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Müge Müzeyyen Ciyiltepe *

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Research Article

Oral Reading Performance in Schizophrenia: A Morphological-Based Approach

Müge Müzeyyen Ciyiltepe *, Ozgül Akın Şenkal

Research Center for Psychotherapy Russia.

***Corresponding Author**: Müge Müzeyyen Ciyiltepe, Dept. Speech and Lang Therapy Faculty of Health Sciences Tarsus University, Adana, Turkey. Prof. PhD., CCC. SLP.

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Abstract

Objectives: Schizophrenia may cause an abnormal perception, emotion, thought and language system. Confused thought and perception disorganize language structure. Reading ability depends upon the integrity of underlying visual and auditory (phonological) systems. The purpose of this study was to present reading errors of Turkish patients with paranoid type schizophrenia utilizing a morphophonological perspective.

Methods: The sample of this study was selected from Outpatient Clinic of the Psychiatry Department of a Local Hospital. There were 15 male patients who were examined according to the protocol of psychiatry department for schizophrenia. 15 age-matched healthy individuals in the community served as a control group on a voluntary basis. Oral reading performances were evaluated by three different texts including emotional, ironic and pragmatic content. The type of analysis basically included morphology (phonological interactions and articulation errors), syntactic/ grammatical properties (agreement, case marking, negation, number and tense etc.), and other morphological properties in relation to syntax and phonology (spelling, stop, repetition, omission, correction) in detailed study levels.

Results: Many patients' errors were mostly on morphological and grammatical levels. Many, but not all the patients did similar types of articulatory reading errors. All of the patients had difficulty in reading the task due to repeating syllable and word structures, especially by spelling. Common errors of omission were with conjunctions and pronouns.

Discussion: Morphological and grammatical process is variable and complex in all patients with schizophrenia. In this study, it has been demonstrated that embedding pause between words into a sentence may bring out 'accent impairment' in schizophrenic prosody. Morphological impairments nearly are seen in endings.

Keywords: stuttering; adults; reading problems; schizophrenia; morphophonological approach; phonology

Introduction

Reading is a complex skill that requires the simultaneous activation of many different brain processes. When reading a word, the reader must recognize the visual configuration of letters, the letter order of that language, and must engage in segmentation (breaking the word into individual sounds). Then, while being held in working memory, sounds must be synthesized and blended, to form recognizable words. Furthermore, to comprehend sentences, several more skills are also required. The reader must not only decode the words, but also comprehend the syntax (word order) and morphology, retain the sequence of words, use contextual cues, and have adequate vocabulary knowledge. This must be done simultaneously in order for sentences to be understood. At the same time, sentences must be held in working memory and integrated with one another. Each sentence is read, understood, associated and integrated with the previous one. This process will continue until the last sentence of the reading material. The details of the reading material, characters and the main idea need to be retained in working memory[1-2] (Baddeley, 2003; Young, 2000).

Most studies in the field evaluated single word reading abilities (Fuller, 2002) or reading comprehension at passage level[3] (Hayes & O'Grady, 2003) or reading skills of patients with schizophrenia (PWS) analysed with a standardized psyco-educationally based reading batteries[4]. Revheim et al (2006). To our knowledge this is the only study tried to analyse the error pattern of reading skills (including omissions, pauses, etc.) of PWS.

PWS have dysfunctions on pragmatic and semantic reasons. Reading skills require word recognition, word comprehension (facts, sequence and theme), and behaviours such as ability to follow word sequence, and line (not losing your place while reading). Morpho-phonologically speaking, an analysis and classification of the phonological factors which affect the appearance of morphemes or the grammatical factors may be the way to analyse reading error patterns of schizophrenia by their connection of dysfunctions with pragmatics and other language related levels since morphophonology focuses on interaction between morphological and phonological processes. Unlike linguistically point of views for this study, we present oral reading performances by articulatory errors of patients. While prior studies focused on semantic and pragmatic structures of the schizophrenic language [5-9] (Andreasen 1979a, b; Meilijison et al. 2004; Nestor et al. 1998; Covington et. al. 2005), we divide main language structures by their interactions to

morphology into two categories: phonology and grammatical process (McCarthy 1981; *Haspelmath 2002*)[10-11].

