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Phonological Errors of Broca's Aphasia: A Single Case Study of Neurolingusitics

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Abstract— Broca's aphasic patients display language problems in initiating utterances with groping movements, multiple false attempts and self-correction resulting from a lesion to the third frontal convolution of the left hemisphere of the brain. This study describes the forms of sound impairment, types of errors and phonetic processing by a Balinese patient who suffered from non-fluent speech disorder. The results showed that KW's speech performance was categorized severe. There were 0.80% phonological errors in word naming, 0.92% in picture naming, 0.87% in answering questions and 0.89% in oral reading. Of the three other types of errors, sound substitution errors mostly appeared in every phonological task. He made 65% sound substitutions, 20% sound distortions, 10% sound insertions and 5% omissions. Different speech stimulation could trigger sound inconsistency. The phonological errors occurred because there was not any appropriate coordination between phonological representation and phonetic realization due to the loss of linguistic message in Broca's area.

Keywords*:* aphasia; language modality; lexical access

1. Introduction

Language modality is one of human behavior components including language function, memory function, visual-spatial function, emotional function and cognitive function. Language function is one of the most prominent components in behavioral neurology because special feature of human beings is their ability to express notion and emotion through speech and language. Language disorder can be predicted to happen if there is lesion in one's language zone caused by traumatic brain injury (TBI) or cerebral vascular accident (CVA). Stroke can cause so many changes of human behavior components, one of which is considered aphasia (Kusumoputro, 1992). Lesion in left hemisphere, especially in the area of anterior Rolandic fissure can cause non-fluent aphasia with autism, difficulty of naming things, repetition, articulation, and writing (Benson, 1979).

Based on dichotomy classification of aphasia proposed by Kirshner & Freemon (1982), aphasia has different underlying spectrums. From the spectrum of physiology, the relationship between brain damage in anterior language zone and any type of language disorder syndrome is

well known as a Broca's aphasia. This term shows some identical features, such as decreasing verbal expression and language modality disorder. The later includes non-fluent speech, words or sentence repetition, naming and writing. These language errors occur due to pathology in the area of Broca that affects the system of brain network in such a way from sending verbal concepts into the system of sound symbols caused by the breakdown of phonological planning into phonetic output. Simplification is a type of phonetic errors found in Broca's aphasia including distortion, prolongation and voicing (Gandour, 1998).

This study tries to find out the forms of sound impairment, types of errors and phonological encoding process produced by a patient with Broca's aphasia, named KW who suffered from CVA. From the medical record, the patient has diabetes causing him to suffer from stroke. There was lesion in the frontal inferior gyros and underwent hemiparesis on his right body part as well as non-fluent aphasia. After stroke, KW used any body language to communicate due to the difficulties of expressing ideas or responding simple orders. This phenomenon is very challenging to be further investigated from neurolinguistic side of view. Empirically, investigation in clinical phonology has been very few in Bali; however, aphasics who suffer from stroke are increasing in number.

Studies of neurolinguistics have claimed that lesion in left hemisphere especially in the area of Broca follows speech disorder called non-fluent or Broca's aphasia. Based on neuronal mechanism, this type of speech disorder is shown by incapability of the motor cortex controls nervous system of speech to manipulate either verbal or non-verbal concept into sound symbol system. This disorder involves sound simplification through the process of distortion, substitution, omission, and insertion (Gandour, 1998, Blumstein, 1994). For the solution of speech disorder, a lot of analysis and phonological therapy have been conducted through experimental, clinical, and theoretical approach, such as Robson, et.al. (1998), Muso et al. (1999), Hesketh, et al. (2000), Kendall et al., (2003), Sengkey, et al. (2014),Widjaja & Nuartha (2015), yet there have been only few studies conducted to describe the natural the phonological error form, types of sound errors, syllabic patterns and decreasing language modality of an aphasic.

