AGRAMMATIC PATIENT'S DUAL CODING PROCESS IN SENTENCE COMPREHENSION

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Article Info:	Abstract:
  To cite this document: Visvanathan, D. (2020). Agrammatic Patient's Dual Coding Process in Sentence Comprehension. International Journal of Education, Psychology and Counseling, 5 (37), 159-172. **DOI:** 10.35631/IJEPC.5370013. 	This paper reports on a study on the dual coding process involved in an agrammatic patient when comprehending sentences using a sentence to picture matching test. The test was undertaken at The National Stroke Association of Malaysia (NASAM), Petaling Jaya, Malaysia. The current study employs the theory of Paivio's (1991) Dual Coding Theory (DCT) as an explanation for the agrammatic patient's ability to comprehend active and passive sentences and adopts an influential hypothesis by Grodzinsky's (1990) Trace Deletion Hypothesis (TDH) concerning agrammatism that characterises agrammatic patients as a good comprehender of Subject Verb Object (SVO) sentence structure, the active sentence but as bad comprehenders of Object Verb Subject (OVS) sentence structure, the passive sentences. A comprehension test, the Sentence to Picture Matching Test designed by Christensen (2001) has been adopted in this study to examine the suitability of dual coding theory as an explanation for the agrammatic patient's comprehension ability. The performance of the patient's comprehension pattern in this study supports the account of TDH and in general, the findings of this study suggest that sentence to picture matching test could be used to investigate the dual coding process of the agrammatic patient. **Keywords:** Dual Coding Theory (DCT), Trace Deletion Hypothesis (TDH), Agrammatism, Sentence Comprehension, Sentence to Picture Matching Test

Introduction

Background to the Study
This study is an investigation of the suitability of using Christensen's (2001) Sentence to Picture Matching Test (SPMT) to determine the comprehension ability of an agrammatic

patient by adopting Grodzinsky's (1990) Trace Deletion Hypothesis (TDH) as the theoretical foundation. Paivio's (1991) Dual Coding Theory (DCT) is employed as an explanation for the verbal and non-verbal processing (dual coding process) of the agrammatic patient in comprehending semantic reversible sentences during the test. The findings of Carammaza and Zurif (1976) on Broca's patients' difficulty in understanding semantic reversible sentence structures has led to the term "overarching agrammatism," which refers to the fact that the grammatical constituents of language are not employed in either production or comprehension of sentences (Peach and Shapiro 2012). Broca's aphasia, a subtype known as agrammatic aphasia, is characterized as an effortful, telegraphic speech or reduced in length, longer to express their thoughts or to describe pictures, have severe problem with word findings, omission of functional categories such as determiners, tense and complementizers (Avrutin 2001; Peach and Shapiro 2012).

One of the most influential theories on agrammatic comprehension is Grodzinsky's (1990) Trace Deletion Hypothesis (TDH). This theory is fundamental to the study on the different types of sentences that can be comprehended by Broca's aphasics especially those having semantic reversible sentence structures. The theory characterizes agrammatic patients as good comprehenders of active sentences but as bad comprehenders of passive sentences. This study is an attempt to establish the adequacy of Grodzinsky's (1990) TDH in explaining language impairment, in particular the comprehension ability among the agrammatics by using Christensen's (2001) Sentence to Picture Matching Test (SPMT) by which Paivio's (1991) Dual Coding Theory (DCT) is incorporated. This theory is related to the dual coding process that is involved in the comprehension of agrammatic patient. The DCT proposes that a verbal and non-verbal processing (dual coding process) that deals simultaneously with language (sentences) and with nonverbal objects and events (pictures). The core principle of DCT is that recognition is enhanced by presenting information in both visual and verbal froms (Clark and Paivio 1991).

According to Paivio (2013), DCT has become operationally explicit when neurolinguistic researchers use sentence to picture matching or verification tasks to test hypotheses concerning agrammatism. The dual coding process involved in the sentence to picture matching test supports the idea that people learn by connecting knowledge to prior knowledge in which materials involve in the test related to verbal and pictorial information is more salient and better remembered than information presented through verbal material alone or pictorial material alone (Paivio 1991; Najjar 1995). Therefore, a comprehension test known as Sentence to Picture Matching Test (SPMT) designed by Christensen (2001) has been adopted in this study to determine an agrammatic patient's comprehension ability and also to establish the adequacy of Grodzinsky's (1990) TDH using semantic reversible sentences using active and passive sentences as stimulus.

