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Modality- and Task-Specific Impairments in Speaking and Reading: A Case Report From Persian[1]

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Abstract

The question of whether specific patterns of impairment across different language modalities are isolated, associated, or doubly dissociated has been a major theoretical issue in aphasiology. In this paper, we describe modality- and task-specific language impairments in a Persian-speaking patient (AG) with ischemic stroke. AG's overall language impairments were evaluated using the bedside version of Persian Western Aphasia Battery (P-WAB-1), which indicated an Aphasia Quotient (AQ) index of 86. Moreover, his performance on the Reading subtests of the Persian Diagnostic Aphasia Battery (P-DAB-3) indicated a Language Quotient (LQ) index of 60. We also evaluated his word reading, sentence reading, and sentence repetition using the subtests of the Persian version of the Bilingual Aphasia Test (BAT). Based on his performance on these assessment tools during the chronic post-onset time, AG was diagnosed with transcortical motor aphasia. Notably, he exhibited two striking characteristics, namely, (a) a modality-specific dissociation, with severely impaired reading comprehension in

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the face of relatively spared auditory comprehension; and (b) a set of task-specific agrammatic symptoms in verbal expression and out-loud sentence reading in the context of relatively well-preserved sentence repetition. The general characteristics of our patient's grammatical violations also highlight certain universal and language-specific agrammatic impairments. The present clinical linguistic data argue against the existence of monolithic speech-related regions in the brain.

Keywords: aphasia, modality-specific dissociation, task-specific agrammatism, Persian

1. Introduction

It is generally recommended that acquired language disorders should be described in relation to the locus, extent, and etiology of the lesion as well as other premorbid abilities. This approach largely follows from Poeppel and Hickok's (2004) argument about the anatomical shortcomings and functional underspecification of the classical narrow localization brain–language model. For example, there are case reports demonstrating that patients with the same lesion site and etiology behave differently with respect to aphasic deficits (Nilipour et al., 2010). In the present paper, we provide tentative evidence for a dissociation of impairments between two language modalities, that is, reading and auditory comprehension, in a Persian-speaking patient with aphasia. Further inspection of the current clinical linguistic data also reveals task-restricted deficit profiles and some language-particular agrammatic impairments.

2. Associated and Isolated Modality Impairments Revisited

A longstanding controversy in aphasiology revolves around the question of whether the relative degrees of impairment across the four language modalities (i.e., verbal comprehension, speech, reading, and writing) are isolated, associated, or doubly dissociated. Classical aphasiological studies were mostly concerned with the location of independent language processing centers in the brain (Geschwind, 1970). In this localizationist view, they sought distinct aphasia syndromes based on postmortem studies. This finally led to the idea of *isolated modality impairments*, according to which some modalities may be impaired, while others may remain partially or completely intact. Others,

however, have argued that all language modalities may become impaired to approximately the same extent (Duffy & Ulrich, 1976; Smith, 1971). For instance, people with Broca's aphasia who have agrammatic speech would also exhibit impairments in reading and writing grammatical words.

Given that linguistic domains have rich internal structure with numerous subcomponents, Poeppel and Hickok (2004) have argued against the existence of anatomically or functionally monolithic speech-related regions. In this case, we cannot determine with certainty any one-to-one relationship between lesion sites and aphasia syndromes. To provide a more comprehensive account, Pulvermüller (2002) proposed the notion of *neuropsychological double dissociation*. He argues that following associative learning, discrete distributed functional webs are established. However, subsequent to lesions in specific parts of the networks, the strong links among distant neuron ensembles may become functionally separate again. Therefore, it is not too farfetched to expect that one or two modalities may be selectively impaired, while others may remain spared to varying degrees, depending on the lesion site and size.

Evidence accumulated so far demonstrates varying degrees of impairment across different language modalities and linguistic tasks (Assal & Buttet, 1981; Nilipour, 1989; see also Hier & Mohr, 1977). Assal and Buttet (1981) reported a native French speaker (JFM) with a large zone of hypodensity in the left middle cerebral artery following a vascular accident. A striking feature of JFM's language performance was a dissociation between his oral and written disorders. He had expressive and receptive difficulties in both oral and written modalities. His verbal expression was slow and poor in vocabulary, but with no signs of agrammatism. As opposed to his verbal modality, JFM showed typical agrammatic features in the written modality. At reception, his reading comprehension of short commands was superior to that of his severely impaired auditory comprehension. Close inspection of JFM's linguistic profile implied that he was characterized with Wernicke's aphasia in the oral modality and Broca's aphasia in the written modality.

