

An Optimality-Theory Analysis of Lexical Disorders in the Speech of Iraqi Aphasic Patients: A Case Study

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Abstract:

This study provides an investigation of lexical disorders noticed in the speech of Basri-Iraqi aphasics, via Prince and Smolensky's 1993 constraint-oriented approach of Optimality theory, OT for short. The work aims to describe and analyze the lexical processes found in the produced verbal output of the patients. The data is collected qualitatively by conducting interviews with three Basri aphasic participants from different districts of Basra, using an elicitation form. The results indicate that the language performance of aphasics is lexically impaired. The findings also confirm the applicability of OT to the data. Added to that, lexical impairments manifest themselves in the impairment of the phonological output lexicon of the lexical system. The work recommends creating a database of aphasics and their whereabouts so as to pave the way to other researchers who might be interested in the subject area of the study. This study might further be followed by studies that provide speech therapy and intervention strategies that would help aphasics regain their language.

Keywords: aphasia, lexical, disorders, Optimality theory.

تحليل تفاضلي لغوي للاعتلالات المفرداتية في كلام العراقيين المصابين بالحبسة اللغوية: دراسة حالة

الباحثة

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المخلص:-

تبحث هذه الدراسة في تطبيق النظرية التفاضلية اللغوية على الاعتلالات التي تم ملاحظتها بمفردات عدد من المشاركين المصابين بالحبسة اللغوية. ترنو هذه الدراسة الى وصف وتحليل الاعتلالات الظاهرة بنماذج المفردات المنتقاة من العينة الكلية. تم تجميع البيانات نوعياً عن طريق اجراء مقابلات مع المرضى باستخدام فحص تشخيصي مع صور تحفيزية استخدمت للاستنتاج. اظهرت النتائج ان كلام مرضى الحبسة اللغوية معتل مفرداتياً. كذلك اكدت النتائج على امكانية تطبيق النظرية التفاضلية اللغوية باعتبارها قدمت تحليلاً ادق وواضح للاعتلالات. علاوة على ذلك، اظهرت النتائج ان الاعتلال الفونولوجي في النظام القواعدي هو المسبب للاعتلالات المفرداتية في هذه العينة. توصي هذه الدراسة بإعداد قاعدة بيانات تضم معلومات مرضى الحبسة اللغوية بانواعها المختلفة وذلك لتسهيل الطريق للباحثين المهتمين بالتعمق في هذا المجال. يمكن اعتماد هذه الدراسة كبدائية ممهدة لدراسات لاحقة تقدم مقترحات وعلاج تأهيلي ولغوي كي يستعيد المرضى لغتهم.

1. Introduction

Language pathologies have attracted the attention of many researchers around the globe, in linguistics, psychology and neurology, besides others. Many valuable studies have been submitted concerning this area of inquiry, the findings of which helped to understand these phenomena, language pathologies, by uncovering the ambiguities surrounding them.

The term language disorder is ascribed to a deviated speech pattern that results from various causes. Language disorders are grouped in two groups, taking into consideration the main cause of the erroneous speech, developmental and acquired. In the study at hand, the core interest is acquired language disorders, Aphasia. In aphasia, language disorders are of many types; they can be Phonological, lexical, syntactic and semantic. The interest lies within the boundaries of lexical disorders.

Impairments at the level of lexis emerge along each single case of language disorder, and as a disorder in their own right. This disorder is manifested in the production and comprehension of words. The impairment affects the structure of the word. Conceived of as a major language disorder, lexical disorders can be described as deficits in the language processing system. The processing system of language is the tool employed by the speaker or listener to manifest their expressions and communicate with others using language, verbally or written (Libben, 2008: 147). The processing system involves orthographic, semantic, syntactic, morphological and phonological information. According to Rapp and Caramazza (1998), lexical disorders indicate the impairment of one or more

of the lexical components participating in the processing of words.

Disorders of lexis are said to be of two main types, agrammatism and paragrammatism. As generally conceived, agrammatism refers to a specific type of language disorders in which the speech produced by aphasics tend to be characterized by the omission of function words, content words are spared. The speech rate is slow and the articulation of sounds is impaired to some extent which causes lexical delay. These forms of lexical disorders are in respects to English language. This disorder is not a uniform systematic disorder; it differs according to the used language. Paragrammatism is related to the disorder in lexical semantics, with the impaired ability to retrieve the target words from the lexicon that leads to semantic paraphasias. Provided with the abovementioned information of lexical disorders, they can be investigated by examining problems of lexical access or problems of lexical selection elicited from the speech of aphasics, whereby the former is related to Broca's aphasia and the latter is associated with Wernicke's aphasia.