Statement of the Problem
Broca's aphasia is typically characterized by halting, non-fluent speech. Grammatical function words such as "is," "and," "the" and inflections for tense, agreement, number, and gender are often omitted in language production (spoken or written) with mainly root content words being produced. Patients with Broca's aphasia may say "boy girl fall" to mean "boy and girl are falling". Language production is therefore described as telegraphic or agrammatic ("without

grammar"). In the 1970s, it was discovered that this agrammatic component of Broca's aphasia also extends to comprehension (Peach and Shapiro 2012).

The failure to detect comprehension deficits in agrammatic patients extends to comprehension of more complex sentence constructions such as passives and object relatives. This impairment was investigated by Caramazza and Zurif (1976), who noted that agrammatic patients demonstrated poor comprehension for sentences containing reversible noun phrases (e.g., "The boy was chased by the girl," where either of the nouns boy or girl can perform the action *chase*) (Nelson *et.al*, 1996). According to Grodzinsky (2000) agrammatic patients' language is impaired due to the acquired damage in the Broca's area which in turn has affected their syntactic processing of certain syntactically complex sentence types most prominently OVS-passive sentences in English is in sharp contrast with SVO- active sentences.

To date, there has been limited study conducted in Malaysia employing Grodzinsky's (1990) TDH as the theoretical framework involving local Broca's aphasics' speakers of English. Most of the studies attempt to provide typical characterisations of the Broca's aphasics. This lack of data pertaining to agrammatic patients in Malaysia has led the researchers to conduct the study on the area. Damasio (1992) claims that agrammatic are well aware of their impairment and are often depressed especially when their inability to repeat sentences they hear and unable to repeat the types of sentences that they fully understand.

Hence, this study is an attempt to establish the adequacy of Grodzinsky's (1990) TDH in explaining agrammatic patient's comprehension ability using Christensen's (2001) Sentence to Picture Matching (SPMT) which incorporates Paivio's (1991) Dual Coding Theory (DCT). As pointed out by Grodzinsky (1990), agrammatic patients are good comprehenders of SVO – active sentence and bad comprehenders of OVS – passive sentences. This study is also undertaken in order to determine the (verbal and non-verbal processing) dual coding process of agrammatic patient that is involved in a sentence to picture matching test whereby the agrammatic patients are required to hear sentences and point out pictures that best describe the heard sentences. SPMT will enable the researchers to investigate the comprehension ability of the agrammatic patients (Christensen 2001).

Research Objectives
This study is undertaken in order to seek the answer to the following research objectives:

  a)   To investigate an agrammatic patient's comprehension ability using Sentence to Picture Matching Test (SPMT) based on the dual coding process.
  b)   To determine the adequacy of Grodzinsky's (1990) TDH in explaining the patient's comprehension of semantic reversible sentences using active and passive sentences as a stimulus.

Literature Review

Broca's Aphasia and Related Studies on the Area
Broca's aphasia is the results of the damage to the anterior regions of the brain, the left posterior inferior frontal gyrus (LIFG) or inferior frontal operculum described as Broca's area ,i.e. Brodman's area 44 and 45. Broca's aphasia results in a drastic loss of speech fluency, effortful

and telegraphic. It is known as expressive aphasia in clinical neuropsychology and also known as agrammatic aphasia in cognitive neuropsychology (Purves 2008). Figure 1 below shows the Brodman's area in human brain in a schematic lateral view of the brain's left hemisphere.
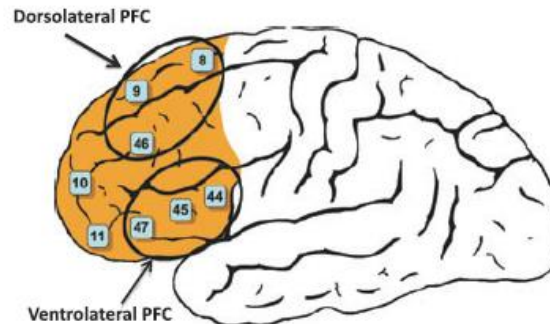

Figure 1: The Prefrontal Cortex (PFC) is Shaded Orange. Number Labels Indicate Brodman Areas (BAs). The Left Inferior Gyrus (LIFG) Falls Within Ventrolateral Portions of PFC, Including the Posterior Anatomical Regions Known as Broca's Area (BAs 44 & 45)