In addition to studies supporting modality-specific language deficits, one aphasic patient (PA) has been extensively reported as reflecting task-

specific agrammatic symptoms (Nilipour, 1989). She was a Persian–English bilingual with a left side cerebrovascular accident (CVA) in the frontotemporal area. Whereas her oral production and comprehension were almost preserved, PA manifested major grammatical violations in Sentence Oral Reading and Sentence Repetition tasks of the BAT (English and Persian versions; Paradis et al., 1987; Paradis et al., 1987). Interestingly, these violations were compatible with the structural properties of each language. For example, whereas her performance in Persian involved omission of grammatical particles, substitution of bound morphemes, and reconstruction of verb inflection, all of the violations in English were omission of grammatical morphemes. This study demonstrated that syntactic processing impairments can be not only restricted to certain linguistic tasks, but also specific to structural properties of languages. Given the site, extent, and etiology of the lesion in the present case, we aimed to examine whether impairments of verbal expression and comprehension parallel patterns of expressive and receptive disorders in the reading modality. To anticipate, the patient exhibits not only modality-based degrees of vulnerability, but also task-based sets of deficit profiles that are in part specific to the structural properties of Persian.

3. Case Description

AG is a 60-year-old right-handed native speaker of Persian, with five years of elementary education. He worked as a company manager and had no history of difficulties with spoken and written language in Persian prior to his illness. He reported to have been previously suffering from high blood lipid levels, however. A few days after experiencing a mild heart attack, he lost his consciousness consequent to an ischemic CVA on the way back home from a journey on February 4, 2018. He was hospitalized in Shahid Beheshti hospital in Qom and fell into a one-month coma. Upon regaining consciousness, he reported to have lost his speech production, repeating only meaningless syllables for the first 30 days. AG was referred to speech therapy and physiotherapy on April 21, 2018 (2.5 months post-onset). By the time of this examination, he has undergone speech therapy once a week for almost 14 months.

His brain scans, taken on February 5, 2018 (Figure 1) and July 29, 2018 (Figure 2), indicate that there is evidence of cerebral edema extending superiorly from the left medial temporal lobe affecting severely the temporoparietal areas. Specifically, it includes the temporoparietal junction, the angular and supramarginal gyri as well as small portions of the superior temporal gyrus. In the left medial frontal lobe, particularly in the Anterior Cingulate Cortex (ACC) of the left cerebral hemisphere, edema is also evident. It should be noted that the extent of edema in the superior temporal and angular gyri decreased by almost one-half over 6 months between scan time points.

Figure 1

AG's CT scan taken on February 5, 2018. Affected regions are plotted onto axial slices.

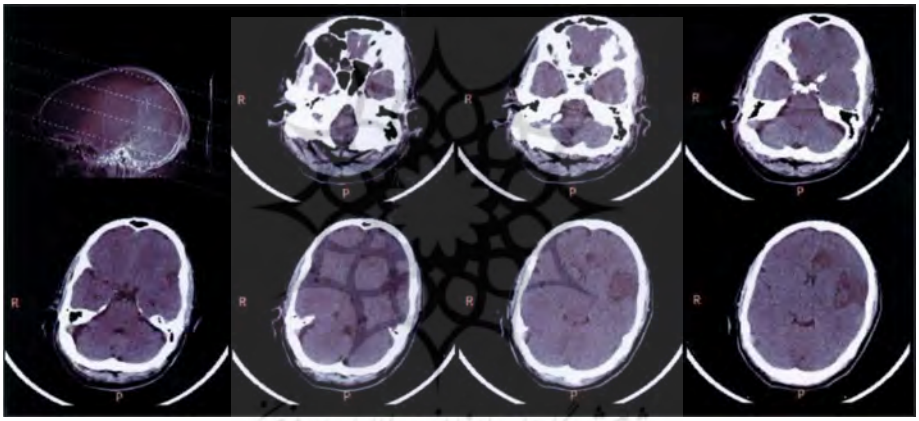
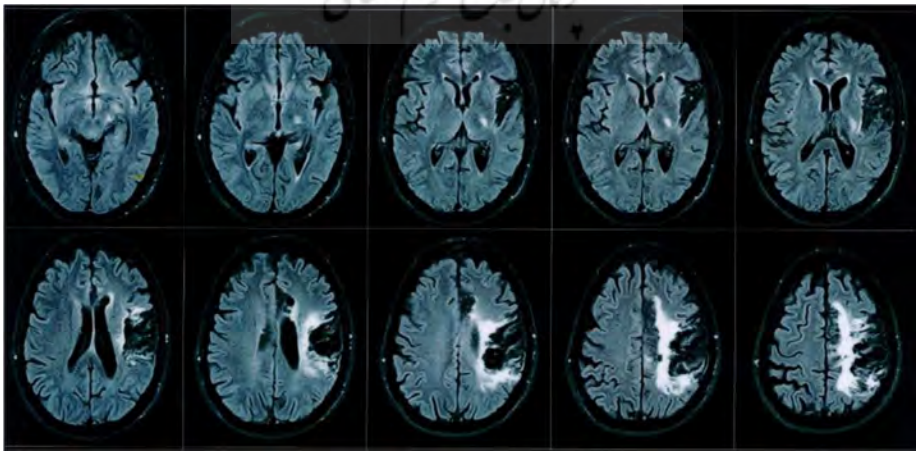


Figure 2

AG's MRI scan taken on July 29, 2018. Affected regions are plotted onto axial slices.