The Turkish language has transparent orthographies with regular print-to-sound correspondences. The mappings of orthography onto phonology and phonology onto orthography are sufficient to read and spell the words. In Italian, a language similar to Turkish, morphology has been found to have a main effect on reading fluency (Traficante, 2011)[12] and morphological information is a useful resource for both reading and spelling (Angelelli, 2014)[13]. Reading ability depends upon the integrity of underlying visual and auditory (phonological) systems.

The purpose of this study was to present reading errors of Turkish patients with paranoid type schizophrenia (PWS) utilizing a morpho-phonological perspective. Recently studies examined reading ability in schizophrenia and with respect to the aetiology of schizophrenia-related reading impairments, Condray[14] (2005) has hypothesized a neurodevelopmental cause that links reading deficits in schizophrenia to developmental dyslexia though this link is yet to be clearly established. To date, no study has examined PWS's reading abilities from morpho-phonological perspective. Accordingly, the current study also sought to explore reading and cognitive functions in schizophrenia.

Methods and Material

This study included 15 male patients who applied to the Outpatient Clinic of the Psychiatry Department of Local Hospital from March 2021-August 2022. Inclusion criteria was a diagnosis of paranoid type schizophrenia (PWS), age range of 18-35 (young adult), absence of any neurological disease, mental retardation and able to read and write.

There were 65 patients were seen during the given period. Of whom there were 19 with additional diagnosis of depression, 19 with a diagnosis of bipolar disorder, 4 were not able to read which was not eligible for the study. PWS Group participants were medicine free for two months with this being their first attack reportedly. Six patients with other types (e.g. acute or residual) excluded from this study. Neither the ones reportedly with more than one attacks which were two are included. Fifteen age-matched healthy individuals in the community served as a control group on a voluntary basis. All participants were right-handed. Amongst participants of the PWS Group, three were married (30%), and 12 were single (80%). The number were similar in the control group, 1 (6.7%) to 14 (93.3%) respectively. The education level of the all subjects is listed in Table 1.

Education Level	*PWS*	*Control Group*
Primary	4 (26.7%)	0
Secondary	6 (40.0%)	11 (73.3%)
High School	4 (26.7)	3 (20.0%)
Collage/University	1 (6.7%)	1 (6.7%)

Table I. Education level of the participants:

The patients were examined according to the protocol of our department for schizophrenia. The scales utilized included;

A. ***Scale for Assessment Positive Symptoms*** **(SAPS)** which examines the distribution and the severity level of positive signs of schizophrenia, B. ***Scale for Assessment Negative Symptoms*** **(SANS)** which examines the distribution and the severity level of negative signs of schizophrenia and C. ***Brief Psychiatric Rating Scale*** **(BPRS)** which assists to determine the distribution and the level and stability of psychotic and some depressive symptoms (Table 2).

	SANS	**SAPS**	**BPRS**
Mean	62.8	38.9	37.4
Median	69	36.0	36.0
SD	21.01	9.08	9.0
Min	29	21	16
Max	93	60	58

Table II. SANS, SAPS and BPRS distribution of the PWS

Healthy individuals were given only *The Short Cognitive Evaluation Form* (SCF) following their oral peripheral examination. The SCF determines the overall cognitive functioning of an individual. For healthy individuals scores below 27 of the SCF were not included in the study (Table 2). All patients signed written informed consent to participate after procedures had been fully explained. All participants were given an oral-peripheral examination which determines the basic cranial nerve functions for speech and language production purposes.

The hearing level 500-4000 Hz were within normal limits (WNL), no articulation problems were present (such as rhotacism, palatal lisping), and smoking was somewhat higher in the PWS group when compared to control group. Nine patients (60%) were smokers whereas 2 (13.3%) in control group. Diadochokinetic (/pa/, /ta/, /ka/, /pataka/) measures for all participants were also WNL.