Source: (Novick, Trueswell and Thompson-Schill, 2010: p. 908)

The function of prefrontal cortex (PFC; see Figure 1) in human brain is one of dynamic filtering or 'sculpting the responses space in human brain in which appropriate or inappropriate information will be selected (Shimamura 2000). So, damage to this PFC specifically in the Broca's Area, i.e. Brodman's area 44 and 45, the left inferior frontal gyrus (LIFG) will have effect on human's cognitive control which will cause a flawed response towards a cognitive control tasks such as expressing thoughts, describing pictures, having severe problems in finding words and poor naming (Avrutin 2001; Novick, *et.al* 2010).

Broca's aphasics have difficulties with semantically reversible sentences and this mechanism underlying this selective impairment has been the focus research done by Grodzinsky (1990). Comprehension problems can typically emerge when the understanding of sentences hinges exclusively upon the correct analysis of syntactic structure. These comprehension difficulties especially arise when sentences are semantically reversible (Caramazza and Zurif, 1976; Novick *et. al*, 2010). According to Avrutin (2001) the utterance produced by Broca's aphasic are typical reduced in length and it takes patients significantly longer to express their thoughts, or to describe pictures and have severe problems with word findings, which can at least partially account for their elliptical utterances and poor naming.

Theoretical Foundation of the Study
This study is based on Paivio's (1991) Dual Coding Theory (DCT) and Christensen's (2001) Sentence to Picture Matching Test (SPMT). There are two modes of representation in memory. One mode processes verbal information such as text. The representations of information processed by this system are known as logogens. The other mode processes nonverbal images such as illustrations – pictorial. The representations of information processed by this system are known as imagens (Clark and Paivio 1991).

Logogen and imagen representational units are connected by three types of processing (1) representational - the direct activation of verbal or non-verbal representations, (2) referential - the activation of the verbal system by the nonverbal system or vice-versa, and (3) associative

processing - the activation of representations within the same verbal or nonverbal system (Clark and Paivio 1991; Najjar 1995). A given task may require any or all of the three kinds of processing. The referential type of processing is relevant for the study as it is the core aspect of Christensen's (2001) Sentence (Verbal/Logogen) to Picture (Non-verbal/Imagen) Matching Test (SPMT) which is used to test the agrammatic patient's comprehension ability in this study.

Figure 2 below shows Paivio's (1991) General Framework of Dual Coding Theory (DCT) that is involved in Christensen's (2001) Sentence to Picture Matching Test (SPMT).
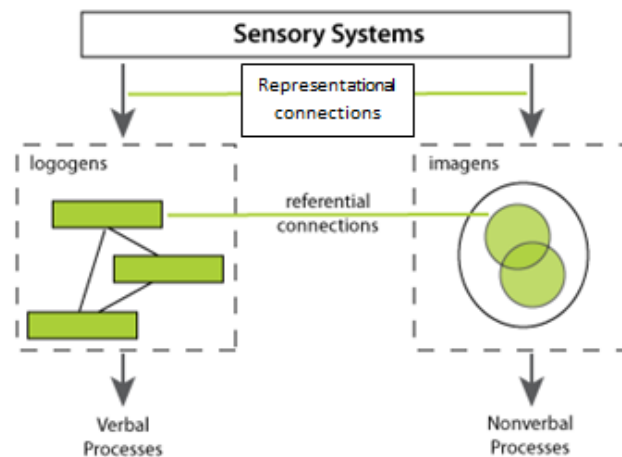

Figure 2: Paivio (1991) General Framework of Dual Coding Theory
Source: (Clark and Paivio, 1991: p. 149 - 170)

Trace Deletion Hypothesis
Another theoretical foundation of this study is Grodzinsky's (1990) Trace Deletion Hypothesis (TDH). Grodzinsky's (1990) TDH is concerned with agrammatism which characterizes agrammatic patients as good comprehenders of Subject Verb Object (SVO) sentence structure, the active sentence but as bad comprehenders of Object Verb Subject (OVS) sentence structure, the passive sentence. Grodzinsky (1990) states that traces are deleted, and patients assign thematic roles to non-thematic positions, relying on a default strategy. According to O'Grady (2005) movement of constituent results in a phonologically silent but structurally represented position, which filled with a construct, called trace (t).