His language impairments were assessed during the chronic phase of aphasia (15 months post-onset). He was alert, well-oriented, and cooperative, with no gross cognitive damage preventing him from concentrating during the three test sessions. No major hearing problems or visual field defects were observed. He suffered from right hemiparesis but had no left-sided sensory-motor deficits. AG could not use his right hand for fine motor activities, but he was able to use his left hand for a very rough sketch of simple words. In addition, we observed acalculia in performing simple mathematical operations. Acalculia is one of the symptoms of Gerstmann's syndrome, which is associated with lesions in the left angular gyrus (Gerstmann, 1940). AG's short-digit span memory was 4.

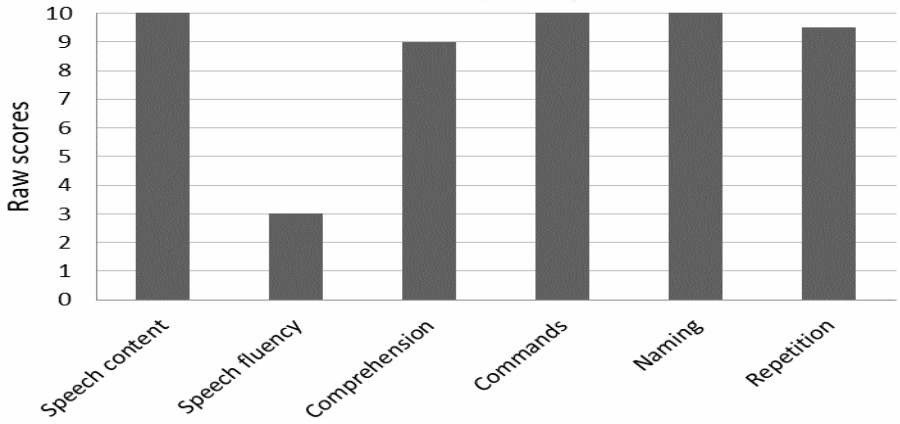
4. Language Assessment Tools

4.1 Evaluation of Oral Skills

In the first session, AG was assessed using the bedside version of P-WAB-1 (Nilipour et al., 2014). Based on AG's AQ index (86 out of 100), his overall severity of aphasia is classified as mild. The clinical picture of his performance on the P-WAB-1 can be summarized as good auditory comprehension, good repetition, good confrontation naming, but nonfluent speech (Figure 3). The subtest of sequential commands was also performed without the least difficulty. Based on the obtained operational index and classical classification criteria (Paradis & Libben, 1987), these symptoms are compatible with a diagnosis of transcortical motor aphasia.

Figure 3

AG's raw scores on the subtests of the P-WAB-1.



The evaluation of AG's spontaneous speech indicated that his verbal comprehension was markedly superior to his effortful and nonfluent expression. It comprised a total of 50 words (43 content words and 7 function words), with an overall mean length of utterance (MLU) of 3.15. His descriptive speech on the Bird Nest Story resulted in 15 utterances comprising 42 words (37 content words and 5 function words), with an overall MLU of 2.8. The fluency rate was 18 words per minute; his type–token ratio was 0.88.

The analysis of AG's connected speech confirmed that it was characterized by laborious articulation, distorted pronunciation of certain words, and imprecise consonant production. These dysarthric speech problems seem to have arisen from the presence of cerebral edema in the ACC of the left hemisphere, which is assumed to have a modulatory influence on some aspects of higher-order motor control such as vocal production (Jürgens & von Cramon, 1982; Paus et al., 1993). He also exhibited instances of omission (e.g., /lune/ "nest" was replaced by [une]), substitution (e.g., /gonješk/ "sparrow" was replaced by [gondet]), and one case of neologism (i.e., /gonješk-hā/ "sparrows" was replaced by [gott-ā]). A description of AG's performance from the elicited speech sample is provided in what follows.

Postposition direct object marker. The post-posed direct object marker /-rā/ was omitted in two instances out of three required contexts; it was used only in one instance (3).