Oral reading performances were evaluated by three different texts including emotional, ironic and pragmatic content. Each of texts changed in length with the following word count: 261, 75 and 57 and sentence count 42, 9, and 18 respectively. The text included in pragmatic items (261 words, 42 sentences) consists of three paragraphs differed in morphologic, syntactic and lexical properties. The text with ironic contradiction (75 words, 9 sentences) has a dialogue between two people including of different types of wh-phrases and mutual conversations. The ironic and emotional contradiction text (57 words, 18 sentences) also included corresponding questions and answers.

During data collection, the speaker and the examiner were sitting face to face in a quiet room. The recordings were in a digital medium with a stereo microphone. The Cool Edit Pro 2.0 and Praat 4.6 (Boersma & Weenink 2002) computerized software's were utilized to analyse the digitally recorded data. The type of analysis basically included morphology (phonological interactions and articulation errors), syntactic/ grammatical properties (agreement, case marking, negation, number and tense etc.), and other morphological properties in relation to syntax and phonology (spelling, stop, repetition, omission, correction) in detailed study levels. Further analysis is done as text to each paragraph, paragraph to each sentence, sentence to sentence, sentence to word. All texts were evaluated with connection of duration patterns and reading skills.

3. Data Analysis

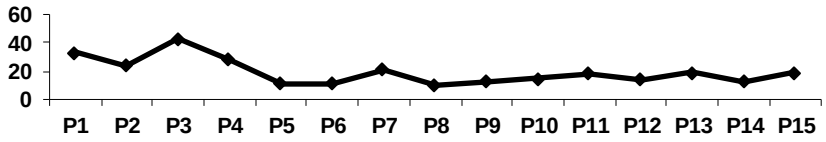
Data were analysed by means of SPSS 21.0 (IBM, Armonk, NY). According to Shapiro-Wilk normality test results, all the variables were not normally distributed (p=0.03). Kruskall Wallis and Mann-Whitney U tests were used to compare the mean scores of PWS and control group. Pearson correlation

test used to show the correlation between scales and reading errors. Pearson correlation coefficient is denoted by "r".

4. Results

Different types of morphological reading error patterns were present among PWS. Many patients' errors were mostly on morphological and grammatical levels (Figure.1).

(a)



(b)

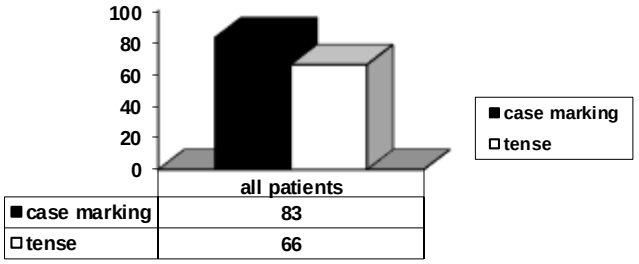


Figure. 1 (a) Above panel: Grammatical complexity as sentences with embedded, relative, question, adverbial, noun etc. clauses, repetition and all related levels. (b) Below panel: Numeral differences of tense and case marking errors. In both of the graphs, higher violations demonstrate worse oral reading performances.

In Figure.1, we didn't embed every articulatory and morphological panel into figure. We preferred to display more common reading errors patterns. Errors presented here are seen on languages as Turkish of which unmarked word order is SOV. PWS may not able to clear up main sentence structure and SOV interaction also within affections of pause and repetition. Interestingly (Fig.1), some, but not many of PWS aware of errors and by repeating the word one or two times and they corrected it well. However, this may not prove their awareness of reading skills well.