The contribution of scientific findings on rehabilitation of language disorder by those researchers is entirely prominent for further analysis of neurolinguistics, especially in the field of

phonology, psycholinguistics, physiotherapy, and neurology. The study of error sound, either segmental or suprasegmental has been ever conducted using software speech analyzer or PRAAT, like Sastra (2016), Adam (2014), Marotta, Barbera, & Bongioanni (2008). This property can explain sound system phenomenon, especially phonation, frequency duration, and intonation produced by aphasics (Sastra, et al. 2014, Sudaryanto, 2014). Studies in phonetics and phonology on aphasia have been exposed by Buckingham & Chrisman (2008), Gordon & Ledoux (2008) and Gandour (1998). However, there must be further some case studies that investigate phonological error phenomenon that include distortion, substitution, insertion, and omission of a single subject with Broca's aphasia.

In line with the description above, any possibilities of decreasing language modality can be stimulated through word and picture namings, answering short questions, and reading passages. The detailed result can be significant for strategy or model in speech therapy. The language sound produced by KW can give readers any valuable information including errors of segmental forms, types of errors, features of syllabic patterns, and grade of sound severity. This study proposes three questions, (i) what are the segmental forms and types of sound errors produced by KW?, (ii) how severe are the language modality of KW?. In general, neurolinguistics is concerned with the relationship between language and brain (Bambini, 2012). Its final goal is the comprehension and explanation of the neural bases for language knowledge and use (Gandour, 1998). Neurolinguistics is by its nature an interdisciplinary enterprise and straddles the borders between linguistics and other disciplines that are connected to the study of the mind/brain (Bambini, 2012). From the perspective of the neurosciences, neurolinguistics focuses on how the brain behaves in language processes, both in healthy and pathological conditions; conversely, from a linguistic standpoint, neurolinguistics aims at clarifying how language structures can be instantiated in the brain, i.e. how patterns and rules exhibited in human languages are represented and grounded in the brain (Arifuddin, 2010, Kusumoputro, 1992., Gordon and Ledoux 2008). In addition, neurolinguistics has a fundamental clinical impact for assessment and treatment of patients suffering from aphasia and other language pathologies (Kemmerer, 2014). This language disorder involves language aspects; phonology, morphology, syntax, semantics and pragmatics (Adam 2014; Novick et al. 2010; Bastiaanse, R., & Zonneveld, V.R., 2004, Alexander, et.al, 1990). Phonological errors may be concerned with two major scopes, segmental and

suprasegmental. (Lieberman and Blumstein,1988) in which the former can be analyzed using Generative phonology proposed by Schane, (1992).

The theory claims that the smallest sound units are not known as phonemes but their distinctive features, i.e. sound produced by a Balinese aphasic, /papat/ 'four' mentioned /papas/ which is known as a non-word. The final consonant sound [t] is stop sound and [s] is fricative sound. The substitution results in non-word. This is caused by incapability to lift and stick the tongue tip on alveolar ridge and there is space for the air stream to leave the mouth resulting in a fricative sound (Lieberman and Blumstein, 1988., Ladefoged, 2003). The phonological process, according to Simanjuntak (1990), Schane, (1992) consists of three stages, lexical representation, phonological representation and phonetic representation.

Impairment in one of these parts results in errors in determining word meaning. Dell refers to retrieval process which involves three elements; semantics, words and phonemes. According to Dell, et.al (1997), lexical knowledge is summarized in nets of three layers, in semantic layer, word layer and phonological layer, each of which connects bidirectional through the activation of semantic features and phonological features with top-down, from semantic unit into word unit and phonemic unit and with bottom- up, from phonemic units to word unit and to the semantic unit.