1. *bi-ār-id* *tado-punda* (*s*ado-punzda*h*)[1] *[-rā]*
   V-(IMP: 2PL) N [postp]
   bring sado-punzdah[2] [OBJ]
   bring sado-punzdah
2. *barānkārd* *[-rā]* *āvard-and*
   N [postp] V-(PAST: 3PL)
   stretch [OBJ] brought-they
   they brought (the) stretch
3. *une* (*l*une) *-rā* *bardāt-a-Ø* (bardāšt-*e-Ø*)

[1] The correct pronunciations of words are provided in parentheses.
[2] /Sado-punzdah/ "115" is the emergency telephone number for the ambulance service in Iran.

N [postp] V-(PAST: 3SG)
nest [OBJ] picked up-he
(he) has picked up (the) nest

Possessive morpheme. Possessive morphemes were correctly used in four required contexts.

4. *del-at* (del-a*š*) *[dārad-Ø] be āle-tun* (*h*āle-*š*un) *mi-tud-ad-Ø* (mi-*s*uz-ad-*Ø*)
N-POSS [AUX] prep N-POSS PROG-V: 3SG
heart-her [has-she] for status-their breaking
her heart is broken for their status

Plural morpheme. Grammatical morpheme errors were rare in his speech. However, only in one instance (5) a plural noun was not marked with the regular plural morpheme /-hā/.

5. *[zan] negāh be atte*[1]*-goje[-hā]* (*l*atte-go*n*je*šk*[-hā]) *dārad-Ø*
[N] N prep N[-h*ā*] V-(PRES: 3SG)
[woman] looks at chick-sparrow[s] has-she
[the woman] is looking at (the) hatchling[s]
6. *atte-e gott-ā* (*l*atte-*gonješk-hā) badbax* (badbax*t*) *tod-and* (*š*od-and)
N-LINK N: PL ADJ V-(PAST: 3PL)
chick-of sparrows miserable became-they
(the) hatchling[s] became miserable

Past tense morpheme. AG used past tense morphemes in five required contexts correctly.

7. *doctor mo'ālej-aš kard-Ø*
N N CLITIC V-(PAST: 3SG)
doctor treatment him did
(the) doctor treated him
8. *tu āmbulānt-et* (āmbulān*s-aš*) *godāt-and* (gozā*š*t-and)
prep N CLITIC V-(PAST: 3PL)
in ambulance-him put-they
they put him in (the) ambulance

[1] In AG's local accent, /bačče/ "child" is pronounced /latte/ whose first phoneme /l/ is omitted in his speech.

Conjunctions. The coordinate conjunction /va/ "and" was missing from almost four required contexts; the missing conjunctions were replaced by a long pause.

9. *deraxt vāžegun tod-Ø* (šod-*Ø*) *[va] [mard] pate* (part) *tod-Ø* (šod-*Ø*)
   N ADJ V-(PAST: 3SG) [conj] N N V-(PAST: 3SG)
   tree capsized became [and] [man] fell became
   (the) tree was downed [and] [the man] fell
10. *barānkārd [-rā] āvard-and [va] tu brānkārd-et* (brānkārd-*aš*) *kard-and*
    N [postp] V-(PAST: 3PL) [conj] prep N pro V-(PAST: 3PL)
    stretch [OBJ] brought-they [and] on stretch-him did-they
    they brought (the) stretch [and] laid him on (the) stretch

Nouns. In AG's speech, most of the sentences lacked an agent or experiencer in the subject position. Overall, he used 13 nouns in the elicited speech sample.

11. *[zan] [dārad-Ø] doton-e* (*nešā*n-e) *towar-eš* (šow*h*ar-*a*š) *mi-de-Ø*
    [N] [AUX] N N POSS PROG-V: 3SG
    [woman] [has-he] show spouse-her giving-she
    [the woman] is showing her spouse
12. *[zan] negāh be atte-goje[-hā]* (*l*atte-go*n*je*šk*[-hā]) *dare-Ø*
    [N] N prep N[-h*ā*] V-(PRES: 3SG)
    [woman] looks at chick-sparrow[s] has-she
    [the woman] is looking at (the) hatchling[s]

Verbs. The verb, which is conjugated for person, number, and tense, was properly used in all required contexts. However, he preferred to use the past tense form of the verbs in four contexts where it was more appropriate to use the present continuous tense form (see sentences 7 and 10). Overall, there was only one case of verb omission.

13. *[zan] telefon [mi-zan-ad-Ø]*
    [N] N [PROG-V: 3SG]
    [woman] telephone
    [the woman] is telephoning

Progressive verb prefix. The obligatory prefix /mi-/, which indicates progressive aspect on the simple present of content verbs, was correctly used in two required contexts (sentences 4 and 11).