Based on the research done in a diversity of language backgrounds including Japanese, Chinese, Hebrew, Dutch, Russian, Italian and English, Grodzinsky (1990, 1995, and 2000) concludes that in fact most of the Broca's aphasics' grammar is intact. According to Grodzinsky (1990, 1995:p.31, 2000:p.4), in comprehension, Broca's aphasics can construct basic syntactic tress for simple sentences, for example active sentences. They are also able to detect violations of phrase structure rules. In contrast to these spread abilities, Broca's aphasics on the other hand suffer severe difficulties with constructions involving syntactic movement, such as passives, where a noun phrase is moved from object position to subject position leaving a trace.

Conceptual Framework of the Study
Figure 3 shows the conceptual framework of the study. Paivio's (1991) General Framework of Dual Coding Theory (DCT) and Grodzinsky's (1990) Trace Deletion Hypothesis (TDH) are

used as the theoretical framework for the study. A Sentence to Picture Matching comprehension test (SPMT) adopted from Christensen (2001) is used to determine the comprehension ability of an agrammatic patient in which Paivio's (1991) DCT will be used as an explanation for agrammatic patient's comprehension ability and two types of sentence construction are constructed; SVO-Active and OVS – Passive sentences are formed into semantically reversible sentence to determine the adequacy of Grodzinsky's (1990) TDH in explaining the patient's production of semantic reversible sentences using active and passive sentences .
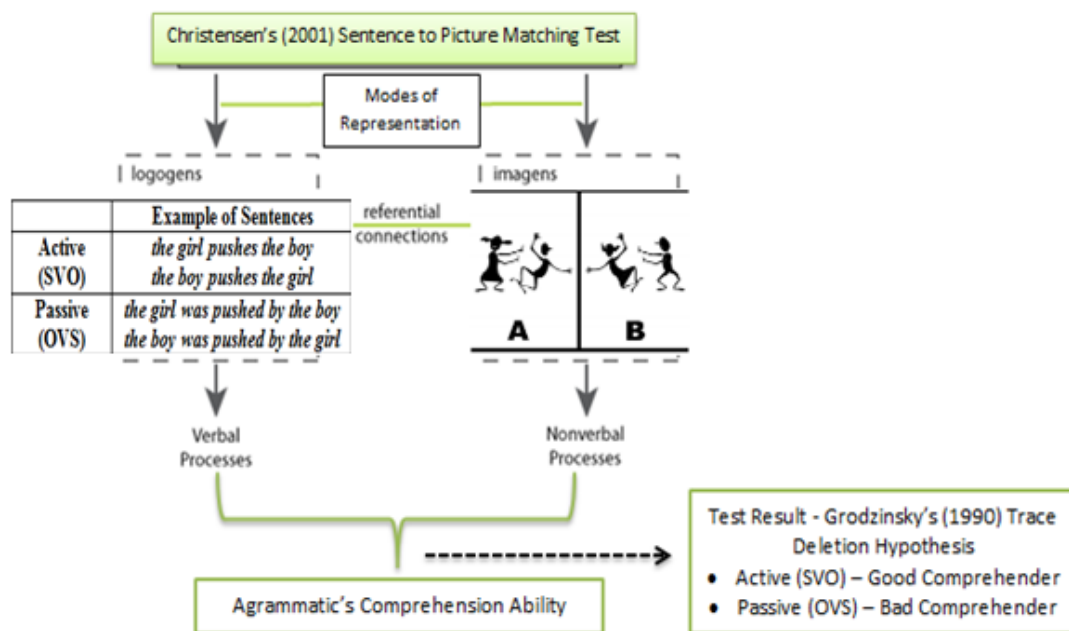

Figure 3: The Conceptual Framework of the Study

Methodology

Research Design
The researchers conducted a case study on agrammatic's comprehension ability of the aphasic patient. This study involves one agrammatic patient from National Association Stroke Malaysia (NASAM), Petaling Jaya. The study is based on the accessibility and availability of the subject.