The purpose of the study is to explore the syndrome entitled aphasia by presenting its history, definitions, and types. The second objective is to explain what is meant by language disorders, specifically disorders of lexis. The third and last aim is to examine the possibility of applying the constraint-based approach of optimality theory to lexical disorders in the speech of aphasic participants via the analysis of the data.

The current study is an attempt to explore the following hypotheses:

- The speech of aphasics is mainly characterized by lexical disorders
- The lexical disorders of aphasics can be better analyzed and described using OT generative model.
- At the word level, lexical disorders seem to manifest themselves only in regards to content words, sparing function words.

2. Theoretical Background

2.1 An Overview of the Lexical System

It is theorized that the lexical system is composed of independent yet connected elements. There is an independent input and output as well as independent phonological and orthographic input and output (Caramazza and Hillis, 1990: 95). The architecture of the lexical system is exhibited in figure (1).

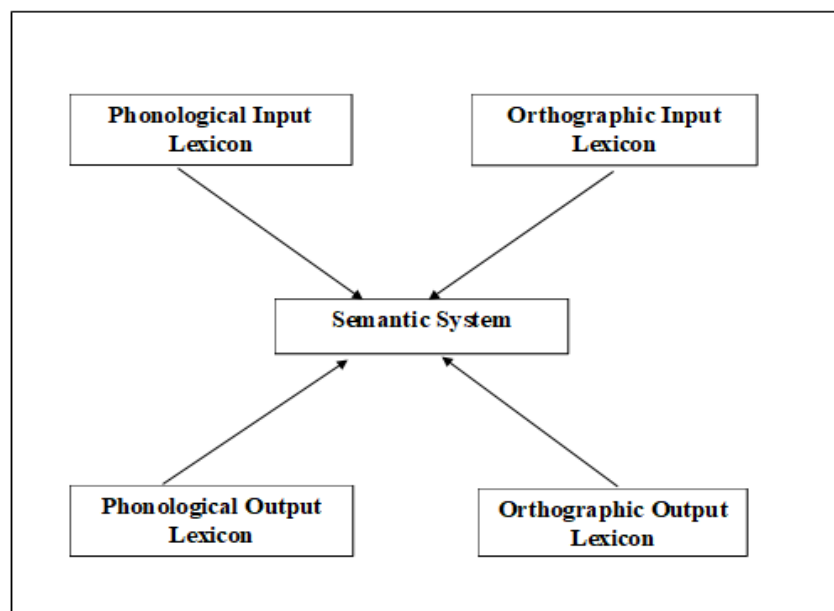


Figure (1). The Lexical System

As conceived, the information of each lexical form is processed independently, that is to say, the production and recognition processes are independent from each other as well as the processing of the phonological and orthographic forms. In addition, these independent constituents of the lexical system are linked to each other through the semantic system. This semantic system involves semantic information of words, making it a store of semantic information for every single word to be represented in the output lexical system, be it phonological or orthographic (Rapp and Caramazza, 1998: 191).

Another issue to be noted in the architecture of the lexical system is that lexical semantics is independent from the lexical system processing of the input and output. Researchers found that some brain-damaged patients suffer from dyslexia, the inability to read orthographic forms in spite of the knowledge of the semantic information which can be gathered from the phonological input form, a syndrome that shows the intact phonological input and impaired orthographic output. Added to that, some patients have their lexical input and output intact but suffer from an impaired semantic processing system. This gives the indication that components of the lexical system can be impaired separately (Shelton and Caramazza, 1999: 6).

Furthermore, it is assumed that the knowledge of the lexical system and its workings can facilitate describing and explaining lexical disorders. To put it differently, a damage to any assumed component of the lexical system can shed light on the nature of that lexical deficit, thereby providing a better angle to the investigation of the damaged component (Caramazza and Hillis, 1990: 96).