Imperative. /be-, bi-/ as an obligatory prefix on imperative verbs appeared once on a morphologically correct form (sentence 1).

Auxiliary. There were two cases of auxiliary verb deletion in two required contexts (sentences 4 and 11).

Pronouns. AG never used independent personal pronouns in his speech. This might be because Persian is a pro-drop language in which personal pronouns are optional. However, he used the clitic pronoun /-aš/ "him" resumptively at the end of nouns (sentences 7 and 8).

4.2 Evaluation of Written Skills

In the second session, AG's written language skills were examined using the Reading subtests of the P-DAB-3 (Nilipour et al., 2015). This battery provides an LQ score as a severity index of oral, written, and reading skills. He obtained a score of 8.5 (out of 20) for his performance on the Reading subtests. Since he was not able to use his right hand for the Writing section, AG exhibited a moderate LQ index (i.e., 60 out of 100).

4.2.1 Reading Comprehension

In this task, Reading stimuli were in a multiple-choice format, and the patient had to choose an appropriate word from among four options to fill in the blanks. At reception, his reading comprehension was markedly inferior to his auditory comprehension. He could answer only the first items that included short simple sentences (score = 12 out of 40). At expression, he showed frequent agrammatism by constantly omitting function words and using morphologically simpler content words. At one point in reading a simple word /barf/ "snow," he repeated /bar-/ a few times, but was not able to identify the last phoneme and replaced it with /g/; this resulted in another word /barg/ "leaf." Nevertheless, he immediately hesitated that this might not be the right word and after several trials in seemingly groping for the right sound, he could finally read the word correctly. A sample of AG's reading performance is presented in the Appendix.

4.2.2 Semicomplex Commands

In reading a number of sentences aloud and then executing the required actions in the correct sequence, AG had a very poor performance. He could understand and execute only one out of a total of six sentences.

4.2.3 Matching Tasks

To evaluate semantic processing, matching tasks were administered by using the same words (six items) in each task. AG's reading of written words and matching them to their corresponding objects and pictures were perfectly performed. He failed to identify two words on matching pictures to words seen. On matching words heard to words seen (four items), he could not respond to two items. He selected either words that were minimal pairs (e.g., /tiz/ "sharp" instead of /miz/ "chair") or words that were phonologically similar (e.g., /polow/ "rice" instead of /pāltow/ "coat").

4.2.4 Recognition Tasks

In the Recognition of Letters (six items), AG failed to identify two letters (score = 4). In the Recognition of Syllabized Words (six items), he was not able to recompose individually presented letters into their corresponding words, particularly in words with more than four letters (score = 3). In the Syllabification task (six items), he had difficulty decomposing words heard into their corresponding individual letters, especially with di- and trisyllabic words. He correctly responded to only two monosyllabic words (i.e., /mār/ "snake" and /āb/ "water").

4.3 Complementary Tests

In the third session, we administered additional tasks, including Word Reading, Sentence Reading, Sentence Repetition, and Matching Sentences to Pictures by using the subtests of the Persian version of the BAT (Paradis et al., 1987) and the P-DAB-3 (Nilipour et al., 2015). AG was successful in reading more than half of the regular and irregular words, but his ability to read nonwords was severely impaired. Although AG was able to repeat almost all the sentences, his sentence reading was characterized by paraphasias, omission of grammatical particles, and structural simplification that resulted in poor sentence-to-picture matching performance.

4.3.1 Reading Regular Words

In this task, the patient read a list of 10 Persian regular words, including eight nouns and two adjectives. The list included seven monosyllabic and three disyllabic words in the Persian version of the BAT (Paradis et al., 1987). He was able to read two words correctly (/barde/ "slave" and /bār/ "burden"), yet four words were characterized by phonemic paraphasia (e.g., [tar] was substituted for /sar/ "head"). He also misread either the initial or the final syllables/sounds of four other words (e.g., [čāne] "chin" was substituted for /dāne/ "seed," [čāy] "tea" for /čāq/ "fat," [xormā] "date" for /xol/ "clumsy," and [panir] "cheese" for /tir/ "arrow"). Overall, he obtained a score of 6 out of 10.

4.3.2 Reading Irregular Words

In this task, AG read 10 Persian irregular words, including concrete, abstract, and proper nouns in the P-DAB-3 (Nilipour et al., 2015). He could read two proper nouns correctly (/kobrā/ and /ʾisā/) as well as one concrete noun (/roqan/ "oil"). However, four words were characterized by phonemic paraphasia (e.g., [ortid] was substituted for /xoršid/ "sun" and [tiār] was substituted for /xiār/ "cucumber"). He also skipped the initial phoneme in the word /xāb/ and failed to read one word /nok/ "beak." Overall, he obtained a score of 8 out of 10.

