

Deep Agraphia

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A case of agraphia is documented which resembles in every respect the pattern of results obtained in deep dyslexia. Pronounceable pseudowords could not be written to dictation while concrete nouns were more accurately transcribed than abstract nouns. Verbs and functions words were written very poorly and oral spelling was impaired. In addition, semantic paraphasias were present. In contrast to the deficit observed in writing, no such impairment was found for reading. It is concluded that writing can occur without phoneme-grapheme conversion and that codes generated for reading are functionally distinct from codes generated for writing.

INTRODUCTION

Studies of acquired dyslexia in terms of modern information processing concepts have revealed the existence of two reading processes which can be separately affected by brain damage. Lexical processing can take place without accessing phonological codes and is compromised in instances of surface dyslexia (Marshall & Newcombe, 1973; Shallice & Warrington, 1980). As a result, orthographically irregular words are read incorrectly while greater accuracy occurs for pronunciation of nonwords and orthographically regular words. A second process involves grapheme-phoneme conversion and when impaired results in an almost total inability to read pronounceable nonwords. In its pure form this particular deficit is the major feature of phonological dyslexia (Beauvois & Derouesne, 1979), but cases have also been reported of "deep" dyslexia, which besides showing impaired grapheme-phoneme conversion also reveal a complex array of additional deficits for single-word reading. Specifically, these patients (Marshall & Newcombe, 1973; Patterson & Marcel, 1977; Saffran & Marin, 1977) produce semantic paraphasias when reading (e.g., TABLE is read as CHAIR), are considerably more accurate when reading concrete as opposed to abstract nouns, and read function words and verbs very poorly.

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While the existence of surface and deep or phonological dyslexia supports the existence of a two-process reading model, the organization of the writing system is obscure. The importance of phonology in writing has often been stressed, in contrast to the lesser role such processing usually plays in reading. Indeed, Wernicke (1874) maintained that writing without the mediation of sound images was impossible since a "direct path from the concept formed by sensory images to the motor writing center" did not exist. Marie (1897) and Dejerine (1926) concurred with this viewpoint, suggesting that writing was inextricably linked to oral language.

Some visual-orthographic processing must occur for writing, however, since irregularly spelled words are normally correctly written. A purely phonological approach would result in errors. The nature of such processing and its relationship to phonological writing is unknown, however. While orthographic processing must in principle take place for writing irregularly spelled words, it is not clear whether regularly spelled words are also on occasion processed nonphonologically. It may be the case for example, that visual-orthographic information is only used for unusually spelled words and that phonological writing occurs in all other instances. Recent work with normals has indeed supported the strong dependence of writing on phonology (Frith, 1979, 1981; Hotopf, 1981) and does not show convincing evidence for frequent use of an orthographic route.

This in itself does not demonstrate that a purely orthographic form of writing cannot occur, however. The data obtained with normal subjects may be due to the fact that phonological writing is the preferred mode in most instances or alternatively, that testing methods are at present insufficiently sensitive to measure the role of visual processing. A number of studies using brain-damaged populations have in fact supported the existence of orthographic writing in patients with impaired phonological processing. Hier and Mohr (1977) report a case study of a Wernicke's aphasic who, in spite of very poor oral naming, was nevertheless capable of spontaneously producing the written form of many concrete nouns. These authors conclude that writing occurred "lexicographically," without reference to the sound of the word. Wapner and Gardner (1979) have suggested that anterior aphasics show only weak evidence for preserved phoneme-grapheme conversion when writing and that they instead appeared to retain a memory of the visual characteristics of the word. Wapner and Gardner (1979) speculate that both lexical and phonological routes exist in writing and that these processes are to some extent dissociable in aphasics. A similar conclusion has also been reached by Langmore (1979) and Marcie and Hécaen (1979).

The presence of two writing processes still remains a strong possibility therefore and deserves further investigation. An additional question con-

cerns the relationship between the lexical and phonological codes generated for reading and writing. If common lexical and phonological codes are involved in both processes, then a particular type of agraphia would coexist with an identical deficit in reading. Both would be due to functional impairment affecting a single processing pathway. Thus, for example, writing performance in deep dyslexia usually mirrors reading performance (Newcombe & Marshall, 1980) and can be characterized in terms of a general impairment in transcoding information phonologically. Both phoneme-grapheme and grapheme-phoneme conversion are affected.

It is possible however, that phonological and lexical codes generated for reading and writing are functionally distinct, at least to some extent. If this proved correct, then phonological or lexical agraphia could occur in the absence of a corresponding deficit in reading performance. Such a functional disconnection would provide considerable understanding of the organization of input and output systems in reading and writing.