2. **Research Method**

This single-case study was conducted to investigate the phonological deficit of a single Balinese participant with Broca's aphasia syndrome. The participant was KW who had suffered from a non-fluent aphasia after cerebral vascular accident (CVA) and there was lesion in anterior fissure rolandic of left brain hemisphere. He was 70 years of age with right hander and was a retired elementary school teacher. He participated in this study to produce utterances stimulated by different phonological tasks. The study applied quantitative-descriptive through a single-case investigation approach so that description of phonological errors of consonants and vowels, determination of sound severity and decreasing language modality can be further scientifically performed. KW's language disorder syndrome was confirmed by testing his language modality; fluent speech, repetition, naming words or pictures, reading and writing. The tests were in the form of four phonological tasks, namely word naming, picture naming, answering questions and

oral reading. Each task had 65 words or pictures that mainly represented consonants and vowels in different distributions. KW named words orally, identified and mentioned pictures, answered the questions and read a reading passage. The recorded data were then phonetically and phonemically described and classified to determine the sound severity, types of errors and phonological process. The sound errors were classified into four types of phonological deficits; distortion, substitution, insertion and omission. All alterations were analyzed to know the phonological process, such as mutation, assimilation, syllable structures and simplification and phonological rules using generative phonology. The severity applied Aphasia Severity Rating Scale of Boston test that ranged from scale of 1 to 5 with specific criteria. All total correct and incorrect sounds were calculated to find out the percentage of the deficit. After severity level was found, the number of types of errors were definitely measured to know what errors were more and less dominant.

3. Result and Discussion

Verbal data were in the form of speeches spoken by KW in four different phonological tasks. Broca's aphasia syndrome showed decreasing language modality, known as spontaneous speech, auditive comprehension, repetition, naming and writing (Benson, 1979). Evaluation was conducted by asking them to name listed words, to name pictures, to answer some short questions and to read a short reading passage each of which consisted of 65 words. The data spoken by KW in each phonological task is presented below.

3.1 Word naming

KW was shown 65 words. The speech was then recorded, tabulated, phonetically and phonemically transcribed and then classified into 4 different phonological errors, namely phonemic distortion, substitution, insertion and omission. 10 of 65 words named by KW are as follows.

Table 1 Form and Types of Phonological Errors in Words Naming

No	Targeted words	meaning	Spoken sounds	Types of sound errors
1	Ipah /ipah/	'sister in law'	/aleh/	distortion
2	Uled /uləd/	'caterpillar'	/oles//olef/	substitution
3	Aluh /alUh/	'easy'	/lul/ /alluh/	insertion
4	Toke /tokè/	'gecko'	/tuke/	substitution

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5	Keket /kèket/	'thorny plants'	/keiket/	insertion
6	Oleg /oleg/	'A Balinese dance'	/olleʔ/	substitution
7	Roko /roko/	'cigarette'	/lokoh/	insertion
8	Katos /katos/	'hard'	/hastuh/	substitution
9	Kapak /kapak/	'an axe'	/hapah/	substitution
10	Papat /papat/	'four'	/papas/	Substitution

3.2 Pictures naming

65 pictures representing the consonants and vowels in different distribution were shown to be named by KW. All errors were counted to determine the level of severity. The phonological errors are listed below.

Table 2 Forms and Types of Phonological Errors in Pictures Naming

No	Pictures shown	Targeted sounds/meaning	Spoken sound	Types of sound errors
1		/kapak/ 'axe'	/lapak/	substitution
2		/tujuh/ 'seven'	/subuh/	substitution
3		/baju/ 'shirt'	/badu/	substitution
4		/bikul/ 'rat'	/pikul/	substitution
5		/tabuan/ 'wasp'	/na naŋkuan/	distortion
6		/tomat/ 'tomato'	/opat/	omission
7		/sate/ 'satay'	/sake/	substitution
8		/kipas/ 'fan'	/ipas/	omission
9		/dədarə/'pigeon'	/dədalə/	substitution
10		/toke/ 'gecko'	/meldə/	distortion

3.3 Answering short questions

There were 65 short questions to be answered by KW. The questions were about his identity, his relatively closed environment, his past experience and problem-solving questions. This was conducted to know his language modality. The phonological errors are listed below.