There was a significant relationship between the SANS scores and reading errors including additions and omissions which was computed as for addition, r(15)=.61, p=0.05 (2-tailed); for omission r(15)= .64, p=0.05 (2-tailed). Other significant relations were as follows: Being blunt, allogenic and apathy were associated with addition errors r(15) =.59(p=0.05)(2-tailed), r(15)=.59(p=0.05)(2-tailed), and 56(p=0.05)(2-tailed) respectively. Further, omission errors were more pronounced with allogenic, apathy, and asocial scores: r (15) =.57(p=0.05) (2-tailed), r(15) =.66(p=0.05)(2-tailed) and r(15)=.55(p=0.05)(2-tailed) respectively. There was a significant relationship between attention and repetition sub scores of the SANS r (15) =.56(p=0.05) (2-tailed).

There are different types of phonological structure observed in readings of PWS when segmentation of words into syllable or morphemes taken into account descriptively (Figure.2).

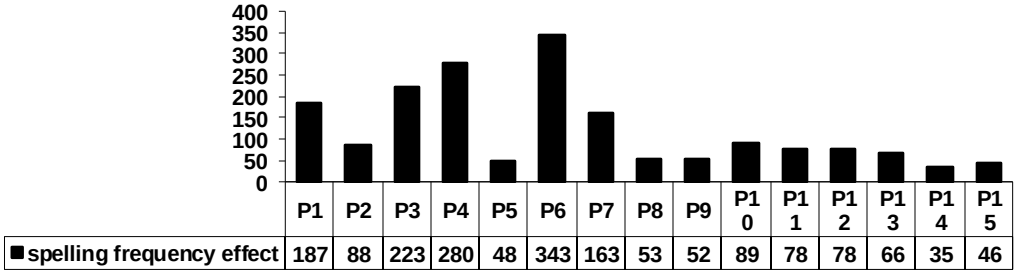


Figure 2: Patients impaired in spelling frequency by syllable pause

Many, but not all the PWS did similar types of articulatory reading errors: as substitution, distortion, deletion, addition, final and initial position errors.

When the reading errors were analysed, syntactic/grammatical properties are assembled in following variables: segmentation of sentences into phrases, perception of sentences with embedded and all related clauses, percentage of case and tense relation, percentage of sentences with attention impaired success (Figure.3, 4).

Numeric pause scores in violated patients

Patients	P1	P2	P3	P4	P6	P7
Syllable	187	88	223	280	343	163

Word	291	142	205	151	65	36
Sentence	0	0	0	0	0	0

Figure 3a. Numeric 'duration measurable' pause scores of most violated patients with schizophrenia

Numeric pause scores in all patients

Patients	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15
Syllable	187	88	223	280	48	343	163	21	52	89	78	78	66	35	46
Word	291	142	205	151	23	65	36	32	24	47	53	41	112	75	37
Sentence	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0

Figure 3b: Numeric 'duration measurable' pause scores of listed patients with schizophrenia

Figure. 4 (a) Above Left Panel: Impaired repetition variables. (b) Right Panel: Numeric scores of all patients. (c) Below Left Panel: Percentage of correction and repetition in all patients.

While reading the passage combining morphologic structures resulted in reading skill as every syllable being considered as a new word (Figure.5). As seen in Fig 5, PWS-3 was read every syllable as a new word and also he combined two different sentences, as there was only one sentence.

Spelling frequency and unusual pauses between syllables were also present which were affecting reading acuity and causing problems in the area of rhythm of the reading. Distribution of the spelling frequency by syllable pause among PWS is in Figure. 6.

When we analyse the pause during reading activity we assembled pause in three structural levels: syllable, word, and sentence. As seen in (Figure.6), PWS embedded pauses mostly between syllables. These types of pauses are also phono- tactically measurable. However, we assume that acoustic data of syllable pause display different duration spaces and it may be clearer to comprehend how patients place stress on every syllable in a word.

Some, but not all patients read syllables well attached to word, even it is clear to select the main stress. However, in these types of pauses, some patients embedded pauses between words as seen in Figure.7.