Recently, Beauvois and Derouesne (1981) have documented a patient with surface or lexical agraphia, who although capable of correctly writing pronounceable nonwords and orthographically regular words, made many errors when writing irregular words. In contrast, the same patient showed evidence of phonological dyslexia when reading, i.e., pseudo-words could not be read while both orthographically regular and irregular words were read without difficulty. Beauvois and Derouesne (1981) conclude that lexical processing in reading is functionally distinct from lexical processing in writing.

In this paper, a patient is documented with agraphia, showing a pattern of deficits identical to that produced by deep dyslexics when reading. The ability to transcribe pronounceable nonwords to dictation was totally absent, the patient instead producing confabulatory responses or converting the stimuli into words that sounded similar to the targets. In addition, semantic paraphasias were present, abstract nouns were less accurately written than concrete nouns and performance for verbs and function words was very poor indeed. In marked contrast, reading of both words and pronounceable nonwords was extremely accurate with no evidence of semantic paralexia or difference in accuracy due to word class. The presence of deep agraphia without deep dyslexia suggests that phonological processing for reading is functionally separate from phonological processing for writing and that writing can occur even when the ability to perform phoneme-grapheme conversion is grossly impaired.¹

¹ It is worth noting that this written analog of deep dyslexia proved to be transient in the present case. Six months post onset, a portion of the test stimuli were readministered to J. C. for writing to dictation. Performance for pseudowords had improved dramatically (8/10) and no difference in accuracy was found between concrete (10/10) and abstract (9/10) words. Recovery of function clearly rules out any explanation of the deficit based on developmental difficulty in spelling.

CASE REPORT

J. C., a 21-year-old female, was admitted to hospital in February 1981 to manage the lack of intrauterine growth during 4 months of pregnancy. Four months prior to this she suffered a stroke with aphasia. During hospitalization, she continued to have multiple small episodes of transient neurological deficit. Examination failed to reveal evidence of fetal heart activity and induction of labor was carried out resulting in stillbirth. Neurological testing showed a minor drift of the right arm and slight facial weakness, with normal reflexes and intact sensation. No visual field defects were evident. Her stroke was thought to be embolic in origin and she was anticoagulated.

Lesion Localization

The patient had a C.T. with radiopaque enhancement 4 months after her stroke. This showed an atypical lesion in the left middle cerebral artery territory. The inferior portion of this infarct appeared to be continuous in undercutting the pars opercularis of the inferior frontal gyrus, involving precentral and postcentral gyri and the superior temporal gyri, the temporal operculum of the insula, the supramarginal and angular gyri partially, and the superior portion of the precentral and middle frontal gyri anteriorly (Figs. 1-5).

The lesion resembles in some respects the CT scans obtained in deep dyslexic patients. In the cases discussed by Marin (1980), the lesions were all extensive, perisylvian, somewhat larger than expected for the degree of language impairment and in all cases the supramarginal gyrus region, insula, and subcortex were involved.

Language Testing

Testing on the Western Aphasia Battery (Kertesz, 1979) 4 months after stroke (see Table 1) disclosed halting, telegraphic speech typical of Broca's aphasia. Auditory comprehension of yes/no questions (19/20) and single words (19/20) was excellent but some difficulty was experienced in executing sequential commands (8/11). Repetition of single words was accurate (6/6) but when short phrases and sentences were used as stimuli, the response was halting and nonfluent with word-finding difficulty and phonemic paraphasia. Naming of common objects was relatively good (15/20). Sentence completion and single-word responses to questions were performed flawlessly. Written comprehension of single words was found to be intact within the sample of items tested. J. C. correctly matched simple written words to both real objects (6/6) and visual representations of these objects (6/6). She was also capable of reading single words (6/6) and letters (10/10) aloud. Comprehension of written sentences was adequate (6/8), though difficulty occurred when