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Table 3 Forms and Types of Phonological Errors in Answering Short Questions

No	Short questions	KW's answers	Targeted answers
1	*Nyen adane Pak?* 'what's your name, Sir?'	/I Kətut widiyə/	I Ketut Widya
2	*Kuda umure?* 'What's your age?'	/ah eh uh/	Tujuh Puluh 'seventy'
3	*Bulan ape pak lekad?* 'In what month were you born?"	/dua bəlas/	Desember 'December'
4	*Dija pak ngoyong?* 'Where do you live?'	/kəlagə//buleleŋ/	Buleleng
5	*Apa gegaene pidan?* 'What did you do for a living?'	/kulu/	Guru 'teacher'
6	*Bapak ngajin murid kelas kuda?* 'What grade did you teach?'	/celem un em enem/	Kelas enem 'grade sixth'
7	*Mata pelajaran ape ajin pak e?* 'What lesson did you teach?'	/matih, ipapa, ipeneh	Matik, IPA, IPS Math, natural science
8	*Dugas pidan pak pensiun?* 'When did you retire"	/empat dua riju, dua duo ridu delapan/	2008
9	*Nyen adan kurenan bapake?* 'What is your wife's name?'	/kətut ladiye/	Ketut Ladri
10	*Dija kurenan pak megae?* 'What does she do?'	/kuud lekon penadi/	Petani 'a farmer'

3.4 Oral reading

The speech output of aphasia patients can be stimulated by oral reading task. It is considered prominent to allow him to produce linked sounds, not an individual sound, because language sounds are functional (Ladefoged, 2003). It is conducted to know the sound errors and any intonation, rhythm and word stress that is related to the extent of normal function of right hemisphere. Here is the ability of KW in reading a Balinese folklore.

I Siap Selem

Ada katuturan satua I Siap Selem ngelah pianak pepitu. Ane paling cerika tusing ngelah bulu madan I Doglagan. Sawai-wai I Siap Selem ngalih amah nganti ke dauh pangkunge. Sedek dina anu ritatkala I Siap Selem teken panak-panakne ngalih amah dauh pangkunge, lantas langite megerudug nyihnayang lakar ujan. Tusing joh uli pangkunge ento, tepukina ade umah tongos maembon.

A Black Hen

Once upon a time, lived a black hen with her seven chicks in which the youngest did not have any feathers, called I Doglagan. Every day she took hers to the river bank, sometimes crossed the river to find foods. On a single day, when the Black hen and her chicks were enjoying the food, suddenly the sky was covered by the dark clouds about to rain hard. Is was nit far away from the valley, there was seen a house to have shelters.

KW: /se se lah eap eleb/

> /Sade...adə katuturan..cu.. pulia… pula… eyap ketem…ku…kolo…konan… elah… pelak ..pi.. panak papitu/. /Lande paling kelike,.. gege..ge ge ige ige.. ulih ngalek ngulih.. pe…pe …ulun kelah hulu madi madan iidog…. / Wis wai wai I siap penlem ngalih amah ladi ke lauh pangkung/. Dadi..ce.. ye ..pe..joh… ya.. aken.. akud.. ne …ladu ikaoh ritatkala..iyap..elem…kete..ketet…ketet..ehketet..uh..geliget..ganah..man...nag…ah…ngadih…ng alih amah..wo po do kulo o dah pangkunge/. /Lantas.. la… langite maduduk ilaka...laka dijah..ka..sugi doh…lalu…bloh..lejo…udoh…uri tabinge ndoh ngatu linah ngandah kondah kocong ngenah anggon membon/.

All data were then observed comprehensively both to find linguistic phenomenon and underlying pathology in his language area. The data were counted to determine percentages of correct, incorrect sound and sound severity. Based on the observation, language modality of the subject was decreasing due to a lot of errors in words naming, pictures naming, answering short question and reading. It was clear that KW tended to prolong the stress in the first vowel of the first syllable, as opposed to the Balinese words which are usually stressed in final syllable. To know KW's language modality, here is the summary of all results of phonological tasks.