Repetitions and omissions are the final component of morphological analysis. In this study repetition impairment evaluated in three structural levels: syllable, word and sentence (Figure.8). All of the patients had difficulty in reading the task due to repeating syllable and word structures, especially by spelling. However, sentence repetition wasn't widely common in reading performances (PWS-1, PWS-2, PWS-11, and PWS-13). Analysing repetitions there were minimum 6 repetitions (PWS-9), and maximum 33 (P1) with a mean of 13.6 repetitions (SD=7.1). Omission were also present in the reading error pattern (Figure.9).

Common errors of omission were with conjunctions and pronouns (Figure.10). In pronoun table, 12 patients skipped [sen >you] pronoun (it is possible to drop pronouns in Turkish word order), 3 patients skipped [de>also] conjunction.

Next, in all reading tasks, as cited in repetition errors, there seem prominent word omissions. For instance, most of the patients skip same words. We assume that this may be a fact of syntactic structure of such sentences (Figure.12). Therefore, final parts of morphological errors show visible connection with mental concentration and lack of attention on patients with paranoid schizophrenia It is significant to cite that all numeral pause scores display a phonotactically analysed measurements. Because in reading performances of patients with schizophrenia, this issue may not able to be noticed easily by 'listening analysing method', it should be analysed in an acoustic method. However, time measurements of pause and all levels are not displayed acoustically in here. It is studied in further research.

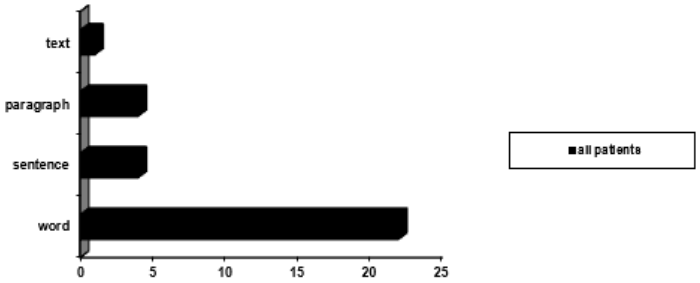


Figure 11: Omission errors in all patients

Common Errors	
Conjuction	"Hele gel **X (de)** su manzaranın güzelliğine bir bak" dedi. **(P5)** *You just come! Look at the beauty of this view! He said.*
Pronoun	Yahu **X (sen)** yemekten icmekten baska bir sey düsünmüyor musun! **(P1, P3, P5, P7, P8, P9, P10, P11, P12, P13, P14, P15)** *Don't you think anything else other than eating and drinking!*

Figure 12: Common errors of omission. In pronoun table, 12 patients skipped sen >you pronoun (it is possible to drop pronouns in Turkish word order), 3 patients skipped de>also conjunction.

3.3 Summary

Consider aim of this study, it is possible to discuss morphological based model of reading patterns of patients with schizophrenia. Different types of morphological reading error patterns are changed between patients (Figure.13). This exhibited that many patients are impaired mostly on morphological and grammatical levels. As we referred above, patients with schizophrenia have impairments on pragmatic and semantic reasons. The results of this study represent that including reading and speech; all related constituents of language (phonology, morphology, semantics, and pragmatics) may also be affected. As well as schizophrenic speech, oral reading errors present a fundamental relation to all language levels.

