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Research Paper

Cognitive and linguistic implications of learning Japanese as foreign language: A case study of a Brazilian aphasic learner

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Abstract:
Considering that foreign language (FL) learning invokes a diverse brain network with different functions, this paper aims to discuss the activities proposed in a case study with a Brazilian participant with aphasia learning Japanese as a FL. We focus on the metalinguistic processes required from him to accomplish the Japanese tasks. The participant attended weekly sessions, one-hour per session, for seven months. The sessions were recorded and transcribed. Therefore, we explore the relation among language, brain, aphasia, and metalinguistic processes and embodied simulation in the context of FL learning activities. The results of this research support the idea that learning a FL might be a valuable technique for language intervention in aphasia.To our knowledge, this is the first work to address the FL learning by people with aphasia. Several questions still remain to be answered, such as the long-term effect of FL learning and the use of a broader variety of participants. However, the findings of this study contribute to the discussion of language learning in aphasia rehabilitation.
Keywords: Aphasia; Foreign Language Learning; Metalinguistic Skills; Atypical Population; Language Impairment

1. Introduction

Learning a foreign language[1] (FL) requires a number of cognitive and linguistic processes, including working memory, sound discrimination, inductive reasoning, speech segmentation, and semantic memory (Antoniou et al., 2013). Due to neuroplasticity, human brains can adapt and reconfigure themselves in response to a cognitive demand and environmental stimulus presented in an individual's linguistic experience, such as learning an FL. Studies suggest that FL learning brings benefits to the brain's neural structure by modifying it, regardless of whether the learning process results from lifelong learning or is a short-term laboratory setting learning (Li et al., 2014).

Cognitive gain from FL learning applies not only for children, but also for typical older adults as well as people with cognitive impairments. Since aging is associated with symptoms of reduced working memory and attention, slower lexical retrieval, existing studies indicate FL learning might modulate neural plasticity in such contexts and is considered a form of cognitive training for such populations (Antoniou et al., 2013, Tigka et al., 2019). Considering that, we ask whether FL learning might be useful as a language intervention for people with aphasia (PWA).

Among aphasia rehabilitation field, several studies have addressed the question of language learning in PWA (Penaloza et al., 2022), and more recently, have been interested in word learning ability in aphasia and its relationship with cognitive-linguistic measures and treatment outcomes (Coran et al., 2020; Dignam et al., 2016 and so on). Although

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[1] In this work, we refer as FL for all contexts where an individual learns a new language that is not their native language, such as second or third-language.

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these previous studies highlight the importance of learning capacity for aphasia treatment, the majority of them have focused on novel, or unfamiliar, words learning. Considering that, we aim to discuss the activities proposed in a case study with a Brazilian participant with aphasia learning Japanese as an FL, as reported in Misaka (2017). Our objective is to analyze the metalinguistic processes required from the participant to accomplish the tasks and propose the FL learning as one of the techniques that can be used in language intervention in aphasia. For that, we will raise a discussion based on the relation among language, brain, aphasia, and metalinguistic processes in the context of FL learning activities.

The current study is divided into the following: in section 1.1. we present the concepts of language, brain and aphasia, relevant for this work, integrating the main aspects of Luria's, Freud's, and Jakobson's theories. Also, we briefly present recent studies on aphasia from neuroimaging and linguistic perspectives. Then, in section 1.2. we discuss the key concepts of metalinguistic awareness (MA) and the different linguistic properties. In section 2, the case study reported in Misaka (2017) is described, including its methodology, the participant, the proposed activities, and the data collection. After, in section 3, we discuss the Japanese activities and the data collected in the case study, dividing them into reading and speaking activities. In the last section, we conclude our analysis, emphasizing the importance of this work as well as the need for further research on this topic.

1.1. Language and aphasia

Aphasia is a language disorder resulting from damage to portions of the brain related to language, and communication. It can cause impairments in different aspects of language such as understanding the language, reading, writing, or speech disorders. As stated by Armstrong and Ferguson (2010), there are two main language perspectives in the field of clinical aphasiology: the first views the language system as a set of rules that must be mastered for someone to produce correct speech. The other views language as a social process, where meaning is created and negotiated between individuals. Our study stands on the latter, taking a sociocultural approach to the brain and language (Coudry, 1986; Pinto, 2012).

Language is more than a means of communication; it is also a way of expressing and shaping human thoughts and ideas. Language, in this regard, demonstrates a creative power capable of producing various forms of meaning (Franchi, 2002), which is enhanced in a discursive and enunciative context by the interaction between the speakers (Benveniste, 1966). This sociocultural approach is especially relevant when studying a language affected by neurological episodes, such as aphasia, since it is interested in analyzing all types of resources (verbal or nonverbal communication) that aphasic people can use to communicate (Coudry, 1986; Armstrong & Ferguson, 2010), whereas traditional approaches focus on what is missing in the linguistic system (Pinto, 2012).

Informed by the work of Luria (1976), Freud (1891), and Jakobson (1956) on the brain and aphasia, our study particularly utilizes Luria's (1976) concept of the brain as a highly plastic and integrated system. In other words, the brain is equipped to promote changes both in normal situations, such as the search for new solutions to problems, and in pathological processes, as in the case of aphasia.