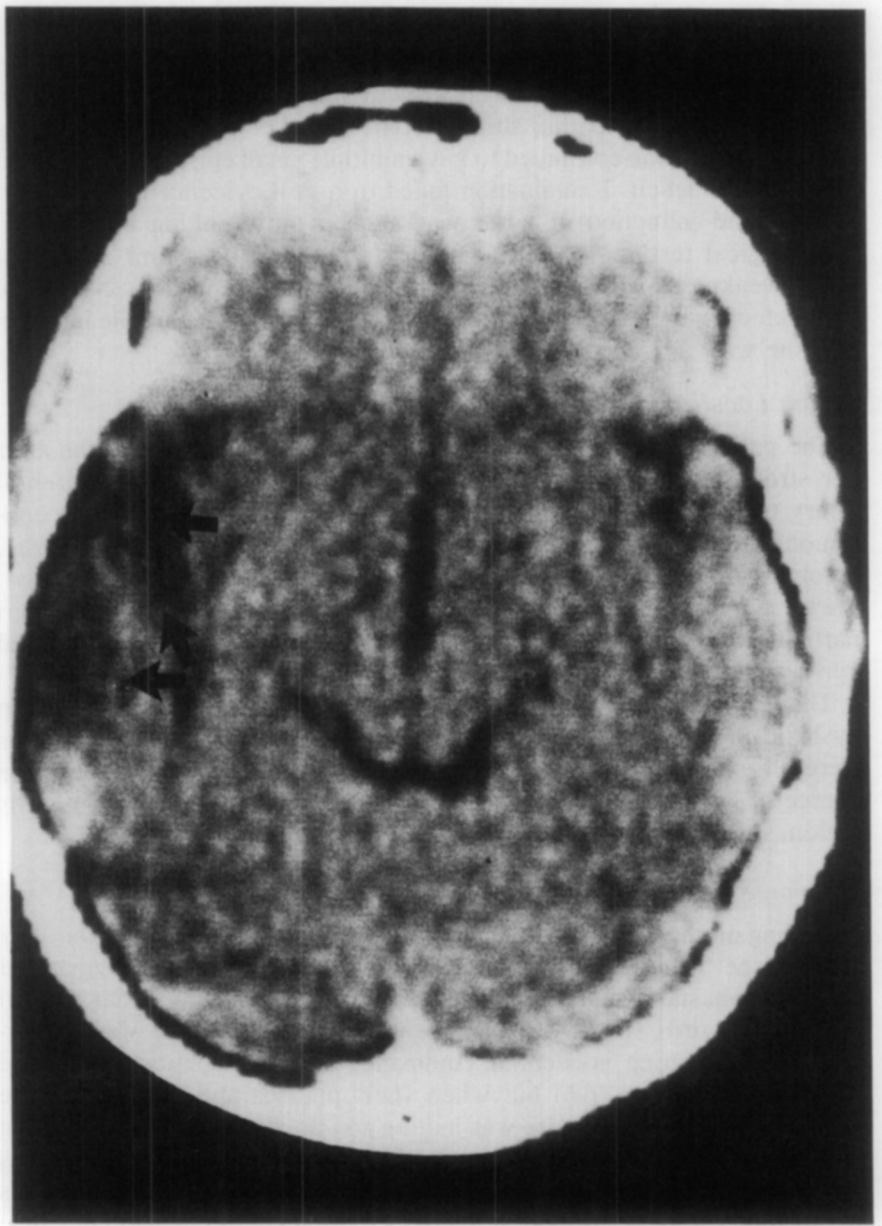


FIG. 1. The lowermost cut shows two lesions in the inferior temporal lobe marked by the arrows. The pars opercularis of the inferior frontal gyrus may also be involved.