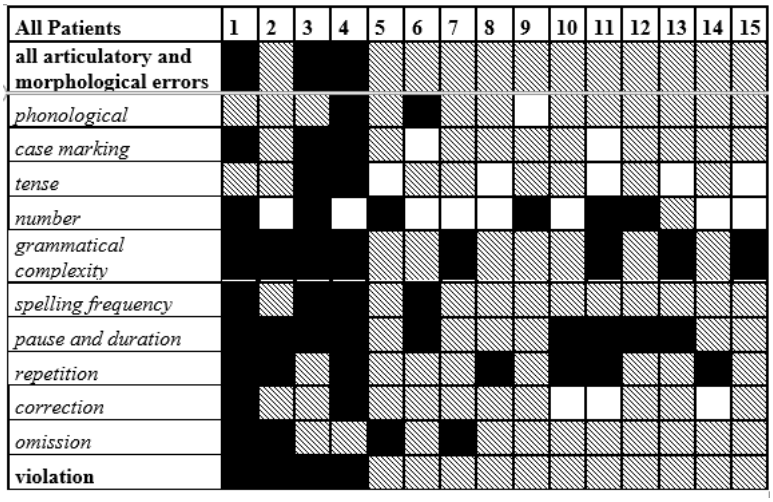


Figure 13: Graded values of violations. Black section: most violations; white lined section: lower violation up to black; white section: no violations.

5. Discussion

Since the seminal investigation of language in schizophrenia by Kleist (1914), who reports deficits in affected patients in multiple areas of language, including morphology, we are aware of only a few brief mentions of morphological abnormalities in the literature (Covington et al., 2005; DeLisi et al., 1997). Some previous studies have linked schizophrenic reading errors to various causes such as working memory impairment (Bagner, 2003), poor comprehension (Hayes, 2003), and difficulties with phonological (Arnott, 2011) or visual processing (Reyheim, 2006) deficits. This study attempted to apply the morphological based model to the reading while representing error patterns of the patients. All morphemes we explore within this study may exhibit a fundamental fact of reading errors as in the main structure of syntax (Condray et al., 2002) and phonology (e.g. Chaika 1974; 1990, Clemmer 1980). Analysis of the two related structure of language in a morphological approach was utilized: errors in phonological and morphological levels.

Reading errors can be observed in different types of disorders such as attention deficit hyperactivity disorder (ADHD), sub-types of depression disorders, aphasia, alcoholism, conversion disorders and obsession disorders are some of them (Lecours & Vanier-Clement 1976; Silver 2003; Wender 1995; Riccio & Cecil 2001; Gold et. al., 1997). Barr (2001) compared their all-language performances of subjects with attention deficit disorder (ADD) to schizophrenia. He concluded that attention is a key factor for language however; these two groups have in common distractibility and maintain focus of attention which interferes with adequate language process. All these reports show that structural language impairments on these disorders and schizophrenia may have common neural pathways in the brain.

Text reading relies on the ability to select words and their features based on their spatial location on the written page. This ability is largely mediated by neural pathways in the dorsal visual stream which receive strong magnocellular input. Any impairment along the dorsal pathway can cause an

inability to move the focus of attention along the length of each word and thus lead to poor reading performance (Pammer et al., 2006).

Most of the studies of cognitive dysfunction in schizophrenia have focused on attention, executive processing or working memory (Goldman-Rakic, 1994). More recent studies, however, point to significant deficits in visual sensory processing as well. Deficits in visual performance of patients with schizophrenia have been described for many years. The findings of a new fMRI study have supported the hypothesis that schizophrenia is associated with impaired functioning of the magnocellular visual pathway and further suggested that these sensory processing deficits may contribute to higher-order cognitive deficits in working memory, executive functioning, and attention (Martinez 2008). The magnocellular/dorsal component of visual recognition system plays an important role in normal reading (Levy et al., 2010). It can be suggested that impaired sensory processing of magnocellularly biased reading related visual stimuli lead to impairments in the effective processing of various aspects of reading performance including pausing, stressing and prosody.

In this study, it has been demonstrated that embedding pause between words into a sentence may bring out 'accent impairment' in schizophrenic prosody. Embedding pause into sentences also form inflectional reasons (Fig.7). For instance, P1 sounded a non-inflectional form *(bit-**mek** > **to** finish)* by an inflectional form *(bit-**miş** > finish-**ed**)*, then he embedded pause after the inflectional verb for Turkish. It is significant to state that P1 separated sentence into two different sentences, due to embedding pause inside of one sentence. This example may display that there is a dependable combination between sublexicalization and pause. Furthermore, we select examples of pause between patients, more affected in other morphologic reasons. By this method, it is clearer to comprehend that pause can affect patients to make morphologic reading errors. In addition to these, out of 15 patients, only P5 embedded two prominent sentence pauses in the same paragraph (as 20 sentences, 13 sentence.). Seen in (Table 3),

Mean	27,8
Median	27
SD	1,35
Min	27
Max	30

Table III. The SCF distribution of the control group

Numeric pause scores of P5 is more below than stop scores of other patients. In addition to (Table 3), numeric pause scores of all patients with schizophrenia are shown in (Table 4).