2.3 Definition of Optimality Theory

Simply speaking, Optimality theory, OT for short, was introduced within the framework of phonology by Prince and Smolensky, in 1991, and later was developed by McCarthy and Prince in 1993. OT marked a radical change of thought and direction of scientific research away from rule-oriented theories. OT came into being as a constraint-oriented theory, which postulates that there are universal constraints that govern the grammar of languages. Given so, OT is regarded as a model that describes how grammar is constructed. In other words, UG is composed of universal constraints out of which particular grammars are constituted (McCarthy, 2007: 260).

This model has been applied in phonology, syntax, semantics and morphology. Given the rich literature on morphology, OT is going to be used as a framework to analyze lexical disorders in the speech of aphasic patients. The fundamentals and principles of optimality theory are going to be explained in this section respectively.

2.4 Related Studies

Various studies investigated different aspects of aphasia and its related syndromes.

Kim and Thompson (2000) presented a study that studied the process of verb retrieval in regards to the verb argument structure in language performance, production and comprehension. The tasks used to elicit the requested data from the participants involved grammaticality judgment test, comprehension conditions, naming conditions, and categorization conditions. According to the results, verb and

noun comprehension was normal as well as naming. On the other hand, concerning verb naming, it was disordered. The accuracy of verb naming was dependent on the verb argument structure. In other words, the one argument verb is better than the two arguments verb, and the two arguments verb is better than the three arguments verbs in respect to impairment. In addition, it was found out that there was no link between production difficulties and comprehension difficulties for nouns and verbs. This finding sheds light on the dissociation between nouns and verbs. What is more important is that verb production was highly affected by the verb argument structure. This influence can be observed in both levels of production, at word level and at sentence level.

Luzzatti, Raggi, Zonca, Pistarini, Contardi and Pinna (2002) conducted a research, which mainly focused on displaying the dissociation between nouns and verbs in language impairment. Given this, the study aimed at examining the degree of this dissociation between nouns and verbs in language impairment, shedding light on whether there is a link between the rate of this dissociation and different types of aphasia. In addition, it also aimed to investigate the effect of verb type over the nature and rate of the noun-verb dissociation, as well as to provide an explanation of the dissociation and the language processing mechanisms that take place during the process. The other objective was to explore whether verb superiority and noun superiority are linked to specific types of aphasia. A confrontation naming task was performed to elicit data. The frequency and imageability variables were taken into

consideration during the performance of the task in addition to the age of acquisition and word familiarity. The task result exhibited a noun-verb dissociation in naming. There is also a selective impairment of verbs depending on the verb type and it is more frequent than that of nouns. with respect to the relation between the rate of the dissociation and various types of aphasia, it is found that noun superiority is more frequent in fluent aphasia, namely Wernicke's aphasia while verb superiority is linked to anomia.

Furthermore, Kim and Thompson (2004) conducted a study that aimed at investigating the impairment in the production of verbs in respect to the speech of Alzheimer patients and agrammatic aphasia patients, taking into consideration the syntactic and semantic features of verbs. The researchers performed several speech elicitation tasks, including sentence completion for nouns and verbs alike, narrative tasks in addition to verb and noun comprehension tests. Apparently and according to the results, both of Alzheimer and agrammatic patients exhibit an impaired linguistic behaviour in respect to verb production. It was found that the verb argument structure or the syntactic features of verbs cause a great difficulty for agrammatic patients. On the contrary, these syntactic features have no role to play in verb deficits produced by Alzheimer disease patients. However, the semantic features of verbs exhibit a great effect over Alzheimer patients while these same features exercise no effect over agrammatic aphasics. Given the abovementioned information, it is made clear that the encountered verb deficits were different in Alzheimer and

Agrammatism. This is attributed to the fact that verb impairments in agrammatism were affected by lexical-syntactic information of verbs, while it is the lexical-semantics that causes verb disorders in Alzheimer disease. Regarding nouns, they are less impaired than verbs in language production and comprehension as well.

Howard and Gatehouse (2006) proposed a study that tackled the impairment of word retrieval in aphasic patients. The research postulated that the deficit of the word retrieval process is a result of many causes. Given so, the main aim of the study was to investigate these causes in an attempt to provide an inclusive view of the word-retrieval disorder. These causes included the nature of errors in the process of naming; language performance in production and comprehension; the variables that affect the accuracy of naming in addition to the impact of correct and incorrect signalling. The methodology used to elicit data from the participants included using several experiments. The first experiment used involved picture naming, which focuses on the impact of certain variables over the process of naming pictures, specifically the accuracy of the test. The variables were frequency, imageability, and target word length. The second experiment investigated the role played that correct and incorrect cueing in the process of word retrieval. The third experiment shed light on picture comprehension abilities in spoken and written forms. The fourth experiment examined the participants' capacities needed to process the orthographic information in order to produce phonemic signals used in naming. Based on the tests results, the word retrieval

impairment falls into different levels due to semantic causes. The target word imageability and familiarity have an evident effect on the accuracy of the naming process. With reference to cueing, the correct cueing helps in word retrieval while the incorrect signalling leads to semantic errors. The comprehension test reveals poor performance of the participants.