Table 4. KW's Performance on the Set of Phonological Tasks

Phonological Task	Total correct (n=65)	% correct	Level of severity	Phonemic errors/ total errors	% errors = phonology
Word naming	21	0.32	severe	35/44	0.80
Picture naming	25	0.40	Mild	37/40	0.92
Answering question	19	0.29	severe	40/46	0.87
Oral reading	22	0.34	severe	38/43	0.89
Total	87	1.35	severe	150/173	3.48

Based on Aphasia Severity Rating Scale of Boston test, KW's speech performance was categorized severe. He could not perform fluent verbal expression, i.e. double repetition of first syllable. It was required some hard effort for listener to conclude, question and predict what he was trying to say. He showed limited information range and communication burden was on listener's side. He had difficulties in repeating words and articulating sounds (Kusumoputro, 1992). Rating showing correct phonemes and phonological errors produced by KW can be seen in the following graph.

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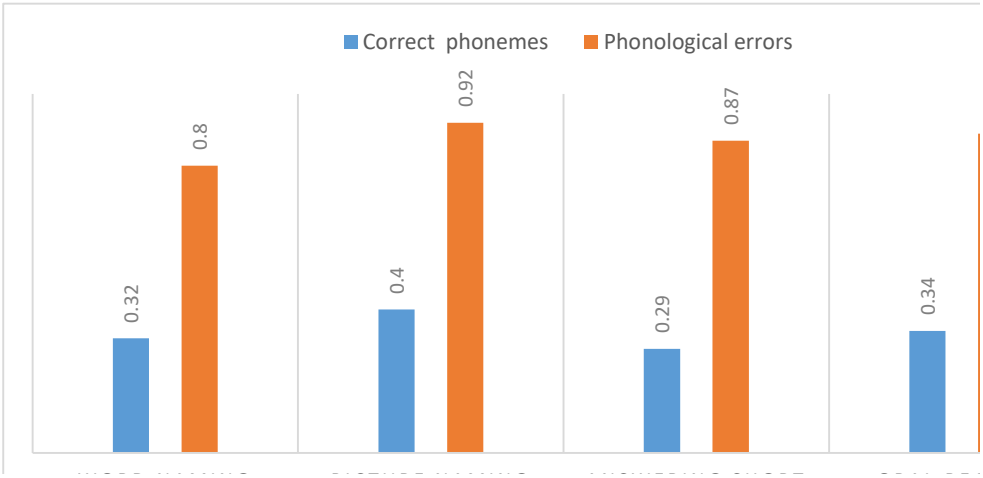

Figure 1: KW's Correct Phonemes and Phonological Errors

3.5 Forms and types of phonological errors

Phonological errors produced by KW covered two domains, phonetic errors and phonemic errors. Phonetic errors were related to inaccuracy of individual sound articulation, either place of articulation or manner of articulation. Individual sound means that it is not a functional sound in a combined segment, i.e. vocal onset time. They are usually caused by neuromuscular impairment; cranial nervous and muscles of speech production organs (Lieberman and Blumstein, 1988). The phonetic errors can be recognized from formant value and physiology of speech sounds. Meanwhile the later are related to neighboring sound rules, in which a sound segment in a word can undergo a phonological process due to the characteristic or distinctive features and position in identical or contrast environment (Schane, 1992). Of four different phonological tasks, there were 4 types of phonological errors, namely distortion, substitution, insertion and omission of consonants and vowels as shown in the following table.