Freud has been known for his contribution to psychoanalysis; however, in his initial years of research, he was also interested in aphasiology studies. As Wallesch (2004) points out, Freud developed elements of a neurobiological theory of cognition and behavior, criticizing mechanistic localizationist theories of the brain. Yet, his influence on aphasiology studies was very limited, and at that time, the linguistic theory could not provide the necessary support for his claims. Nevertheless, drawing on Freud (1891), we are interested in the concept of a speech apparatus designed to make associations. Neurologically, this apparatus is not constituted by distinct and separate centers divided by non-functional areas. Instead, it is represented in a large, continuous region of the brain.

For over 150 years, scientists have been interested in how the brain reorganizes after damage, particularly concerning language recovery. Initially, it was believed that the right hemisphere played a key role in recovery, based on observations that new language problems could occur after right hemisphere strokes in patients who had previously recovered from left hemisphere damage. Early imaging studies indicated that both the left and right hemispheres are involved in language processing, both in individuals with aphasia and in those without brain damage. (Wilson & Schneck, 2021; Stephen et al., 2021).

The advent of three-dimensional PET scans in the early 1990s significantly advanced our understanding of how the brain reorganizes language processing following a stroke. In 1995, a study (Weiller et al., 1995) suggested the right hemisphere played a major role in language recovery for some patients. However, subsequent research (Karbe et al., 1998; Heiss et al., 1999) contended that recovery primary depended on the left hemisphere regaining function.

Over the next two decades, research using PET and fMRI showed varied results. While some studies supported the right hemisphere's role, others emphasized the residual function of remaining left hemisphere areas. Additionally, some identified the recruitment of new left hemisphere regions becoming involved (Turkeltaub et al., 2011; Griffis et al., 2017; Fridriksson et al., 2012). Recent studies suggest that general brain networks, not specific to language, might also aid recovery (Geranmayeh et al., 2014). According to Stephen et al. (2021), researchers agree that multiple mechanisms likely contribute to aphasia recovery, depending on the location and severity of the brain damage as well as the stage of rehabilitation.

Brady et al. (2016) shows PWA experience impairments in one or more language modalities, affecting their ability to produce or comprehend speech, read, write, and use gestures. Aphasic symptoms can range from mild, such as word-finding difficulties, to global, where all language modalities are severely impaired. Evidence suggests that patients with aphasia can benefit from rehabilitative programs even years after onset (Cacciante et al., 2021).

From a linguistic perspective, Garrafa & Fyndanis (2020) argues that to some extent linguistic theory has informed aphasiology studies up to date. Starting from Jakobson (1956), who proposed that two fundamental operations could be affected in aphasia: selection and combination of linguistic units. Over the last 35 years, the majority of linguistically informed research on aphasia has been framed within the paradigm of Generative Grammar approaches. For instance, Drai & Grodzinsky (2006) presented an empirical study on the impairment of syntactic movement in 69 selected Broca's aphasic patients. Grillo (2009) focused on explaining the problems of sentence comprehension by agrammatic Broca's aphasics based on the Relativized Minimality.

Gahl & Menn (2016) adopted a contrasting linguistically-informed approach, focusing on analyzing the probabilistic models of aphasic sentence comprehension and production. Grodzinsky & Friederici (2006) pointed out that recent findings on language deficits studies challenge and refine the understanding of how language is represented in the brain. Research that integrates syntactic concepts and imaging technologies show that syntactic knowledge and processing are distributed across various brain areas. Syntax is not limited to the traditional Broca's and Wernicke's areas in the left hemisphere but also involves parts of the right hemisphere.

In addition to the neurological and linguistic frameworks that helped us elucidate the process of language recovery in aphasia, we take considerations from the role of Embodied Simulation (ES) in semantic association to further understand our data. ES is a cognitive mechanism by which an individual can use their bodily experiences to simulate or mentally rehearse actions, emotions, and sensory experiences. This understanding can provide us deeper insights into the complex interplay between brain reorganization, language processing, and rehabilitation.

By means of embodied simulation we do not just 'see' an action, an emotion, or a sensation. Side by side with the sensory description of the observed social stimuli, internal representations of the body states associated with actions, emotions, and sensations are evoked in the observer, as if he/she would be doing a similar action or experiencing a similar emotion or sensation. (Gallese, 2006, p.3)

According to Gibbs et al. (2006), people can create clear mental images for metaphorical actions because many abstract concepts may be understood through our physical experiences with tangible objects. Metaphors such as "grasping a concept" or "chewing on an idea" can create a connection between bodily experiences of manipulating physical objects in order to understand abstract concepts.

Based on the theoretical approach of ES, research on embodied cognition in the context of FL learning and teaching has emerged. Birdsell (2020) emphasizes how embodied cognition can be applied to an embodied learning approach in the context of FL instruction. According to him, there are two versions of embodied cognition theory: in the stronger version, the sensorimotor system is the basis for higher thinking. For example, when we think of or read the word "guitar," we mentally simulate our experiences with guitars—seeing its shape and color, and hearing its sound. This simulation gives meaning to the word. Conversely, in the weaker version, simulation is not always necessary, especially for familiar words. Here, multiple systems interact to process language more quickly. Nonetheless, both versions emphasize the importance of the body, actions, and situations in understanding language.