Instruments

Comprehension Test –Sentence to Picture Matching Test (SPMT)
A Sentence to Picture Matching Test (SPMT) adopted from Christensen (2001) was used to determine the comprehension ability of an agrammatic patient. In this comprehension test, the patient is required to see a set of pictures, after some inspection time, a spoken sentence was presented. One of the pictures depicts the sentence content, the others are distracters. The patient's task is then to select one picture that best portrays the meaning of the presented sentence. By manipulating the kind of disagreement between sentences and the distractor pictures in the test, the effected aspects of language systems can be obtained (Wassenaar and

Hagoort 2007). Numerous studies were done by (Caramazza and Zurif 1967; Heilman and Scholes 1976; Schwartz *et. al* 1980; Gallaher and Canter 1982; Sherman and Schweickert 1989; Yi-Ching 2007) in which they had used the sentence to picture matching test to obtain data from agrammatic patients specifically that is related to the comprehension modality.

Eight sets of pictures that correspond to the two interpretations of semantic reversible sentence are devised in a comprehension test known as Sentence to Picture Matching Test (SPMT) designed by Christensen (2001). The researchers constructed a total of 32 SVO – active and OVS-passive semantic reversible sentences that can be matched with the pictures. Each of the two pictures of the same set is represented. The researchers construct the set of the sentences in such a way so that each type of construction represents 16 token sentences.

Table 1 below is an example of semantically reversible sentences for Active (SVO) sentences and Passive (OVS) sentences used in this study:

Table 1: Semantically Reversible Sentences for Active and Passive Sentences

	Example of Sentences
Active (SVO)	*the girl pushes the boy* *the boy pushes the girl*
Passive (OVS)	*the girl was pushed by the boy* *the boy was pushed by the girl*

The patient is presented with the set of pictures below depicting a girl pushing a boy (A) and a boy pushing a girl (B):
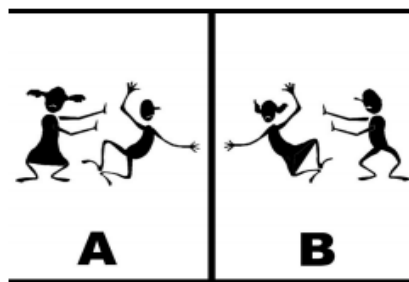

Figure 4: Picture of ─*The Girl Pushes the Boy* and ─*The Boy Pushes the Girl*
Source: (Christensen, 2001)

Both Active (SVO) sentences and Passive (OVS) sentences are presented to the agrammatic patient in a random order in which the patient is required to point out the picture that corresponds to the sentences presented. The correct answer, either (A) or (B), of the presented sentences appear in series of no more than three. For example, the correct answers may come in sequences such as A-A-B-A- B-B-A-A-A-B, but not for example A-B-A-A-A-A-B-B. The latter has a sequence of more than three consecutive identical correct answers: 4 as in a row. This is done to secure that the intact comprehension of certain structures that happens to be presented consecutively does not affect performance, which may otherwise become biased towards (A) or (B) if longer series were allowed (Christensen, 2001).

The patient is tested twice on each set of pictures in the Sentence to Picture Matching Test (SPMT) to determine the comprehension ability of an agrammatic patient. Patient's ability to match the sentence (logogen) with the appropriate picture (imagen) can be identified clearly by calculating the patient's result in the test which in turn will be able to determine the adequacy of the Trace Deletion Hypothesis (TDH) by Grodzinsky's (1990) which characterizes agrammatic patients as good comprehenders of Subject Verb Object (SVO) sentence structure, the active sentence but as bad comprehenders of Object Verb Subject (OVS) sentence structure, the passive sentence.

Data Analysis

The method of data analysis employed in this study is based on sentence types, correct sentences identification, average percentage and performance suggested. The patient's comprehension ability is evaluated in accordance to the average percentage and performance as suggested by Grodzinsky (1990) that give rise to Trace Deletion Hypothesis (TDH). This is presented in the table below.

Table 2: Grodzinsky's (1990) Standard Norm based on Average Percentage and Performance

Grodzinsky's Standard Norm based on Average Percentage and Performance		
Sentence Type	Average Percentage	Performance
SVO- Active	71 - 100	Good comprehender
OVS- Passive	30 - 70	Poor comprehender

(Source: Grodzinsky, 1990)

Qualitative data is collected based on the occurrence of correct and wrong answers to identify whether the patient's result correspond to Grodzinsky's (1990) TDH and also to explain the dual coding process involved in the Sentence to Picture Matching Test (SPMT) which is used to test the comprehension ability of agrammatic patient. Nueman (2006) explains that quantitative researcher develops techniques that produce data in the form of numbers. The researcher moves deductively from abstract ideas to specific numerical information. So, data for this study are tabulated numerically by calculating the average percentage obtained by the agrammatic patient in the test. The average percentage of the correct and wrong answers is created based on the first and second attempt of SPMT and the agrammatic patient's performance was identified.