Table 5. KW's Performance on the Set of Phonological Tasks

Phonological tasks	distortion	Substitution	Insertion	Omission
Word naming	7	31	4	2
Picture naming	4	28	6	2
Answering question	7	35	2	3
Oral reading	15	18	7	2
Total errors	35	112	19	9

3.5.1 Phonological errors in word naming

In word naming, the 65 listed words were named by KW. These words consist of one or more syllables showing consonants and vowels in different distribution, in initial, middle and final of words. Of those words, there were 44 phonological errors including 31 substitutions, 7 distortions, 4 insertions and 2 deleted segments. The sounds /p/, /r/, /s/ became an [l] for 3 cases in all distributions, the sounds /d/, /t/, /k/, /h/, and /ɲ/ turned into [s] for 8 cases in all distributions, the sound /g/ became [ʔ] and [d] for 3 cases in final syllables, the sounds /s/ and /k/ became [h] for 3 cases in initial and final, the sound /ɲ/ turned into [n] and [s] for 2 cases in initial and middle, the sound /y/ became [j] for 1 case in initial, the sound /y/ became [ɲ] for 2 cases in the middle, the sound /s/ became [k] for 2 cases in initial, the sound /g/ became [k] for 1 case, the sound /t/ became [b] for 1 case in final, the sound /p/ became [k] for 2 cases and the /u/ and /e/ became [o] for 2 cases in initial and final. In distortion, the sound /u/ became [a] for 3 cases, sound /p/ became [l] for 4 cases, insertion of sound [i] occurred for 2 cases, and the omission of sound /k/ occurred for 2 cases.

3.5.2 Phonological Errors in Picture Naming

Briefly in picture naming, KW made 40 phonological errors which consisted of 28 substitutions, 4 distortions, 6 insertions and 2 omissions. The sound [l] was substituted by [r] for 5 cases in all distributions. Sound [b] was substituted by [p] for 4 cases in all distributions, sound [j] was substituted by [b], [g] for 4 cases in final, sound [t], [l] were substituted by [s] for 2 cases in initial and final, sound [y], [j] were substituted with [d] for 3 cases in initial and in the middle, the sound [d] was substituted by [j] for 3 cases in initial, sound [y] was substituted by [ɲ] for 3 cases in the middle, sound [s] was substituted by [k] for 2 cases in initial, the sound [i] was substituted by [e] for 2 cases in final, the sound [t] was deleted for 3 cases in final, the sound [p] was deleted for 3 cases, insertion of [h] in final for 3 cases, and insertion of [i], [u] for 3 cases in final.

3.5.3 Phonological Errors in Answering Questions

In answering questions, KW understood the question quite clearly but mostly he could not implement them into correct sounds. He could answer 19 of 65 questions quite clearly with 46 phonological errors. The errors were 35 substitutions, 7 distortions, 2 insertions and 3 omissions.

Sound /g/ became [k] for 10 cases in all distributions, sound /b/ became [d] for 5 cases in all distributions, sound [t] became /n/ for 8 cases in the middle, sound [k] became /n/ for 2 cases in initial and in final, sound [y] became /d/ for 2 cases in initial and in the middle, sound [d] became /n/ for 2 cases in initial, sound [s] became /h/ for 2 cases and vocal sounds [i] [e] became /I/ for 3 cases in initial and final. Distortions of sounds [k], [l], [s] occurred for 7 cases in any distributions, omission and insertion of sound [k] took place in initial and final for 3 cases.

3.5.6 Phonological Errors in Oral Reading

In oral reading, KW found it very difficult to encode the written symbols into sound system due to lesion in language expression area. He repeated first syllables or added other phonemes. He made 43 errors with 18 substitutions, 15 distortions, 7 insertions, and 2 omissions. The sound [d] was substituted with [l] for 5 cases in all distributions and /l/ became [r] for 5 cases in all distributions. Sound /b/ became [h] for 4 cases in final, sound [g] was substituted by [k] for 2 cases in initial and in final and last was substitution [t] with [d] for 2 cases in final. Distortion of [r], [m], [n], and [s] was in all distributions for 15 cases, the insertion of sounds [h], [k] for 7 cases in final and omission of sound [y] for 2 cases in the middle.