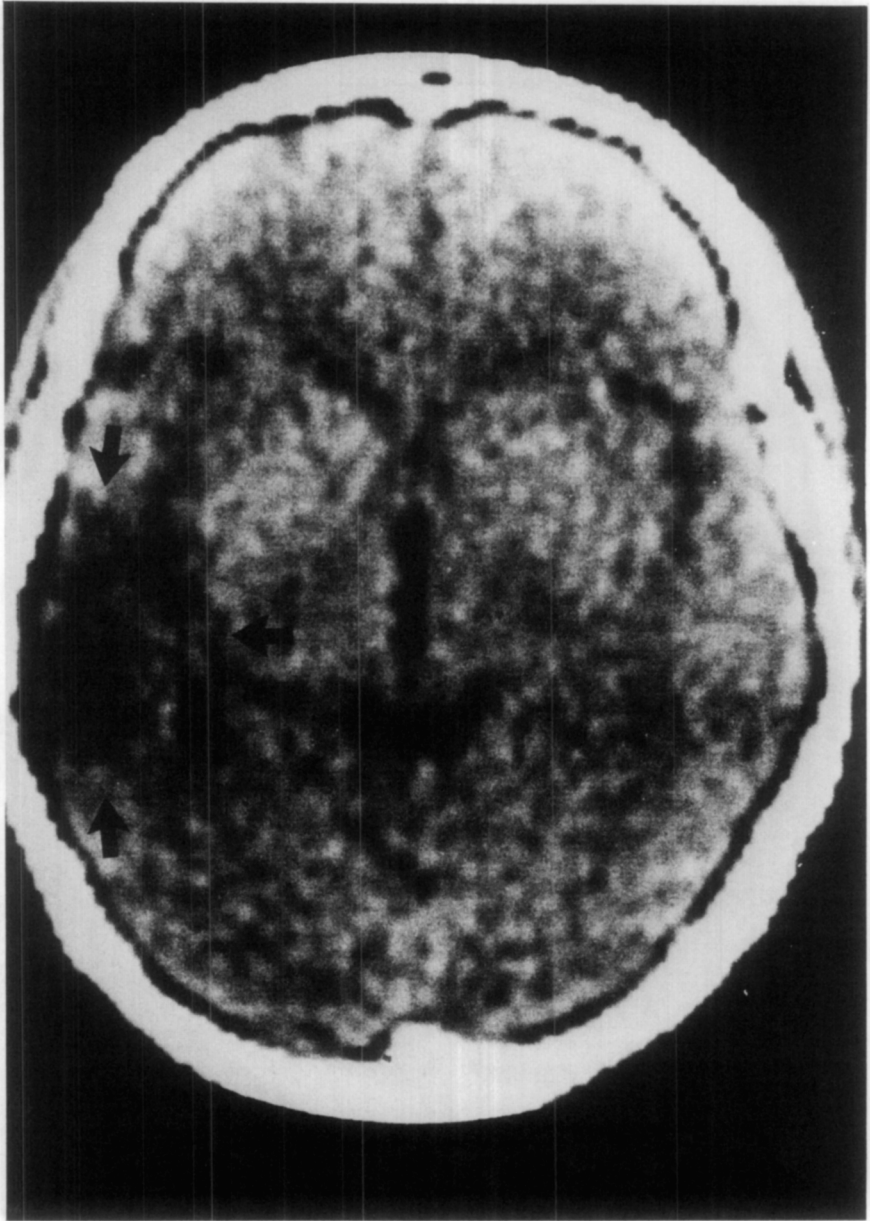


FIG. 2. The definite lesion is outlined by the arrows. Broca's area involvement is uncertain.