Results and Discussion

Table 3 below shows the subject's Average Percentage and Performance in accordance to Grodzinsky's (1990) Standard Norm.

Table 3: The Subject's Average Percentage and Performance According to Grodzinsky's (1990) Standard Norm

Sentence Types	Correct Answer(s)		Patient's Findings		Grodzinsky (1990) Findings	
	1	2	Average Percentage (%)	Performance	Average Percentage (%)	Performance
SVO - Active	15/16	14/16	91	Good	71 - 100	Good
OVS - Passive	5/16	3/16	25	**Very poor**	30 - 70	Poor

As shown in Table 3 above, the subject in this study comprehends well for the SVO-active sentences compared to OVS-Passive sentences which are very poorly comprehended. The comprehension of SVO-active sentences is good when the subject scores 91 percent and the score obtained falls within the range set by Grodzinsky's (1990) in the standard norm. However, the comprehension for OVS -passive sentences is very poor when the subject in this study obtains an average percentage of 25 percent only, which is lower compared to the range set by Grodzinsky's (1990) in the standard norm.

Figure 5 and Figure 6 below show the subject's Performance in Comprehending Active (SVO) Sentences and the subject's Performance in Comprehending Passive (OVS) Sentences for the first and second attempt in SPMT.
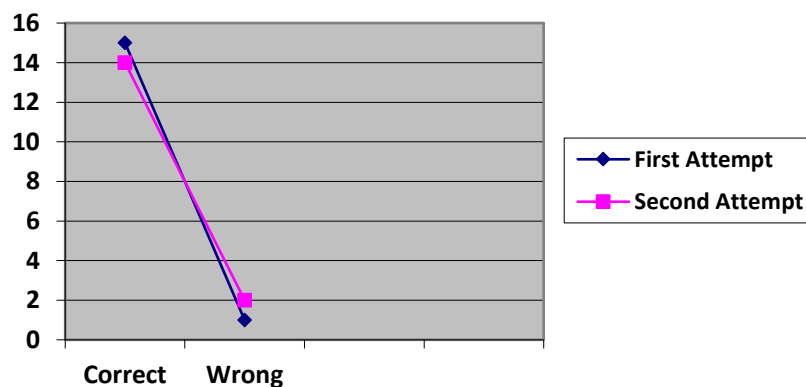

Figure 5: The Subject's Performance in Comprehending Active (SVO) Sentences

As shown in the Figure 5 above, the subject in the study performed better in the first attempt of SPMT by obtaining 15 correct answers and 1 wrong answer. However, for the second attempt of the test, the subject obtained 14 correct answers and 2 wrong answers.
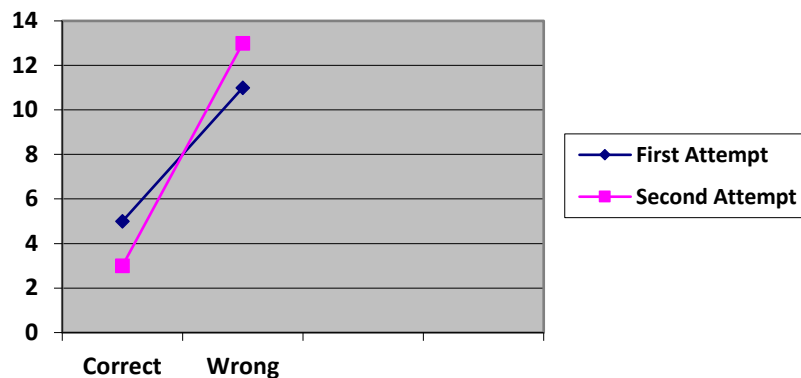
Figure 6: The Subject's Performance in Comprehending Passive (OVS) Sentences

Figure 6 above shows that the subject in the study performed better in the first attempt of SPMT by obtaining 5 correct answers and 11 wrong answers compared to the second attempt of the test in which the subject obtained only 3 correct answers and 13 wrong answers.