The general objective is to provide an inclusive analysis of certain aspects of language disorders aphasic patients suffer from. This comprehensive analysis provides the opportunity for speech pathologists to propose therapeutic treatment. The present study attempts to describe and analyze the lexical disorders found in the speech of Iraqi aphasic patients, using the optimality model of language, OT.

3. Methodology

3.1 Research Ethics, Recruitment, Consent and Demographics

The committee of Recruitment and Human Development in the Ministry of Health, Republic of Iraq approved the present study, which focuses on describing, investigating and analyzing the lexical disorders found in the elicited speech of Iraqi aphasic patients. Participants are recruited through the personal contact with their caregivers during their residence in hospitals of Basra, AlJamhuri, Alta'leemi and ALfaihaa hospitals, in addition to the private clinic of the neurophysician, Dr. Mohammed Sami. Also, patients are recruited through the records of the hospitals, from which their personal information were taken. Verbal and informed consents were taken from the

subjects prior to their participation in the study. Demographic information are available in table (1).

Table (1) Demographic and Diagnostic Information for the Participants

Subject	Gender	Age	Education (years)	Handedness	Hemiplegia	Hearing problems	Vision problems
P1	M	53	6	Right	Right	weakness	Right
P2	M	55	5	Right	No	Weakness	Both of them
P3	M	65	5	Right	No	No	No

3.2 Patients Selection

There are various criteria followed to select patients, demographic; neurolinguistic; neurological; and neuropsychological (Menn and Obler, 1990: 14-15). The demographic information requires patients to be Iraqis, whether monolingual or bilingual. The main point is that they used Iraqi Arabic for most of their lives. The requested age is to be from 18 to 65 at the time of testing. Speakers are ought to be right-handers.

The neurolinguistic criterion is very much dependent on the clinical diagnosis of patients as having agrammatism. The neurological criterion indicates the necessity of having a left-side brain impairment due to a cerebrovascular accident, henceforth CVA, which is preferably to be located in the anterior cortical area of the brain.

Finally, the neuropsychological criterion postulates the importance of having patients who are able to concentrate, be cooperative, and who can undergo the test with no obstacles.

3.3 Elicitation Forms

The evaluation of the language performance of participants with aphasia is administered by using standardized and non-standardized assessment tests. The diagnostic tests are divided into two steps. The first step is the language test and the second step is the cognition test.

Several examination tests were consulted during the preparation of the elicitation form pertaining to language, (the BDAE, (1983), by Goodglass and Kaplan; the KAT, (2007), by Marshall and Wright; and the QAB, (2018), by Wilson, Eriksson, and Lucanie.) The rationale for choosing the BDAE as the principal guide for the test was due to the fact that this respective test provides a more inclusive examination of aphasia syndromes based on the type of syndrome targeted. The form presents an overview of the properties of the patients in all language areas. Administration time ranged from 50 minutes to 60 minutes.

The elicitation form is composed of nine tasks: picture description; yes/no questions; complete the following; naming by pointing; picture naming; repetition and make the following plural; and responsive naming. The preparation of the test was conducted under the supervision of the assist. Prof. Dr. Negris ALMaliki.

4. Analysis and Discussion


The lexical errors extracted from the data involve phonemic substitution, deletion, addition, metathesis, consonant harmony, and multi-processes occurring together in lexical items.

Being the most salient process in the produced data with a 63% percentage, the process of substitution is elected to be treated first with the OT perspective.

4.1 Consonantal Substitution

As mentioned above, a representative sample is chosen to be examined by the OT model. Consonantal substitution occurred 169 times in the elicited data, occupying a percentage of 96.6%.