Sound substitutions mostly appeared instead of the other types of errors. Based on generative phonology, sound segments may alter into other segments either in homorganic or same features or distinctive ones (Schane, 1992). The mental process of sound judgement from underlying representation through phonological rules into phonetic representation. We argue that different speech stimulation could trigger sound inconsistency for the same word. Voiceless velar stop sound [k] that starts the word ‘kapak’ meaning an axe in the word naming task was substituted by a lateral sound [l] leading to a nonword [lapak]. However, the velar consonant sound [k] both in initial and final was substituted by glottal fricative [h] as [hapah] in the picture naming task. Sound distortion in aphasia refers to errors caused by phoneme substitution, insertion and omission of two or more segment leading to non-words. Distortion was also indicated to occur when second syllable was put forward before the target sounds were completed and repetition of second syllable. The summary of the distribution of phonological errors can be tabulated below.

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Table 6. Distribution of Phonological Errors

Task	Distortion	Substitution	Insertion	Omission
Word naming	7	31	4	2
Picture naming	4	28	6	2
Spontaneous answer	7	35	2	3
Oral reading	15	18	7	2
Total Jumlah kesalahan	35	112	19	9

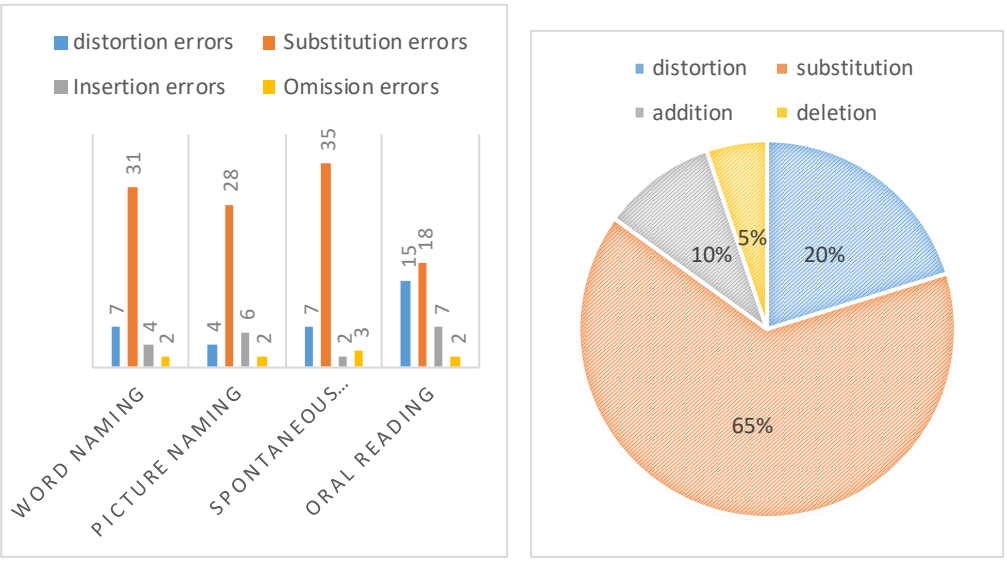

Figure 2. The degree of Phonological Errors of KW

3.5.7 Lexical Access

The high front vowel [i] was altered into a low middle vowel [a] and in the second syllable [a] was substituted by [e]. These errors commonly occurred in aphasia speech production when semantic layer moved to lemma selection and finally to phonological encoding which did not work properly due to breakdown in phonetic implementation (Dell, et, al 1997). Neuronal side of views, the lesion in anterior fissure Rolandic area could bring some motoric failure in sending the messages in Broca to motoric nervous that controls the speech organs to implement the phonetic representation (Kemmerer, 2014). Very interesting evidence was found in KW's speech production. Language impairment could affect the duration of coding the mental concept for the last syllable in mind had not been completed yet and the time for judging the phonological

encoding into phonetic implementation had earlier started, i.e. /batu/ 'stone' becoming [tuh,,batuh]. This kind of phonological rule is well known as mutation (Schane, 1992).