There is a case which makes repetition more significant than all other morphological impairments in oral reading performances. It is considered that repetition errors show a typical comprehension on mental concentration and correction. In our research, in all part of morphologic impairments, owing to not turning back to structure, patients could make impairments more prominently. However, patients hardly corrected by repeating structures one or two times in many examples. This might represent that repetition is a significant reason to see 'fixation' and 'attention process' easily, but in other hand it is an obvious reason for corrections (Figure.8).

In addition to repetition, omission errors are common on syntactic structure. However, omission is almost seen at the end of the texts. Six patients did omission errors in the first reading task (261 words, 42 sentences) which consists of three paragraphs modified with pragmatic items as referred above. 4 patients didn't read last passages, 2 patients didn't read half of the last passages. Out of those 2 patients, 1 patient (P4) didn't read the second reading task (57 words, 18 sentences) which mostly consists of ironic items (Figure.9).

In all reading tasks, as cited in repetition errors, there seem prominent word omissions. For instance, most of the patients skip same words. It is assumed that this may be a fact of syntactic structure of such sentences of Turkish language (Figure.10). Repetitions and omissions during reading activity are common in PWPS (Todt & Howell, 1980; Grillon et al., 2005). This study confirmed such error pattern as well.

6. Conclusion

Reading skills of PWS suggested that phonology, syntax as a lexical / grammatical process related in attention and information process, other levels of morphological identification and duration patterns. Morphological and grammatical process is variable and complex in all PWS. It is widely demonstrated that PWS have dysfunction to comprehend and product sentences with syntactic structures (Morice & McNicol 1985, Morice 1995, Thomas & Leudar 1995, Chaika 1995). However, this process is related to speech production; it may not be included into reading skills. PWS are impaired in mental concentration and information processing. Thus, reading errors of complex syntax may not be related into 'generative structure' (as well stated in literature); it is probably the outputs of unsustainable attention (Figure.2). For instance, as widely known, Turkish is an ended inflectional language and its unmarked word order is SOV (subject-object-verb). Therefore, if reading errors were results of production and comprehension of generative structure, PWS could able to perceive firstly the verb, then they could associate verbs to argument structure. The PWS made more unmarked errors than healthy adults at regular and novel verbs (*shrug-shrug, plag-plag*) but not irregular verbs (*drive-drive*) (Walenski et al., 2010). This finding was consistent with previous findings from patients with grammatical/procedural deficits (Parkinson's disease; anterior aphasia) (Ullman, In Press; Ullman et al., 1997; Ullman et al., 2005). The PWS made more intrusion errors on regular and novel (*scowl-scold, traff-door*) than irregular (*dig-conquered*) verbs (Walenski et al., 2010). However, in this study morphological impairments nearly are seen in endings. Due to lack of attention, PWS may not able to be conscious of word order well and they may be significantly impaired in morphological function: as pause, repetition and omission. Thus, taking into account the morphological impairment may provide useful information for understanding error patterns in PWS's reading at least in transparent languages, like Turkish. Further studies in this area are needed with the focus on attention, concentration, stay on task and eye-movement management tasks are embedded in the study while examining the reading activity. In this study, we have not looked at the understanding component of the reading process. That part is also needs to be addressed.

Conflict of Interest

The authors declare no conflict of interest.

Authors' Contributions

MMC, OAS: study concept, data collection; MMC, OAS: analysis, writing;

MMC, OAS: literature review, editing.

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