Tableau (1): The Substitution of the Voiced Bilabial Plosive /b/ into the Voiced Denti-alveolar /d/ in the Optimal Word /mandæ/ from the Input /manbæ/ "source"

/manbæ/	Labial	Denti-alveolar	IDENT[place]
(a)manbæ	*!		
 (b)mandæ		*	*

Labial>>Denti-alveolar>>IDENT[place]

The normal output candidate (a) is out of the competition for violating the highest ranked constraint. The optimal candidate (b) violates the lower ranked constraint, **IDENT[place]** by producing the segment /d/ instead of /b/ which is not identical to the latter in place of articulation, and this output form is marked by the trait [+denti-alveolar].

Tableau (2): The Substitution of the Voiced Bilabial Plosive /b/ into the Voiced Pharyngeal Fricative /ɛ/ in the Output Sentence / lah tiɛdi ŋliɛba baɛad fway/ from the Input Sentence / rah tibdi ŋliɛba baɛad fway/ "the game will start shortly."

/tibdi/	Labial	Pharyngeal	IDENT[place]	IDENT[manner]
(a)tibdi	*!			
 (b)tiɛdi		*	*	*


Labial>>Pharyngeal>>IDENT[place]>>IDENT[manner]

In this tableau, candidate (a) is removed from the evaluation process as it contains the highest constraint, henceforth, Candidate (b) is the optimal one as it comes in conflict with the lowest-ranked faithfulness constraints mentioned above. This winning candidate is tagged by the characteristics [+pharyngeal] [+fricative], which indicate a glide from labial to pharyngeal and from plosive to fricative.

4. 2 The Treatment of Vocalic Substitution Via the Optimality Model

The process of vocalic substitution is not pervasive in comparison to the process of consonantal substitution, whereby it occupies only 3.4% out of the total amount, which is 62.9%.


Tableau (3): The Substitution of the short Close-mid Front Vowel /i/ into the Short Open-mid Central Vowel /a/ in the Output Form /raziq/ from the Input Word /riziq/ "sustenance".

/riziq/	Front	Central	Lip-position	Tongue-position
(a)riziq	*!			
 (b)raziq		*	*	*

Front>>Central>> Lip-position>> Tongue-position

In this tableau, the short close-mid front vowel /i/ is replaced by the short open-mid central vowel /a/. This indicates a change in the tongue position which leads to a change in the lip spreading from spreading to neutral. Candidate (b) is the surviving output while the typical candidate (a) is out of the competition. The surface output is [+central] [+neutral].

Tableau (4): The Substitution of the Short Close-mid Front Lip Position Vowel /i/ into the Long Close Back Rounded Vowel /u:/ in the Optimal Candidate /mawqu:ε/ from the Input Form /mawqiε/ "location".

/mawqiε/	Front	Back	IDENT[vowel-length]	Lip-position	Tongue-position
(a)mawqiε	*!				
 (b)mawqu:ε		*	*	*	*


Front>>Back>> IDENT [vowel-length] >>Lip-position>> Tongue-position

The well-formed output candidate (a) is pushed away as it meets the highest constraint. On the other hand, candidate (b) substitutes the segment /i/ into /u:/causing a change in the tongue position, and lip position from spreading to rounded in addition to a swift in the length of the respective vowel from short to long, which is represented by the **IDENT[vowel-length]** constraint. Candidate (b) is chosen as the winning output.

4.3 The Treatment of Deletion via the Optimality Model

With a 14.7%, the process of deletion is the second most salient process found in the produced speech. The below tableaux represent the aforesaid process in various contexts. Only representative samples are mentioned.


Tableau (5): The Deletion of the Voiceless Velar Plosive /k/ in the output /yinis/ from the visual stimulus / yiknis/ "he is sweeping".

/yiknis/	Velar	No Velar	MAX
(a) yiknis	*!		
 (b)yiknis		*	*

Velar>>No Velar>>MAX

In this tableau, the segment /k/ is eliminated from the output form /yinis/ during the mapping process, resulting in a violation of the constraint MAX. Though there is a disturbance of the abovementioned constraint, it is considered a low-level kind of violation, indicating that candidate (b) is the winning output. On the other side, the well-formed output is out of the evaluation mechanism, as a result of involving the highest-ranked constraint /k/.

Tableau (6): The Deletion of the Glottal Stop /ʔ/ in the Optimal Word /naha:r/ from the Input /ʔanha:r/ "rivers".

