously in an intricate and systematic way. Whorf (op. cit.) describes this functioning as something that follows a “network established in language, concentrating on certain phases of reality, certain aspects of intelligence and discarding others”.

Concluding, language is based on patterns that are formed according to some intrinsic rules, given by grammar. An analogy can take place establishing a similarity between the grammatical structure of language and geometry, which is based on axioms (postulates) and theorems that
characterize geometric objects. In the case of aphasia (dysgraphia) we can discern this underlying structure by verifying the absence of patterns in the sentence formation of the individual: There are obstacles to the meaning formation; or there is an absence of patterns that leads to the construction of nonsense.

**Interfering with the development skills: how to circumvent a language impairment**

Overcoming an intellectual impairment due to aphasia (dysgraphia) is possible due to the brain plasticity. According to Carter (2012, p. 193), it was believed that brain cells and neuronal circuits were immutable and that the only change would be the loss of cells with reduced volume. However, as the author states, researchers have been able to demonstrate that "experience and learning reshape brain circuits" and the example of this neuronal plasticity lies in "long-term empowerment, in which memory and learning generate new circuits" (op. cit., p.193). The author concludes that "the brain apparently has some ability to repair itself, continue to grow and develop throughout life" (Carter, 2012, p.193). In 1942 Whorf already said that language uses a different kind of manifestation of force putting in new patterns the states of the nervous system and of the glands that are incapable, per se, of a dynamic power, amplifying and activating latent forces (Whorf, 1942).

According to Whorf (1942, np) language determines thinking:

[…] the forms of a person's thoughts are controlled by inexorable laws of pattern of which he is unconscious. These patterns are the unperceived intricate systematizations of his own language […] And every language is a vast pattern-system, different from others […] Much thinking never brings in words at all, but manipulates whole paradigms, word-classes, and such grammatical orders "behind" or, "above" the focus of personal consciousness.

"Every mental condition has a corresponding cerebral state, consisting of certain patterns and sequences of neural processes" (Carter, 2012, p.214). We can infer from this statement that the behavior and learning experience of the child with dysgraphia are also associated with a certain pattern of neuronal activity. From that we have previously discussed about language geometry, we strongly suggest, despite brain injury, that we take advantage of cerebral neuroplasticity and use the mechanisms of language to interfere with the aphasic individual's mental processes, putting them within hierarchy (Dehaene, 2007). There are patterns that affect how meanings appear related to words, something that underlies what was said or written, which is in the very structure of the sentence. Our thoughts understand this pattern in a limited way, "using mathematical or grammatical formulas into which words, values, quantities, etc., can be substituted" (Whorf, 1942, np).

Jakobson and Halle (1971, pp. 85-86) have observed that the dissolution of the ties of grammatical coordination and subordination result in a set but meaningless words. This happens because an underlying logic in the metonymic chain (syntagm axis), which normally shapes the meaningful imposing processes of coherence, loses this function. The authors reinforce that “any grouping of linguistic units binds them into a superior unit: combination and contexture are two faces of the same operation” (Jakobson and Halle, 1971, p. 74). White ([1980]1991) suggests the demand for meaning requires, in a first step, that there be a sequence of events and, secondly, that these events are evaluated for their significance in order to fill gaps, organizing the meaning following a structure.

Researches focused on neural processes of cognitive control and their interaction with the social context in a goal-directed way (Dehaene et al; Monte-Serrat, 2016,
Anguera et al. 2013; Mármora, 2005; Carter, 2012; Hydrocephalus Association, 2002) inspired a longitudinal follow-up of individuals with brain injury whose deficits of neurons related to cognitive control underwent a "correction" by means of a challenge-type training directed at certain tasks in order to improve specific performances. Training was able to extend the untrained cognitive control skills in order to induce an increase sustained attention. A follow-up for a period of 6 months should come to discoveries that show the robustness of the plasticity of the cognitive control system. Evidence of this can be provided by reassessing cognitive abilities to arrive at the conclusion that neural mechanisms are a tool for cognitive enhancement.

**Conclusion**

A social approach of language assessment that prioritizes subjectivity is possible when we use a fourth-generation method (Campos and Furtado, 2011) which goes beyond individual evaluation and rehabilitation, providing a more effective improvement. The plasticity of the human brain and training-induced learning improve the quality of life due to interference in the process of cognition of individuals with dysgraphia. Although their learning tends to be specific to the trained function and not transferred to similar tasks (Green & Bavelier 2008), there are no obstacles that prevent the discussion of new training schemes. These trainings can lead to the acquisition of new knowledge and to the development of new strategies so that they are used flexibly in various tasks and contexts. These challenges are responsible for increasing learning, for progressing the task difficulty, for the motivational state of the individual, and also for reflecting on the type of feedback that the training provides.

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