Alteration of syllable structures from a standard system was caused by failure of phonological encoding process to phonetic implementation. Lexical knowledge of KW was packed in three layers of networks known as semantic layer, word layer and phonological layer each of which is connected bidirectionally from semantic feature to phonological feature. Each step is activated in top down, that is from semantic unit to word unit and to phonemic unit or button up, from phonemes to words and to semantic (Dell, 1997., Schwartz, et. al, 2006). Word naming began from encoding the orthography, to word concept and to phonetic representation. The phonological errors spoken by KW were related with breakdown of phonetical implementation resulting in non-words. Based on the evidences, it can be argued that phonetic output failure was in between of segmental formulation and phonetic judgment either due to existing linguistic experience or physiological system.

The patterns of errors produced by KW were associated with word selection or lemma and phonological encoding. In Balinese, it is hard to find words that share the same concepts, the same sounds and same orthography. The Balinese word 'guak' meaning a crow does not have comparing identical sounds, so it does not share another concept. When 'guak' was activated, the linguistic knowledge of other languages, such as Balinese and Indonesian would also be activated, i.e. *'kedis*' and '*burung*' meaning bird. The phonological encoding lasted in phonetic implementation of non-words. This occurred due to errors in phonemic selection; /kuak/, /guah/, /gədis/, and /bulung/. Phonologically, the implementation of segments in aphasia may change either into identical features or distinctive ones. The voiceless sound [k] was altered by the voiced sound [g] or the voiced sound [g] was altered by the voiceless [k]. Instead of voicing, segment alteration may be determined by the place of articulation distinctive features; trill sound [r] in the Indonesian word *burung* 'bird' becomes lateral sound [l] /buluŋ/. These errors were produced by KW because there was not any appropriate coordination between underlying form and phonetic representation due to the lesion in language expression in triggering the cranial nervous of speech organs (Sidharta & Dewanto, 1986., Novick, et al 2010., Buckingham & Chrisman, 2008).

4. **Novelties**

The novelties in this article are (1) severity measurement of language modalities in Broca's aphasia. The data are categorized as a novelty because they were obtained from oral data that had never been transcibed into writing. (2) The theory used is neurolinguistics combined with the theory of Generative phonology proposed by Schane. Generative phonology describes how the intended sound is represented as the phonetic realization; meanwhile neurolinguistics describes the neuronal base of phonological errors. (3) The method used is qualitative with phenomenology research paradigm. The data of this study are quantitative which certainly differ from the other subjects based on the medical condition of each patient.

5. Conclusion

The research data was along with empirical evidences of previous related studies about decreasing language modality produced by the patients with Broca's aphasia. Based on phonological tasks, such as word naming, picture naming, answering questions and oral reading, the main results of this study showed that there were 4 types of phonological errors, namely sound distortion, substitution, insertion and omission in which the second had high percentage. KW's language modality was considered severe based on Aphasia Severity Rating Scale of Boston test. In phonological encoding, the segments in aphasia may be paired with other segments either with shared semantic or shared phonology. We argue that different stimulation of speech could trigger sound inconsistency. The evidence showed that there was some inconsistent sound alteration from one task to another task. The phonological errors occurred when the second syllable was put forward before the target sounds were completed because there was not any appropriate coordination between underlying form and phonetic representation due to the lesion in language expression area.

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I Ketut Wardana, a lecturer at Mahasaraswati Denpasar University, was born in Kapal, Mengwi, Badung-Bali, 30th of September1971. He completed the bachelor program (S1) on English study program of faculty of Teacher Training and Education of Mahasaraswati Denpasar University in September 2008. He graduated from magister program (S2) of Postgraduate Program of Udayana University on September 2011. In 2016, he joined to doctoral program (S3) of Linguistics Department in Udayana University, and the title of his dissertation is “Phonological disorder of speech output of patients with Broca’s aphasia: An Analysis of Neurolinguistics”. He has taught several subjects of linguistics since he has been a lecturer in Mahasaraswati Denpasar University. There are several researches that have been done, like *Phonological Errors on Impaired Language Modality Produced by Individuals with Broca’s aphasia, and Sonority Sequencing Principle in Phonological Errors of Patients with Broca’s Aphasia*