From an educational point of view, Birdsell (2020) suggests that FL teaching should focus on embodied and situated teaching and learning. Moreover, he points out that there are, at least, three key areas for embodied learning in FL instruction: the use of gestures; grounding abstract concepts through metaphors; presenting phrasal verbs through multisensory activities. Building on these insights, ES, through embodied metaphors, may play an important role in the FL learning context, in particular, aiding PWA to form concrete associations with abstract language concepts, thus enhancing their comprehension and production abilities.

The exploration of language and aphasia through the lenses of aforementioned authors provides a comprehensive understanding of the complex nature of language processing and recovery following brain damage. The integration of sociocultural perspectives highlights the dynamic interplay between neural mechanisms and social interactions in language rehabilitation. This fundamental knowledge sets the stage for our subsequent discussion on the crucial elements that facilitate language recovery and foreign language learning for individuals with aphasia.

1.2. Metalinguistic Awareness

Metalinguistic Awareness (MA) is defined as the ability to intentionally segment and manipulate speech into its various units, differentiate between signifiers and meanings, and judge sentence coherence (Barrera & Maluf, 2003). Additionally, we also assume that MA is understood as the capacity to abstract from the descriptive language level—the simplest level—to reflect on it and manipulate it intentionally—the more complex level.

Figueira and Pinto (2018) highlight two ways of defining MA: while one is technical and specialized, focusing on explaining the language (e.g., linguists), the other presents a more educational perspective related to the categorization of words. For this study, we adopted the first perspective, since we consider that when a person simply executes an activity that requires identifying the category of words such as articles and verbs, or commenting on the endings of verbs in the past tense, without further explanation of their choices, it is insufficient to say that it is metalinguistic

awareness. Classifying words may require some level of abstraction, however, for MA, it is essential to have a higher level of language abstraction such as manipulating structures or justifying an alternative word classification in an activity. Thus, we are interested in the behavior that the subject exhibits when reaching the linguistic level. The development of MA can start even before children enter school, since they already master the basic functions of language; however, it may be enhanced by formal education. In their literacy process, they have an initial development of MA, acquired naturally through exposure to social communication situations (Peters, 1983; Barrera & Maluf, 2003). Phonological awareness is the first skill to be developed, initially progressing with formal exposure—school—due to the high correlation between phonological awareness and the acquisition of writing (Bowey, 1994; Maluf & Barrera, 1997; Barrera & Maluf, 2003; Justi & Justi, 2006). MA involves skills in alliteration and rhyme, syllabic, word, and phonemic awareness, which seem to require specific experiences beyond mere exposure to the concepts of rhyme and alliteration (Mota, 2009, p. 21).

Morphological awareness also plays an important role in the acquisition of writing, as it is related to the sensitivity to perceive and manipulate the morphemic structure of words, contributing to segmentation (Deacon & Kirby, 2004; Guimarães, 2013). There is a close relationship between morphological awareness and syntactic awareness, which is linked to the ability to reflect on and mentally manipulate the grammatical structure of sentences. Lexical awareness is the ability to segment oral language into words, considering their semantic and syntactic-relational functions (Ehri, 1975). Pragmatic awareness is connected to the ability to reflect on the use of language in relation to the meanings of words in social interactions (Crystal, 1985). Metatextual awareness involves conscious reflection on the text, considering not only its content but also its structure, constituent parts, and markers (cohesive devices, punctuation) (Spinillo, 2009).

Research on MA involving adults indicates a learning trajectory very similar to that followed by children. According to Melo and Correa (2013), "the acquisition of reading and writing by young and adult Brazilians who have received late formal education follows the same principles that generally govern the learning of reading and writing in an alphabetic writing system". For example, phonological awareness is only fully developed through formal education. Illiterate adults have lower phonological awareness compared to literate adults (Lopes & Minervino, 2015). Furthermore, for individuals with different levels of education, orthographic principles are not learned in the same way, as there is no generative use of these principles, and there is difficulty in consciously articulating these principles (Queiroga et al., 2012).

Altogether, we assume there is a significant relationship between MA and FL learning in rehabilitation of aphasia as it encourages reflection on language and may facilitate optimal neural plasticity development. Moreover, studies indicate that the complete development of metalinguistic skills requires mediation. In our forthcoming case presentation, the participant, who was already literate, engaged in sessions with mediation.

2. Methods

This study aims to analyze the activities proposed in the case study reported by Misaka (2017), which describes the experience of a Brazilian person with a brain injury learning Japanese as an FL. Our current objective is to analyze the metalinguistic skills required from the participant to accomplish the tasks and propose FL learning as one of the techniques that can be used in language intervention in aphasia. Thus, we will present a brief description of the case study, followed by a discussion of the proposed activities.