4.3.3 Reading Nonwords

The phonological processing of written words was assessed by reading nonwords. This task consisted of 10 nonwords which included two monosyllabic and eight disyllabic items in the P-DAB-3 (Nilipour et al., 2015). AG could not read any of the items correctly. For example, /tarjam/ was replaced by [motardem] (i.e., /motarjem/ "translator"), /xarād/ was replaced by [dordād] (i.e., /xordad/ "the name of a month in Persian calendar"), and /dāxem/ was replaced by [tānom] (i.e., /xānom/ "lady").

4.3.4 Reading Sentences Aloud

This task consisted of 10 sentences of various syntactic constructions and complexities based on the Sentence Reading subtest of the BAT (items 377–386). These sentences were presented to the patient one by one, and he

was asked to read them aloud. AG's performance on this task is presented in Table 1.

Table 1

AG's Performance on the Out-Loud Sentence Reading Task of the BAT

Syntactic structures	Persian sentences	English translation
377. Standard word order, noun as subject or object	/doxtar pesar-rā hol mi-deh-ad-Ø/ pe*t*ar *motkelātun*-rā h*a*l mi-*kon-and*	The girl pushes the boy.
378. Standard word order, pronominal reference	/pedar be xod-aš negāh mi-kon-ad-Ø/ pe*t*ar Ø xod-a*t*	The father looks at himself.
379. Nonstandard word order, OSV for SOV	/sag-rā gorbe gāz mi-gir-ad-Ø/ ag gorbe-rā	The dog is bitten by the cat.
380. Topicalized subject	/in kāmiyun ast ke savāri-rā mi-keš-ad-Ø/ Ø at Ø *t*avāri mi-ke*t*-ad-Ø	It is the truck that pulls the car.
381. Standard word order, negative	/zan ān mard-rā ne-mi-bus-ad-Ø/ Ø mi-bu*t*-ad-Ø	The woman does not kiss the man.
382. Nonstandard word order, negative OSV	/kāmiyun-rā savāri ne-mi-keš-ad-Ø/ *t*avāri-rā mi-ke*t*-ad-Ø	The truck is not pulled by the car.
383. Topicalized object	/in sag ast ke gorbe gāz-aš mi-gir-ad-Ø/ Ø *d*ag Ø Ø gorbe-rā gāz	It is the dog that the cat bites.
384. Standard word order, pronominal reference	/ān-hā donbāl-e u mi-dav-and/ ān-ā-*i ke* donbāl Ø	They are running after him.
385. Nonstandard word order, OSV	/xod-aš-rā ān zan mi-zan-ad-Ø/ *mard* xo*d*-a*t*-ā Ø Ø	The woman hits herself.
386. Nonstandard word order, negative OSV	/savāri-rā kāmiyun ne-mi-keš-ad-Ø/ *t*avāri kāmiyun-rā mi-ke*t*-ad-Ø	The car is not pulled by the truck.

Note. Substitutions are indicated below each word and omissions are marked by Ø.

As in his speech, AG exhibited phonemic paraphasias and one case of semantic paraphasia. The major grammatical violation in his reading was the omission of grammatical particles, including three bound negative morphemes and 10 function words (out of 16 cases) such as the relative clause marker /ke/, the post-posed direct object marker /-rā/, and demonstrative pronouns /in/ "this" and /ān/ "that." There was one case of verb omission in (385) and

one substitution in (377; i.e., /hal mi-kon-and/ "solve" was substituted for the verb /hol mi-deh-ad-Ø/ "push"). AG had a tendency to structurally simplify sentences with nonstandard (noncanonical) word orders (382 and 386) into canonical structures by attaching /-rā/ to the subject constituent in the object position. For example, the sentence *Savāri-rā kāmiyun ne-mi-keš-ad-Ø* "The car is not pulled by the truck" was restructured to *Savāri kāmiyun-rā mi-keš-ad-Ø* "The car pulls the truck."

4.3.5 Repeating Sentences Aloud

In this task, AG was asked to repeat sentences one by one right after the examiner (first author). The items were based on the stimuli in the Sentence Repetition task of the BAT (items 253–259). Apart from constant phonemic paraphasias, AG's ability to repeat sentences was almost perfectly preserved (see Table 2).