The line graphs in Figure 5 and Figure 6 show the trends of correct and wrong answers obtained by the subject in the study. Overall, it can be clearly seen that the subject obtained more correct answers for Active (SVO) sentences compared to Passive (OVS) sentences for the first and second attempts of the SPMT. The results above reveal the performance of the subject in this study is better in the first attempt compared to the second attempt of SPMT.

It can also be concluded that the agrammatic patient in this study is very quick in pointing out pictures that correspond to the sentences having SVO structure heard in relation to the 8 sets of pictures consisting of 32 sentences all together. This is supported by the results of this study where the subject in this study performs well in SVO – active sentences compared to the OVS – passive sentences.

Discussion and Conclusion

The Patient's Comprehension Ability Using Sentence to Picture Matching Test (SPMT) Based on the Dual Coding Process
The dual coding process as stated in Paivio's (1991) Dual Coding Theory (DCT) involving two modes of representation known as logogen and imagen plays a significant role in the formulation of Christensen's (2001) Sentence Picture Matching Test (SPMT). Logogen and imagen are the two representational units connected by three kinds of coding process there are (1) the representational process, (2) referential process and (3) associative processing in which the activation can spread between the units which can result in different activations which flow probabilistically from a stimulus through the links. In this way, a word can evoke a picture and a picture can evoke a word in the sentence to picture matching test (Clark and Paivio 1991; Najjar 1995).

Based on the Paivio's (1991) DCT and Najjar (1995), the referential processing is the kind of dual coding process that is involved in the sentence to picture matching test in which the activation of the verbal system (logogen), the SVO – active and OVS – passive sentences by

the nonverbal system (imagen), the pictures related to the sentences or vice-versa. So, in this study, the activation, which is the comprehension ability of the agrammatic patient happens inevitably with the dual coding process from one of the kinds of coding processes which is the referential process when both logogen (sentences) and imagen (picture), the two representation units presented to the patient, which has resulted to different average percentage for both SVO – active and OVS – passive sentences. However, the agrammatic patient's performance in SVO – active sentence as a good comprehender and OVS – passive sentences as a poor comprehender, in this study as a very poor comprehender somehow correspond to the performance suggested by the Grodzinsky (1990) standard norm.

To sum up, the results of the study reveal that Christensen's (2001) Sentence to Picture Matching Test (SPMT) that consists of the dual coding process could be used to test the comprehension ability of agrammatic patient when the patient perform both SVO- active sentences and OVS-passive sentences leading to good comprehension and very poor comprehension respectively which supports Grodzinsky's (1990) TDH claims. The sentence to picture matching test used in the study has made the agrammatic patient to construct an image, for example the OVS – passive sentences, and the patient tried to match the sentences with a pictured scene conversely or verbalizes covertly to the scene and tried to match heard sentences to the generated verbal description-in either case, involving the referential processing, the activation of the verbal system (logogen), the SVO – active and OVS – passive sentences by the nonverbal system (imagen), the pictures related to the sentences or vice-versa (Clark and Paivio 1991; Najjar 1995).

Neurolinguistic researchers use sentence to picture matching or sometimes known as the verification tasks to test hypotheses concerning agrammatism which now has become operationally explicit (Paivio 2013). For more than 30 years, with the psychological evidence for facilitative interplay, imagery being favoured as the mediating process in the sentence to picture matching task (Paivio 1971). During the last decades, the sentence–picture matching task has been applied to a variety of sentences of different structural types to probe agrammatic patients' ability to understand these types of sentences (Berndt, Mitchum, and Wayland 1997). This approach has revealed a good comprehension for SVO structures like actives and subject-relatives and poor comprehension for OVS structures like passives and object-relatives (Grodzinsky, Pinango, Zurif, and Drai 1999).

The Adequacy of Grodzinsky's (1990) TDH in Explaining the Patient's Comprehension of Semantic Reversible Sentences Using Active and Passive Sentences

The results shown in Table 3 indicate the average percentage obtained by the agrammatic patient in this study for the SVO – active sentences correspond with the average percentage of Grodzinsky's (1990) study when the agrammatic patient achieved the average percentage of 91 percent which has led to the performance of a good comprehender as stated in Grodinsky's standard norm. However, the average percentage obtained by the agrammatic patient in OVS - passive sentences in this study is slightly lower compared to Grodzinsky's (1990) standard norm which is only 25 percent and this does not seem to correspond to the average percentage as stated in the standard norm. But, the performance of the agrammatic patient in this study in the OVS – passive sentences in a sense supports Grodzinsky's (1990) TDH claim whereby the patient's performance is classified as very poor in OVS – passive sentences.