2.1. The participant

GF is a 23-year-old Brazilian male, right-handed, who suffered a traumatic brain injury when he was 18 years old. As a result, he developed lesions in the frontal, temporal, and parietal lobes of his left brain hemisphere, followed by right hemiplegia. From the traditional aphasiology studies, his native language exhibited characteristics similar to nonfluent aphasia (Broca's aphasia), in other words, he may understand what other people say, but he used to speak in short phrases, in a telegraphic style, omitting functional words. Also, we observed semantic verbal paraphasia, "in which the desired and the substituted words are close in meaning" (Benson & Ardila, 1996). For example, when the investigator asked GF if he knew the Japanese city called *Hiroshima*, his answer was "is volcano, no. Is world. Is explosion" and then the investigator added "oh, explosion? The atomic bomb?". He could not retrieve the word "atomic bomb"; instead, he retrieved words that were close in meaning such as "volcano, explosion".

From a linguistic perspective, his language dissociation characterized by "selection and substitution (...) in which the context is the indispensable and decisive factor. When presented with scraps of words or sentences, such a patient readily completes them" (Jakobson, 1956, p.100). As previously noted, GF used to speak in brief sentences, then the communication between him and the investigator relied on context and non-verbal communication, such as gestures. Thus, according to Jakobson's studies on aphasia, GF presented a "similarity disorder" with "selection deficiency", which involves difficulty in selecting the appropriate words based on their meaning or sound similarity. Individuals with this type of disorder frequently substitute words that are similar in meaning (semantic paraphasia) or sound (phonemic paraphasia).

Due to the car accident at the age of 18, he was unable to complete high school; consequently, he was enrolled in a special youth and adult education program. It is relevant to note that he was already literate and he had received formal

education before the accident. Due to the language limitation imposed by aphasia, GF struggled to follow the classes at school, where he mainly copied the content from the whiteboard. As a result, he began attending *Centro de Convivência de Afásicos* (CCA), a university facility designed to host social interactions between neurotypical and non-neurotypical persons, to enhance his communication skills. At the time the case study was conducted, he was not receiving speech therapy treatment but was attending the hospital for health check-ups and exams.

In his free time, he enjoys watching Japanese animation, which helped motivate him to learn. He speaks Brazilian Portuguese as his native language and he had no previous knowledge of Japanese.

2.2. Case study design

Considering the brain's plasticity and the creative potential of language within a discursive and enunciative context, Misaka (2017) proposed a case study to describe how an individual with a brain injury would learn an FL, particularly a language such as Japanese, whose system is entirely distinct from Brazilian Portuguese (BP).

As learning an FL requires years of practice, the goal was not to compel the participant to achieve an expected proficiency level, but rather to examine the learning process. Thus, no Japanese proficiency or language assessment tests were given in this study. Also, since it was an unprecedented study, one could not rely on previous work to guide the research, so the main goal was to describe how a person with aphasia would learn a FL. In other words, the focus was to understand the language resources that the participant might use to accomplish the learning tasks, or the challenges he would face.

Moreover, previous research has observed that a speaker may have their language production affected by context, varying between natural conversational setting and artificial/ monologic tasks (Beeke, Maxim, and Wilkinson, 2008; Avent and Austermann, 2003) Consequently, there was no interest in measuring the language performance of the participant through controlled and decontextualized language tests or activities (Armstrong and Ferguson, 2010). Therefore, His native language was assessed in discursive and contextualized sessions, achieved through interaction between the participant and the investigator. Although the current work focuses primarily on the Japanese activities used in the case study, discussions and transcriptions of sessions utilizing his native language fall outside the scope of this analysis and will not be included.

2.3. Data collection

All the sessions were videotaped and transcribed using Discursive Neurolinguistics notation (Coudry, 1986). This notation system is particularly valuable because it incorporates information on both verbal and nonverbal communication channels (e.g., gestures, intonation, writing). Such details are crucial for a comprehensive understanding of the interactional context. The researcher conducted a qualitative case study, with sessions lasting one hour and occurring weekly for a period of seven months. The researcher, who possessed prior experience in teaching Japanese as an FL, conducted all the activities. The participant attended weekly sessions at *Centro de Convivência de Afásicos* (CCA), where data collection took place.

As qualitative research plays a relevant role for aphasiology studies (Damico et al., 1999), the focus of this case study is answering the 'how' questions, instead of 'why' questions. Here, the focus lies on identifying data that reveals how GF completed the tasks and what cognitive processes those tasks demanded of him.

2.4. Japanese language and activities

The Japanese language employs a hybrid written system consisting of *kana* and *kanji* characters. Japanese has three alphabets (Yamadori, 1998): two syllabic alphabets (*hiragana* and *katakana*) and Chinese characters (*kanji*). Each letter in the *kana* alphabet corresponds to a syllable, with no semantic association. The kana system is further divided into *hiragana* and *katakana*. *Hiragana* is primarily used for Japanese words as well as grammatical particles, conjunctions, and verbal and adjective suffixes. *Katakana*, on the other hand, is commonly used for foreign words. Each alphabet is made up of 102 syllables. The third alphabet *kanji*, originally from China, represents a morpheme that presents both phonetic and semantic information. The case study solely employed *hiragana*, as it represents the first alphabet introduced in both L1 and L2 educational settings.

It is relevant to note that the activities differ from regular FL teaching materials, since they were created specifically for this study, taking into account the unique needs brought on by the aphasia condition. The proposed activities were based on the learning as a process of acquiring knowledge and problem-solving strategies through interactions with other people and the environment surrounding them (Vygotsky, 1984). In that context, it was through the interaction between the participant and the Japanese teacher (researcher) that the learning process could occur.