Table 2

AG's Performance on the Sentence Repetition Task of the BAT

Persian sentences	English translation
253. /doxtar pesar-rā hol mi-deh-ad-Ø/ pe*t*ar ol	The girl pushes the boy.
254. /u donbāl-e ān-hā mi-dav-ad-Ø/ ān-ā	He is running after them.
255. /in sag ast ke gorbe-rā gāz mi-gir-ad-Ø/ *d*ag at Ø	It is the dog that bites the cat.
256. /in pesar ast ke doxtar hol-aš mi-deh-ad-Ø/ pe*t*ar at	It is the boy that the girl pushes.
257. /savāri-rā kāmiyun ne-mi-keš-ad-Ø/ *t*avāri ne-mi-ke*t*-ad-Ø	The car is not pulled by the truck.
258. /pedar u-rā negāh mi-kon-ad-Ø/	The father watches him.
259. /mādar pesar-aš-rā bidār ne-mi-kon-ad-Ø/ pe*t*ar-a*t*	The mother does not awaken his son.

Note. Substitutions are indicated below each word and omissions are marked by Ø.

4.3.6 Matching Sentences to Pictures

To further assess reading comprehension, we asked AG to read the sentences in the Sentence Reading subtest and then to touch the pictures illustrating them. He had a very poor performance with a score of 2 (out of 10). This failure can be explained by the constant omission of function words and the structural simplification of sentences that utterly reversed their meanings.

5. Discussion

AG's brain scans indicated evidence of cerebral edema in the left temporoparietal language areas during acute and subacute stages. Based on AG's clinical linguistic profile manifested 15 months post-onset, he was diagnosed as having transcortical motor aphasia. This clinical impression was corroborated by his profile on the P-WAB-1 (Nilipour et al., 2014), the P-DAB-3 (Nilipour et al., 2015), and the subtests of the BAT (Paradis et al., 1987). The patient had therapy-induced aphasia recovery as indicated by his language improvements over almost 14 months of speech therapy treatment.

Regarding the extent to which impairments in verbal expression and comprehension may coexist with deficits in the reading modality, the data seem to suggest a different picture in the severity of disorders. That is, the patient's grammatical violations in both reading comprehension and expression were greater and more varied than those in speaking. At verbal expression, his connected speech samples indicated symptoms of an agrammatic patient, yet it was less severe than the grammatical violations in the reading modality. His utterances consisted of short single clauses and his grammar was simple and restricted. Nevertheless, he performed well in the oral naming of objects as well as repeating the dictated words and sentences. AG's impaired oral reading in the context of normal naming and repetition may indicate a perceptual disturbance. Specifically, the omission and substitution errors in identifying the initial or final portions of regular words and nonwords along with the failure to recognize some letters suggest an attentional disorder in the early stages of analysis of visual inputs (Glosser & Friedman, 1995).

In addition to structurally simplifying sentences with nonstandard word orders, AG showed typical agrammatic features by frequent omissions of free grammatical particles and bound morphemes in the Reading tasks. Evidence of morphological regression in verbs included omitting negative morphemes and using the singular form of the verbs. Morphological simplification of nouns manifested in substituting singular nouns for their plural forms. Some of these agrammatic symptoms are reminiscent of patients with *phonological alexia* whose reading of morphemes that serve primarily

syntactic functions is compromised (Patterson, 1982). Furthermore, AG exhibited semantic paralexic errors by substituting semantically-related words for target words, such as /mi-gir-and/ "take" in place of /mi-deh-and/ "give."
At reception, whereas AG's auditory comprehension was almost preserved, his reading comprehension was severely impaired. This suggests that the process by which visual inputs gain access to lexical–semantic processing components may be impaired (Glosser & Friedman, 1995). AG's profile differs from Assal and Buttet's (1981) patient (JFM) whose reading comprehension was superior to his severely impaired auditory comprehension. Thus, unlike cross-modal deficits (e.g., impaired repetition, oral reading, and naming tasks) which suggest an impairment *within* the processing component, the modality-specific dissociation of impairment in the present case (i.e., defective reading comprehension but relatively spared auditory comprehension) may implicate a disorder in *accessing* certain processing components (Glosser & Friedman, 1995).

These observations bring us to the question of whether the pattern of disorders might be task-specific. Indeed, AG exhibited agrammatic symptoms in verbal expression, particularly in oral reading, but his ability to repeat sentences was almost perfectly preserved. The clinical picture of our patient can be compared with that of a previously reported case (PA) by Nilipour (1989). Whereas her oral production and comprehension were preserved, PA exhibited task-restricted syntactic processing impairments in both repetition and out-loud reading. A comparison of PA's lesion site in the left frontotemporal areas with AG's in the left temporoparietal areas as well as their respective clinical classifications as conduction aphasia and transcortical motor aphasia indicates that deficits consequent to different brain regions and corresponding to different types of aphasia are likely to manifest relatively similar sets of performance profiles. Broadly speaking, this is evident in the patients' residual modality-specific capacities with intact oral comprehension, but impaired sentence reading.