/ʔanha:r/	Glottal	No Glottal	MAX
(a)ʔanha:r	*!		
 (b)naha:r		*	*

Glottal>>NO Glottal>>MAX

The process of phonemic deletion is accounted for by the faithfulness constraint MAX. In the example at hand, the glottal stop /ʔ/ is omitted from the output. Candidate (b) surfaces as the winning candidate, while candidate (a) is excluded from the competition. The surface output is characterized by [-constricted glottis].

4.4 The treatment of Phonemic Addition via the Optimality Theory

The process of addition is the least occurring amongst the other linguistic processes, with a percentage of 2.5%.

Tableau (7): The Addition of the Voiceless Velar Plosive /k/ to the Output Form /εakaskari/ from the Input /εaskari/ "soldier".

/εaskari/	No Velar	Velar	DEP
(a)εaskari	*!		
☞(b) εakaskari		*	*

No Velar>>Velar>>DEP

In this tableau, the voiceless velar plosive /k/ is inserted in the word-medial position in the winning candidate (b), violating the **DEP** constraint. On the other side, the normal output (a) is excluded as it misses the segment /k/.

Tableau (8): The Addition of the Voiced Alveolar Lateral /l/ in the Plural Output /ʔslama:ʔ/ from the single Input /ʔsim+pl/ "name".

ʔsim+pl/	No Lateral	No central vowel	Lateral	Central vowel	DEP
(a)ʔasma:ʔ	*!	*			
☞(b)ʔaslama:ʔ			*	*	*

No Lateral>>No central vowel>>Lateral>> Central vowel>>DEP


The **DEP** faithfulness constraint is disturbed by inserting the lateral /l/ along with its vocalic segment /a/ in the output string (b). It is important to bear in mind that the plural form is

correctly stated. The typical output (a) is out of the competition. The segment /l/ with its vocalic pattern are added to the word, which leads to the insertion of an additional syllable. This addition indicates the alteration in the syllable structure of the word from two syllables to three syllables.

4.5 The treatment of Metathesis via the Optimality Theory

Metathesis as a lexical process occurs about 7 times in the data produced by the subjects. It occupies a percentage of 4.3% out of the total amount of lexical deficits found in the elicited speech.

Tableau (9): The Metathesis of the Voiced Denti-alveolar Nasal /n/ with the Voiced Bilabial Plosive /b/ in the Optimal Output Form /dʒabu:n/ from the Input Form /dʒanu:b/ "south".

/dʒanu:b/	(Nasal... Labial)	(Labial...Nasal)	LINEARITY-IO
(a)dʒanu:b	*!*		
 (b)dʒabu:n		**	**

(Nasal...Labial>>Labial...Nasal>> Linearity-IO

In this tableau, the regular standard form (a) is ruled out of the competition as it meets the highest ranked constraint, while the candidate (b) violates the lowest ranked constraint LINEARITY, by not preserving the linear order of the segments while mapping them from the input to the output. In this case, candidate (b) is deemed the winning output.

Tableau (10): The Metathesis of the Voiced Alveolar Flap /r/ with the Voiceless Uvular plosive /q/ in the Winning Output /raqam/ from the Input /ramaq/ "breath".

/ramaq/	(Nasal...Uvular)	(Uvular...Nasal)	LINEARITY-IO
(a)ramaq	*!*		
☞ (b)raqam		**	**

(Nasal...Uvular)>> (Uvular...Nasal)>>Linearity-IO

The **LINEARITY-IO** constraint is in charge of the metathesis process, whereby the linear ordering of the segments within the word is disturbed. In the case at hand, candidate (b) violates this constraint by exchanging the places of the segments, resulting in a different output word that is well-formed, yet it does not provide the same intended meaning as the input word. The typical output (a) is left out of the competition, whereas candidate (b) is rendered the optimal choice.

4.6 The Treatment of Consonant Harmony via the Optimality Model

The data includes the lexical deficit met in the process of consonant harmony.

Tableau (11): The Harmony of the Voiceless Denti-alveolar Plosive /t/ with the Voiceless Denti-alveolar Fricative /s/ in the Optimal Output /sisεa/ from the Input /tisεa/ "nine".

/tisεa/	(Plosive...Fricative)	(Fricative...Fricative)	IDENT[manner]
(a)tisεa	*!		
☞ (b)sisεa		*	*

(Plosive...Fricative)>>(Fricative...Fricative)>>IDENT[manner]

In this tableau, the typical output (a) is left out. Candidate (b) harmonizes the segments in respects to the feature of manner of articulation. **IDENT[manner]** is bothered, yet as it is the lowest constraint, candidate (b) is chosen as the optimal output.