For reading activities, flashcards were created with images of objects or animals that began with the same syllable as the target letter, as shown in Figure 1. This is the letter あ [a], and the image of *abelha* (bee) represents it. The Japanese letter follows the shape of the animal/object as closely as possible, and the illustrations are colorful. For that, a combination of the initial sound and the visual image of the picture was used, and the word's name was in the participant's native language. This activity can be considered as a phonological awareness task since it requires the participant to identify the sounds of the words. We can draw a parallel with the research conducted by Freitas (2023), where one of the tasks involved identifying the initial sound of words - alliteration - using images; the difference is that

in the case study's activity, not only images were used but also the written form of the letter because the participant was literate. Unlike traditional activities that rely on acoustic and visual information, the proposed reading activities provided the participant with acoustic, visual, and semantic information all at once. Thus, besides phonological awareness, the activities also relate to morphological awareness, since it requires perceiving the morphemic structure of words and manipulating that structure, and to lexical awareness, since it considers semantic functions.

Figure 1 - Letter /a/ from abelha (bee)

Consequently, the learner remembers the Japanese letters by using a native language word. This material is especially relevant for people suffering from aphasia, a condition in which cognitive processing, such as recognizing and naming an object, can be slow and difficult. Activities that exercise a person's cognitive functions, such as learning an FL, require a variety of brain functions and new neurological associations may form as a result of brain plasticity (Antoniou et al., 2013; Li et al., 2014; Tigka et al., 2019).

It is evident that the image played a crucial role in associating the letter with its sound. When GF could not recall the sound of a letter, the investigator showed him the image again, which enabled him to produce the correct sound. According to Mayrink-Sabinson (1993), learning to read and write is not a linear process that occurs cumulatively. Rather, it involves back-and-forth movement where the learner revisits and re-elaborates previously studied material. In each session, GF learned one or two sets of Japanese letters, and each reading activity reinforced the previously learned letters. Due to time constraints, the participant learnt only half of the *hiragana* alphabet which allowed him to start reading words in Japanese, and speaking basic daily expressions.

3. Results and discussion

Data from the sessions were derived from Japanese speaking and reading activities. Since the scope of the current work is to analyze the proposed activities, we will discuss the data that best provide us with insights into the ongoing learning process. The tables show the transcriptions made from sessions between GF and the investigator. Considering GF's aphasic language requires the context and participants' interaction to be understood, the tables contain the utterances from GF and the investigator, as well as comments on the context and non-verbal communication[1], in order to facilitate the understanding of each session.

3.1. Reading data

Table 1 shows GF reading the Japanese the word いけ/ike/ which means lake. The utterances and comments were translated into English. GF has already learnt some Japanese letters individually, and now he is practicing them as words.

[1] We decided to keep only the English translation of the transcription since the sessions were held in Portuguese.

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Table 1 - Data 1: reading the word いけ/ike/ which means lake

Turn	ID	Transcription	Comments on verbal communication	Comments on non-verbal communication
1	Inv.	Let's use this other one here. I will pull it out and put it here. How do you read it?		The investigator puts the Japanese letters together showing the word いけ/ike/, which means lake.
2	GF	I ... bra.		
3	Inv.	Bra?		
4	GF	No, *cre, que-bra*		GF is trying to mentally segment the word quebrado (broken) and select the first syllable.
5	Inv.	Oh! You thought of the word **quebrado** (broken).		
6	GF	Yes.		
7	Inv.	That's great! The picture is a broken vase, right? So the first syllable is...	The investigator shows a picture of a broken vase together with the Japanese letter け /ke/	
8	GF	I-que. /ike/		

In order to understand Table 1, the pictures corresponding to each Japanese letter are shown below (Figure 2 and Figure 3).

Figure 2 - Letter /i/ from ímã (magnet)

Figure 3 - Letter /ke/ from quebrado (broken)

Table 1 shows that GF is mentally searching for the image that corresponds to each Japanese letter, and when he is about to read the second letter /ke/, he says *bra*, then *cre, que-bra*. This demonstrates that he was mentally segmenting the word *quebrado* (broken), as in figure 3, in order to find its first syllable, /ke/, but the aphasia interfered with the process. Generally, when an automatic association between the Japanese letter /ke/ and its corresponding word *quebrado* (broken) occurs, it occurs in silence. However, the aphasia condition gives us insights into the process of reading Japanese, as if in a slow-motion video, revealing the cognitive and linguistic process in course.

Interestingly, this data shows that when GF reads a Japanese letter, he performs the following process: he associates the Japanese letter with its previously presented image; then, he recognizes the name of this object in his native language; and finally, he segments the syllable to reach the target sound of this letter. In other words, GF could manipulate the structure of the words, select one syllable, and inhibit another. The visual cue from the letter け /ke/ may

have activated the image of a broken vase (Figure 3), which worked as a concrete and tangible object (Gibbs et al., 2006) and ~~it~~ aided GF in learning such abstract alphabet letters.