We also observed certain universal and language-specific agrammatic impairments that manifested mainly in out-loud sentence reading. Among

universal features, the data show syntactic simplification, lesser accessibility of verbs, and more reliance on canonical forms that are consistent with the data reported from other languages (Menn & Obler, 1990). As for language-specific features, the general characteristics of our patient's grammatical violations are in part consistent with the structural properties of Persian. In accordance with the existing Persian patholinguistic data (e.g., Nilipour, 1989, 2000), these violations can be classified into the following agrammatic deficits, namely, (a) omission of free grammatical morphemes, (b) morphological simplification of nouns, and (c) verb deletion and morphological regression.

The present data are suggestive of nonunitary models of aphasia as a symptom complex phenomenon, such that the classical speech-related regions are not monolithic and aphasic patients' linguistic impairments are likely to manifest varying types and degrees of deficits as a function of site, size, and etiology of the lesion, among other factors (Poeppel & Hickok, 2004).

6. Conclusion

The overall clinical characteristics of our patient's residual linguistic capacities conform to the syndrome of transcortical motor aphasia. The present case is remarkable in two respects. First, he exhibits a modality-specific dissociation of impairment, with relatively spared auditory comprehension but severely impaired reading comprehension. Second, he shows task-specific agrammatic symptoms in verbal expression and out-loud sentence reading in the face of relatively well-preserved sentence repetition. The patient's agrammatic features are also partly consistent with the structural properties of Persian. It is worth noting that since the patient's pathologic condition presented the existence of edema in the absence of more focal cerebral lesions such as traumatic brain damage, these conclusions will have to be verified by future reports from Persian-speaking patients with different clinical histories using the same assessment tools.

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Appendix

A sample of AG's Performance on the Reading (Comprehension) Task of the P-DAB-3

In (5a) and (5b), the singular nouns /mo'allem/ "teacher" and /dānešāmuz/ "student" are substituted for their plural forms /mo'allem-ān/ and /dānešāmuz-ān/, respectively. AG also exhibited cases of semantic paraphasia; for example, in (5a) the verb /mi-rav-ad-Ø/ "goes" is substituted for the verb /bar-mi-gard-and/ "return" (see also sentence 4c). Sentence (6a) includes one case of morphological regression in which the third person plural /hast-and/ "are" is replaced by /ast/ "is" (the third singular of the copula /budan/ "to be") (see also sentence 3a).

Persian sentences	English translation
1. /sarbāz (tofang) dārad-Ø/ *t*arbā*t* *d*ofang	The soldier has a gun.
2. /āqā-ye Karimi māšin va otubus ta'mir mi-kon-ad-Ø. u yek Ø Ø amir (ta'mirkār) ast-Ø/ *mekānik* Ø	Mr. Karimi repairs car and bus. He is a mechanic.
3a. /kešāvarz-ān aqlab gandom, zorrat va sāyer-e qallāt ke*t*āvarz-*i* Ø Ø Ø Ø towlid mi-kon-and/ Ø mi-kon-*ad*-Ø	Farmers often produce wheat, corn, and other cereals.
3b. /ān-hā hamčenin mi-tavan-and (sabzi-jāt) be-kār-and/ Ø hamčen*ā*n Ø Ø *kar mi-kon*-and	They can also plant vegetables.
4a. /bā šoru'-e fasl-e bahār, eyd-e Nowruz āqāz mi-šav-ad-Ø/ Ø Ø Ø Ø Ø	At the beginning of Autumn, Nowruz eve starts.
4b. /mardom dar ta'tilāt-e Nowruz-i be didan-e ham-digar Ø Ø Ø Ø mi-rav-and/ mi-ran	People visit each other in the Nowruz holidays
4c. /va be ham (eydi) mi-deh-and/ Ø Ø Ø mi-*gir*-and	And give Eydi to one another.

5a. /mo'allem-ān dar pāyiz be madrese bar-mi-gard-and/	Teachers return to school in autumn.
mo'allem Ø pāyi*t* Ø madre*t*e mi-*rav-ad*-Ø	
5b. /ān-hā be (dānešāmuz-ān) dars mi-deh-and/	They teach students.
Ø Ø dānešāmuz mi-dan	
6a. /qāšoq va čangāl az vasāyel-e qazāxori hast-and/	Spoon and fork are eating utensils.
āšoq Ø Ø vas*ile-ye dad*āxori *ast*-Ø	
6b. /ān-hā az (felez) sāxt-e mi-šav-and/	They are made up of metal.
Ø Ø *d*āxt-e *šod-e ast*-Ø	

Note. Substitutions are indicated below each word and omissions are marked by Ø; the words in parentheses are the correct choice in the Reading Comprehension task.