Tableau (12): The Harmony of Voiceless Denti-alveolar Fricative /s/ with the Voiceless Palato-alveolar Affricate /tʃ/ in the Winning Output /tʃatʃi:n/ from the Input /satʃi:n/ "knife".

/satʃi:n/	(Denti-alveolar...Palato-alveolar)	Palato-alveolar...Palato-alveolar)	IDENT[place]	IDENT[manner]
(a)satʃi:n	*!			
☞ (b)tʃatʃi:n		*	*	*

(Dent-alveolar...Palato-alveolar)>>(Palato-alveolar...palato-alveolar)>>IDENT[place]>>IDENT[manner]

The well-formed output (a) is out of the evaluation process, encompassing the highest constraint. The optimal candidate (b) disturbs the **IDENTITY** of place and manner features by regressively assimilating the /s/ into /tʃ/. The output segments are harmonized in respects to the place and manner features.

4.7 The Treatment of Multi-processes via the Optimality Model

In each of the instances mentioned below, two or more processes occur together in the same lexical item while being processed from the input to the output. The most occurring process, add-on the other lexical processes, is the process of substitution.

Tableau (13): The Substitution of the Voiceless Velar Plosive /k/ into the Voiceless Palato-alveolar Affricate /tʃ/ and the

harmony of the Voiceless Palato-alveolar Affricate /tʃ/ with the Voiceless Denti-alveolar Plosive /t/ in the Winning Output /tʃitʃub/ from the Input /kitub/ "books".

/kitub/	Velar	Affricate	IDENT[place]	IDENT[manner]
(a)kitub	*!			
☞ (b)tʃitʃub		*	*	*

Velar>>Affricate>>IDENT[place]>>IDENT[manner]

In the surface output (b), the change of the segment /k/ into /tʃ/ leads to the assimilation of /tʃ/ with /t/ in terms of place and manner of articulation. The shift of place is from denti-alveolar to palato-alveolar and the shift of manner is from plosive to affricate. The normal output production (a) is left out.

Tableau (14): The Substitution of the Voiced Denti-alveolar Fricative /z/ into the Voiced Palato-alveolar Affricate /dʒ/ and the Harmony of the Voiced Denti-alveolar Fricative /z/ with the Palato-alveolar Affricate /dʒ/ in the Winning Output /dʒara:dʒi:r/ from the Visual input /zara:zi:r/ "sparrows".

/zara:zi:r/	Denti-alveolar	Palato-alveolar	IDENT[place]	IDENT[manner]
(a)zara:zi:r	*!			
☞ (b)dʒara:dʒi:r		*	*	*

Denti-alveolar>>Palato-alveolar>>IDENT[place]>>IDENT[manner]

In this tableau, the segment /z/ is substituted into /dʒ/ and this segment is assimilated with the denti-alveolar fricative /z/

leading to the surface output /dʒara:ɖʒi:r/. The harmony is noted in the place and manner of articulation.

4.8 Discussion

The lexical disorders found in the elicited data were analyzed using the OT model. It is worth mentioning that only selective samples were analyzed.

Starting with the process of substitution, consonantal and vocalic, the ratio of consonantal substitution is pervasive, with a percentage of 96.6% out of the total amount. On the other hand, vocalic substitution occupies only 3.4% of the total amount.

Regarding the constraints conflict in consonantal substitution, it is confined to the faithfulness IDENTITY constraints pertaining to the features of place and manner of articulation, voicing, and emphatic features. IDENT[place] is the most frequent constraint, which occupies a ratio of 40% out of the total amount of constraints employed. After that, comes the IDENT[manner] constraint with a ratio of 35. Furthermore, the constraint pertaining to voicing, IDENT[voicing], is present 15 times, with a ratio of 19%. The least occurring constraint is the IDENT[emphatic] with a sum of 6% out of the total number. These numbers and ratios imply that IDENT[place] and [manner] are the constraints that role the process of substitution in respects to consonants, for the most part. IDENT[voicing] is less pervasive than the abovementioned constraints. Also, IDENT[emphatic] is the least of all.