GF initially requires a visual resource to remember the Japanese letter, but after engaging in reading activities like those in Figure 4 and Figure 5 below, this association becomes quicker and automatic. Then, he no longer needs the picture to read the letter, indicating that he is mentally reading it.

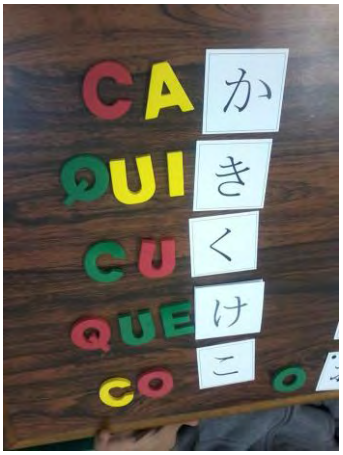

Figure 4 - Data 2: matching activity using hiragana and alphabet letters

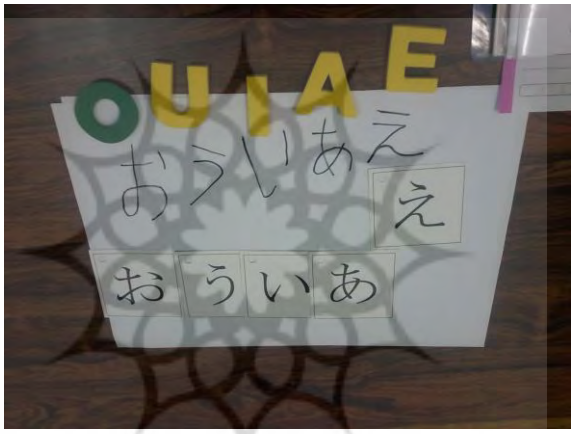

Figure 5 - Data 3: matching and writing activity using hiragana and alphabet letters

Data in Table 1, Figure 4 and Figure 5 demonstrate that GF accesses the MA to accomplish the task. By segmenting the initial syllable of the word *quebrado*, he has already used lexical awareness (Ehri, 1975) to associate the image of a *broken vase* with the word *quebrado*; then, he selects the first syllable of the word. The skill of manipulating syllables, phonemes, or words is related to phonological and morphological awareness (Mota, 2009). This indicates that these metalinguistic skills are preserved, even though the brain injury has caused a dysfunction in his native language.

In Table 2, GF reads a Japanese letter using a semantic association. In the transcription below, he reads the word あそこ /asoko/ (over there), which is represented by the letter /so/ (Figure 6).

Figure 6 - Letter /so/ from *soco* (punch)

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Table 2 - Data 4: reading the word あそこ /asoko/ (over there)

Turn	ID	Transcription	Comments on verbal communication	Comments on non-verbal communication
1	**Inv.**			Investigator shows the word あそこ /asoko/ that means over there.
2	**GF**	o... o... so... co	GF gives a punch in the air at the same time he says /so/. Then, he does the letter C with his hands when he says /ko/.	

By reading the letter /so/, he associates it with the word *soco* (punch) as in Figure 4, and then he punches the air while saying /so/. Then, to read the letter /ko/, he makes the letter C with his hands, which helps him in pronouncing the sound /ko/. This kinesthetic action of punching the air or doing the letter C with his hands demonstrates that the relationship between language and kinesthetic activity is still present and has become an alternative way for him to access the sounds.

Naming an object may seem like a simple activity for a neurotypical person; however, Luria (1976) suggests that such an everyday task implies the coordination of several cognitive processes simultaneously, which can be challenging in the aphasic condition. Despite this, GF discovered an alternative (kinesthetic and visual) approach to overcome it.

Based on Freud's concept of mental representation of words and objects (Freud, 1891, p.150), the representation of the object (meaning) can be accessed through various routes such as visual, acoustic, kinesthetic, and so on. A word (noun), according to Freud (1891), is a complex representation composed of those various elements, and a brain lesion can cause changes in the overall functioning of the language model. However, because of neuroplasticity, the brain can still utilize less compromised regions to ensure its functionality, as seen in Table 2, where GF appears to use both semantic and kinesthetic routes to access the words.

Regarding the language aspect, Jakobson (1956) approaches aphasia from a linguistic perspective, assuming that language consists of different levels (e.g., phonetic, morphological, syntactic and so on), and the freedom to create unique expressions increases at the utterance level. Thus, in this communicative context, as shown in Table 2, GF cannot select and combine the necessary sounds to read the Japanese word; instead, he uses a gesture (semiotic language) to make the letter C or to punch it in the air. Since GF and the interlocutor share the same contextual information, he can make himself understood.

Moreover, from the ES perspective, when GF sees the letter そ /so/, or the letter こ/ko/, the internal representations of the action of punching or the image of a spoon are evoked (Gallese, 2006). Due to the aphasic condition, GF uses the gestures to make himself understood and to associate the new language knowledge with familiar sensorimotor experiences. The use of images depicting objects or animals associated with specific Japanese syllables further engages sensorimotor processes. GF mentally simulates interactions with these objects, reinforcing the connection between the visual image and the phonological representation of each syllable.