Grodzinsky (1990) account of TDH in agrammatic aphasia seems to apply to the patient's comprehension ability in SVO-Active sentences, and it can be seen clearly from the Table 3. The subject's average percentage is 91 percent, and this corresponds to Grodzinsky's (1990) TDH claim in which agrammatic patients are good comprehender of SVO – active sentence when the patient in the study obtained good performance.

However, Grodzinsky (1990) TDH standard norm of agrammatic aphasia does not seem to apply to the subject's comprehension ability in OVS - passive sentences as the subject's results show that the subject's average percentage is 25 percent and this does not correspond with Grodzinsky's (1990) average percentage standard norm. But Grodzinsky's (1990) TDH claims on agrammatic patient as bad comprehender of OVS – passive sentences still correspond with the agrammatic patient's performance as a very poor comprehender of OVS - passive sentences.

The comparison of the subject's results and Grodzinsky's (1990) standard norm reveal that the performance of the subject specifically in OVS – passive sentences is very poor. However, it is not poor as suggested by Grodzinsky's (1990) standard norm. The subject in this study records the lowest percentage score in comprehending OVS-passives sentences and this indicates that the subject does not perform well in the test especially in semantically reversible OVS- passive sentences. Grodzinsky (1990) claims that the average percentage that is below 30 percent will lead to the poorest comprehension of OVS- passive sentences. However, on the whole, the subject's results in Christensen's (2001) Sentence to Picture Matching Test (SPMT) highly support Grodzinsky's (1990) TDH claim that agrammatic patients are the good comprehender of SVO – active sentences and as a poor comprehender of OVS - passive sentences. Thus, in conclusion, Grodzinsky's (1990) TDH can adequately be used to explain the subject's production of semantic reversible sentences using active and passive sentences.

Conclusion

This study provides useful information to speech therapist in designing individualized assessments and treatment programs that uses text and relevant illustrations (verbal and pictorial channel) for their agrammatic patients. Information or meaning can be clearly understood by the agrammatic patients if the mode of representation is clear and concise like the sentence to picture matching task (Najjar 1995; Penke 2011). The dual coding process that is involved during the sentence to picture test shows that information can be processed verbally and nonverbally through logogen (sentences) and imagen (pictures), which means both channels, has an additive effect on recall because the agrammatic patient has more cognitive paths that can be followed to retrieve the information and this is supported by one of Paivio's (1975) studies which have found that people recall more successively repeated pictures than repeated words - the picture superiority effect which means people recall pictures better than words.

Another important implication of the study to the speech therapists that deal with agrammatic patients and have difficulties in conveying meaning to the patient is that they can use the pictures to communicate because pictures access meaning more quickly and completely than words (Smith and Magee 1980). This is supported when the subject in this study is very quick in pointing out pictures that correspond to the 32 sentences in relation to the 8 sets of pictures. This finding corresponds to Najjar's (1995) claim that information that uses text and relevant

illustrations (verbal and pictorial channel) will likely be learned better and quicker than information that uses text alone (verbal channel only), audio alone (verbal channel only), combined test and audio alone (verbal channel only) or illustrations only (pictorial channel only).

The subject's result in Christensen's (2001) Sentence to Picture Matching Test (SPMT) seem to correspond with Grodzinsky's (1990) TDH claim where agrammatic patients are the good comprehender of SVO – active sentences and as a poor comprehender of OVS - passive sentences. The sentence to picture matching test used in this test was a great success and it is suitable to test the agrammatic patient's comprehension ability though the result of their performance in OVS – passive sentences slightly lower compared to Grodzinsky's (1990) standard norm. According to Grodzinsky (1990), individuals with agrammatism are generally assumed not only to produce slow and effortful speech, with short phrases consisting of mainly content words, but also to have relatively intact language comprehension ability. This is supported by the results of this study where the subject in this study performs well in SVO – active sentences compared to the OVS – passive sentences. In conclusion, Grodzinsky's (1990) TDH can adequately be used as a causal explanation for the patient's comprehension of semantic reversible sentences using active and passive sentences.

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