The process of vocalic substitution is not salient in the elicited data. The ratio is 3.4%. The constraints involved in this process are mentioned in the table below. The Tongue-position and Lip-

position constraints have the same ratio, 37.5%. This indicates their mutual importance and priority in the process of vocalic substitution. On the other hand, the IDENT[vowel-length] is less pervasive, with a ratio of 25%.

Regarding the process of deletion, the faithfulness constraint MAX occurs 10 times in the given data, with a ratio of 100%. There are no instances of addition accompanying the process of deletion.

In respects to the interacting constraints in the process of addition, the faithfulness constraint DEP occurs 4 times, with a ratio of 100% of the total amount of the given data, compared to the MAX constraints, there are no instances of deletion accompanying the process of adding segments.

The most prominent constraint in the process of meathesis is the LINEARITY-IO, which is responsible for explaining the process of metathesis. It is worth mentioning that there is no process of deletion accompanying this process, so the percentage of the MAX constraint is zero.

The lexical process of consonant harmony occupies 8% of the total data produced by the subjects. The interacting conflicts are the IDENT[manner] with a ratio 55%, IDENT[place] with a ratio 36%, IDENT[voicing] with a ratio 9%, and there is no presence of the IDENT[emphatic] constraint.

The parameters pertaining to the process of consonant harmony are the configuration or the place of articulation, the manner of articulation, or the place of constriction, and the voicing feature. The type of harmony available in the data is total harmony, whereby the involved segments become

identical to each other. It is important to bear in mind that the process of harmony can take two directions: either progressive or regressive. The one found in the produced data is regressive harmony.

The multi-processes occurring together in lexical items occupy 7% of the total data. The faithfulness constraints of IDENTITY, IDENT[place] and IDENT[manner] occupy a ratio of 28.6%. IDENT[voice] occupies 14.3% of the total number. MAX constraint invades a percentage of 8.6%. LINEARITY-IO and DEP share the same percentage, 5.6%. IDENT[emphatic], Lip-spreading and Tongue-position constraints all share the same ratio of 2.9% of the total number.

These processes are various and each lexical item has, at least, two constraints activated, yet it should be noted that the faithfulness constraints of IDENTITY; place and manner, are more prominent than other faithfulness constraints, since they are activated in , almost, all the lexical processes described above. The process of substitution seems to pervade over other processes, where it occurs in most of the examples.

5. Findings

5.1 Conclusions

The present study is an attempt to apply the model of Optimality Theory, with its constraint-based approach, to the lexical impairments revealed in the analysis of the elicited corpus of the participating Iraqi subjects suffering from aphasia.

The aforementioned approach was applied to the processes of substitution, deletion, addition, metathesis, and consonant harmony, found in the impaired lexis picked out from the

stirred speech of Iraqi aphasics. These respective processes are the most pervasive among other processes, which occurred throughout the analysis of the data, such as the vowel disharmony and phonological distortion.

The below mentioned points are derived from the analysis conducted using the OT model:

1- The analysis showed that the deficits found are better examined using the optimality theory as it elucidates the processes that were inexplicable by other theories. The OT unveiled a way of explaining these lexical processes through the constraints-conflict and the interaction of these constraints within the templates of the lexical items.

2- The mutual synchronization between the tenets of the OT and the main issues concerned in the speech of aphasics made it a rather more appealing theory to be tested and used to explore and examine the problems showed in the speech of these patients.

3- At the word level, the lexical disorders confined themselves to the lexical words; i.e., content words, without any effect upon the function words. Differently put, the disorders did not have an influence over the grammatical words. The constraints-conflict parameter in the speech output of the subjects was confined to the faithfulness constraints of place, manner, voicing, and emphatic features. The aphasics tend to alter these features to get an easier production of the target letters with less disturbance of Markedness constraints. Given so, the subjects try to satisfy the highest ranking constraints by attempting to break the lowest constraints and provide a speech output that is

merely comprehensible, and as grammatically simple as that produced by children.

5.2 Recommendations

Due to the findings of the present work conducted, the researcher recommends the following:

- 1- The current work might be considered a pioneer work within the Iraqi context, thus, it can be followed by studies that provide speech therapy and intervention strategies that would help aphasics regain their language.
- 2- The empirical work conducted in this study could be taken as a guideline to tackle other impaired aspects of language.
- 3- A database of aphasics and their whereabouts are to be created so as to pave the way to other researchers who might be interested in the subject area of the study.

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