The associative technique used in Japanese activities is based on the acrophonic principle, which is a set of rules used to decipher the phonetic value of letters (Cagliari & Massini, 2004). Some literacy activities for children utilize the acrophonic principle by using students' names to teach alphabet letters. According to the authors, the reading process begins with identifying the represented sounds and, over time, this conversion of information becomes automatic. During GF's training, he was not fully literate in Japanese, and for this reason, the activities and language data presented reflect the initial stages of the process. Nevertheless, GF demonstrated that reading some Japanese letters was becoming automatic, while for others, he still needed to rely on the image for support. Initially, GF needed the visual aid to associate the letter with the corresponding sound. However, after several review activities, this association became quicker and more automated, so he no longer needed the images to read the letter, indicating that he was reading mentally.

3.2. Speaking data

GF also learnt basic daily expressions in Japanese. To this end, the investigator prepared slides presentations containing pictures that represented the expressions in Japanese. For example, for the expression *ohayou*, there was a picture of a person waking up in the morning. When asked to repeat the expression, GF encountered difficulty, as illustrated in the transcription in Table 3.

Table 3 - Data 5: pronouncing the expression *ohayou* (good morning)

Turn	ID	Transcription	Comments on verbal communication	Comments on non-verbal communication
1	**Inv.**	So when you meet someone in the morning in Japan, you say ohayou /ohajoɯ/		
2	**GF**	Ro ya yo. /ho ja jo/	GF speaks slowly	
3	**Inv.**	*Ohayou /ohajoɯ/*		
4	**GF**	Oyayo /o ja jo/	GF reads what is written in the computer OHAYOU, but showing difficult.	
5	**Inv.**	Try not to read. Ohayou /ohajoɯ/		The investigador cover the computer screen to avoid him to read the expression
6	**GF**	Ro ya o /ho ja jo/. Wait ro-i-a-o...		
7	**Inv.**	I will write it in a different way to help you. Hold on.		The investigator takes a paper e start writing the expression again in a different way
8	**Inv.**	Here we go. O then here it is like two 'r' ...		The investigator writes: ORRAIO, using RR instead of H, and I instead of Y. Then, she show it to GF e ask him to speak again.
9	**GF**	ohayou /ohajoɯ/	He speaks while reads the expression, emphasizing the sound /ha/	

Aphasia makes it difficult for GF to repeat the expression *ohayou*, resulting in mispronunciations such as *oyayo* or *royao*. Table 3 shows that the written form played a crucial role in GF's speech production. In the transcription of the Japanese word into alphabet letters, the expression *ohayou* contains the syllable /ha/ written with the letter "h", which is not used in Brazilian Portuguese writing system. Consequently, GF had significant difficulty reading this expression. To achieve the same pronunciation, one should write it with double "r" as in *orraio*. After changing how the expression was written, GF was then able to read aloud. This data highlights the importance of writing or visual cues for GF to read and repeat.

Also, his native language played an important role in speaking as well. In Table 4, GF is learning the expression *konbanwa*, which means *good evening*. He can repeat the syllable /baN/ after hearing the word ***ban**deira* (flag) from his native language.

It is observed that he managed to pronounce the word in Japanese when he associates a Japanese phoneme with a Brazilian Portuguese one. For example, the syllable /baN/ is pronounced in the word *bandeira* (flag) and provides ~~the~~ support for him to pronounce *konbanwa*. By integrating visual stimuli (images of objects) with auditory (pronunciation of syllables) and semantic information (native language word meanings), the activity provided a rich multimodal learning experience. This approach aligns with ES by activating the multiple sensory and cognitive systems simultaneously to enhance learning and retention.

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Table 4 - Data 6: pronouncing the expression *konbanwa* (good evening)

Turn	ID	Transcription	Comments on verbal communication	Comments on non-verbal communication
1	Inv.	Now, there is /ba/, you have konbanwa / koNbaNɯᵝa/		While the investigator speaks, she writes on the paper the word CON BAN WA, using the letter C instead of K, because in Brazilian Portuguese the letter K is not common to use.
2	Inv.	This /baN/ is the same as **banho** (bath), **bandeira** (flag).	The investigator uses words in his native language that has the same syllable.	
3	GF	bandeira (flag)	GF repeats it without problem.	
4	Inv.	So, Kon-ban-wa / koNbaNɯᵝa/.	The investigator shows the written paper to GF.	
5	GF	Ban...		
6	Inv.	Kon...	The investigator interferes by giving him the first syllable.	
7	GF	Kon-ban-wa / koNbaNɯᵝa/	GF reads out loud the expression	
8	Inv.	Yes! Konbanwa!		
9	GF	Kon-ban-wa / koNbaNɯᵝa/	GF reads out loud the expression again.	
10	Inv.	That's it, great!		

Data in Table 3 and Table 4 illustrate how aphasia manifests in the Japanese learning process, particularly in repeating words. According to Luria (1991), lesions in the temporal and parietal regions of the left hemisphere of the brain, as seen in GF's case, can disrupt the ability to distinguish complex speech sounds. These areas are associated with receptive speech, responsible for differentiating speech sounds, forming speech articulations, and encoding spoken language. Based on the concept of word representation (Freud, 1891), the auditory image of the expression *ohayou* does not provide an entry point for GF to reproduce it in speech. However, when shown the expression written in his native language's alphabet, it becomes a possibility for association, enabling him to reproduce it orally. The process of reading, in the context of MA, involves the interaction between phonemes and morphemes and the written expression, utilizing phonological, morphological and metatextual awareness (Spinillo, 2009).

Moreover, these data demonstrate the constant interplay between L1 and L2. In Table 3, GF read the expression aloud using the Portuguese alphabet system, and in Table 4, he repeated the Japanese expression by recalling the pronunciation of a Portuguese word. Of interest here is the heuristic approach that seeks to understand the problem and propose alternative pathways to help him achieve his final objective. From a discursive perspective, having an interactive and communicative context, as in FL learning, allows the aphasic person to confront and reflect on their difficulties in order to overcome them (Avent & Austermann, 2003; Coudry, 1986). From a socio-cultural perspective on brain and language, it is possible to observe that GF utilizes his socio-cultural competence to adapt to the various challenges that learning Japanese requires from him, such as gestures and various semantic associations to communicate himself.

Finally, it is relevant to highlight the role played by the preserved metalinguistic skills. One might say that, in aphasia, a person "loses" their language; however, from the data, we can assume that the metalinguistic skills are not lost. On the contrary, GF uses them to manipulate two languages whose systems are completely different. We are aware of the methodological limitations present in the case study, but we consider it to be a stepping stone for future research

on FL learning in the context of aphasia. Therefore, we argue that FL learning may be considered one of the language training methods in aphasia rehabilitation, and further studies are needed to better understand their effects.

4. Conclusion

In GF's case, aphasia interferes with his learning process by causing difficulties in repetition, anticipation of segments, saying unintended words, and failing to say intended words. However, the Japanese language data reveal the strategies he employs (visual, kinesthetic, verbal) to navigate this new experience, by accessing Phonological, Morphological and Lexical Awareness. For instance, in Table 2, when GF was reading the word /asoko/ and uttered the syllable /so/ while simultaneously making a punching gesture in the air, it indicated that he associated or recalled the image of a person punching (Figure 6). In this process, GF used the resources provided by language itself (gestures, semiotic signs) to find solutions to the problems he encountered, demonstrating that he constructs alternative pathways to understand others, the world, and to express himself (Coudry, 1986).

In addition, this case study highlights the importance of MA in FL learning, in particular, in the context of aphasia. By employing flashcards with visual images of objects or animals corresponding to Japanese syllables, GF engages in phonological, morphological, and lexical awareness tasks simultaneously. This approach not only facilitates the retention and application of language skills but also holds particular relevance for individuals with aphasia, whose cognitive processes such as object recognition and word retrieval may be impaired.

ES can also play a role in this process by aiding the participant in concretizing abstract concepts and improving language learning. By stimulating sensorimotor and cognitive processes through simultaneous visual, auditory, and semantic information, the proposed activities not only promote phonological and lexical awareness but also may enhance neuroplasticity in individuals with conditions such as aphasia.

The main goal of the current study was to understand what the activities and materials provoke in terms of language and cognition in the aphasic person. In this respect, the choice of material and activities proved to be positive. Through a language practice involving Brazilian Portuguese and Japanese, integrating speech, reading, and writing with visual imagery, the activities required constant transitions between the two languages and writing systems. As pointed out by Antoniou et al. (2013), learning language involves a diverse brain network and ~~it~~ may bring a valuable contribution to the healthy cognitive function. Through a metalinguistic activity, such as reading or writing Japanese characters, he engages in sound-letter association, following a unique path that utilizes visual or kinesthetic resources, as seen in the data presented. We cannot generalize the results because each aphasic person is unique and seeks their own way of making themselves understood in the world. In GF's case, during the seven months, he was able to make himself understood in the sessions, and his communication developed. More detailed studies would be necessary, but we could assume that, to some extent, his contact with another language helped him develop a sense of words. This can be related to the findings of Freitas (2023), where children who performed better in MA activities had a better understanding of words.

The results of this research support the idea that learning an FL might be a valuable technique for language intervention in aphasia. This new learning experience, as seen in the data above, provided GF with the opportunity to challenge himself and engage in new forms of intellectual reasoning, involving visual memory, auditory analysis, and metalinguistic skills, for instance. These outcomes might not have been observed in a traditional language test or controlled activities. Moreover, the process of learning an FL, as an adult, places the learner in a situation similar to that experienced by an aphasic person. For instance, the learner might know what they want to say but lack the words, or they might say a word without fully understanding its meaning. Under these conditions, it is common to make errors, distortions, pauses, and hesitations in both speech and writing, as the knowledge is still being constructed, and such mistakes are generally anticipated by the interlocutor. Considering this, we suppose that GF's experience with the Japanese language provided him with the opportunity to experiment with speech and writing without the pressure of getting it right, which contrasts with the expectations placed on him regarding his native language. This positively impacted his self-esteem and confidence. Throughout the sessions, GF would take pictures of the Japanese letters with his cellphone to show others what he was learning, indicating his pride in learning Japanese.

To our knowledge, this is the first work to address the FL learning by people with aphasia. Several questions still remain to be answered, such as the long-term effect of FL learning and the use of a broader variety of participants. However, the findings of this study contribute to the discussion of language learning in aphasia rehabilitation.

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