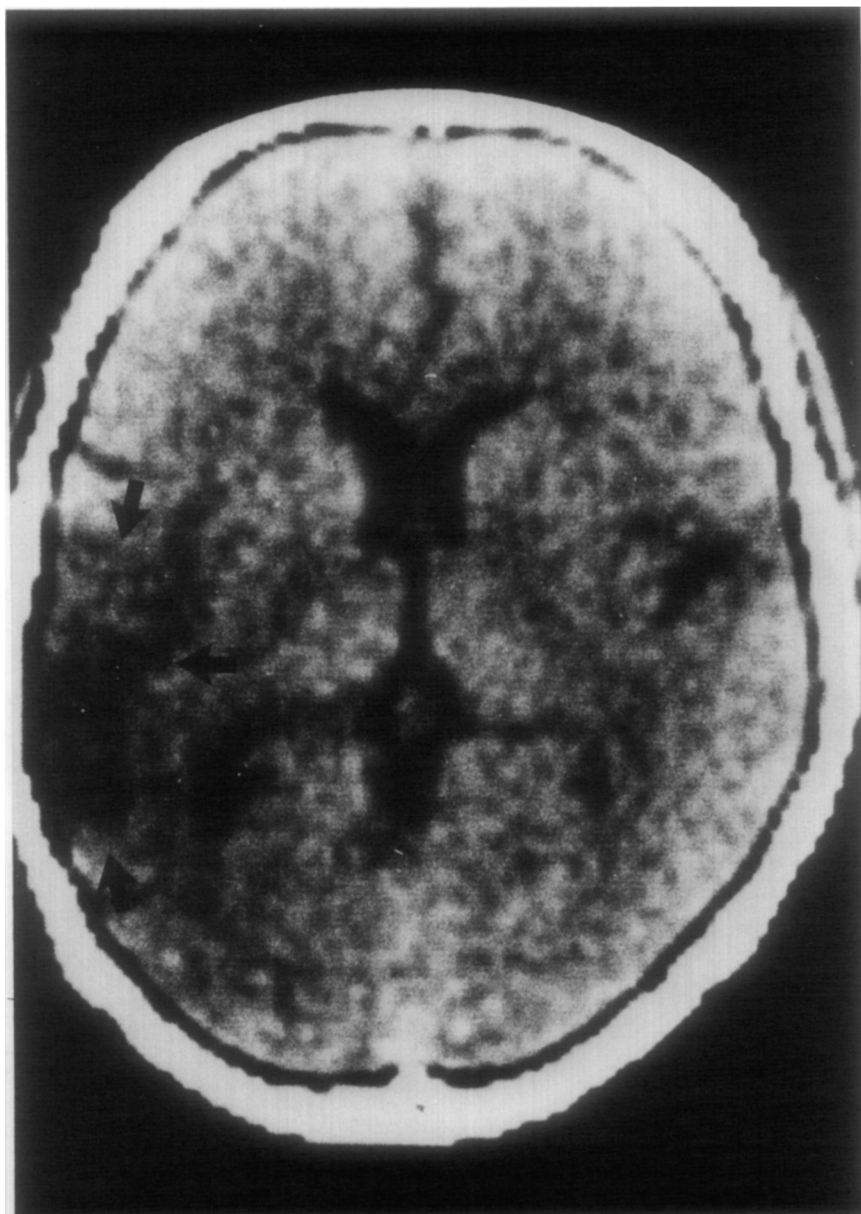


FIG. 3. The arrows outline the extent of the lesion which is mostly in the superior temporal gyrus and the postcentral gyrus. The exact extent of the lesion is difficult to determine. The two linear shadows beside the top arrow and above it represent dilated fissures.

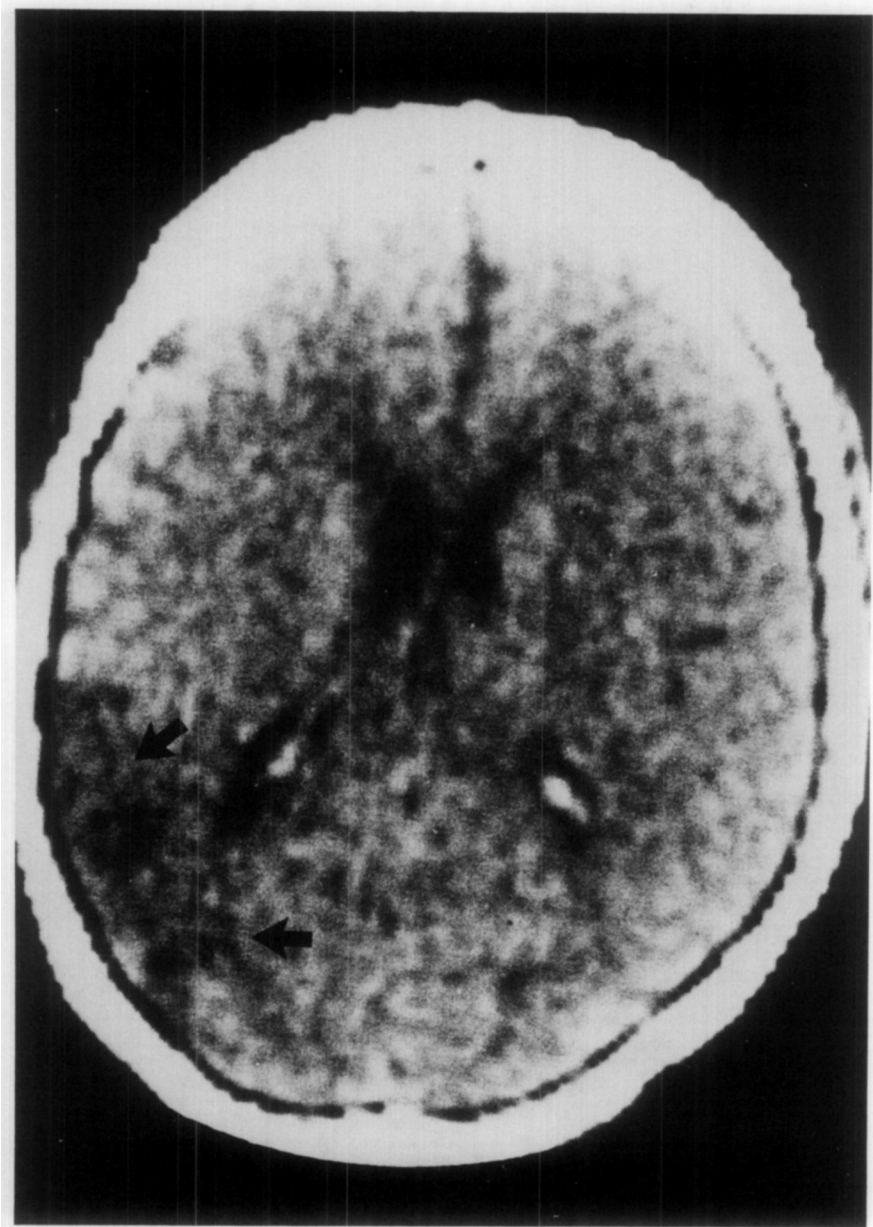


FIG. 4. The lesion between the arrows involves the supramarginal and angular gyri.

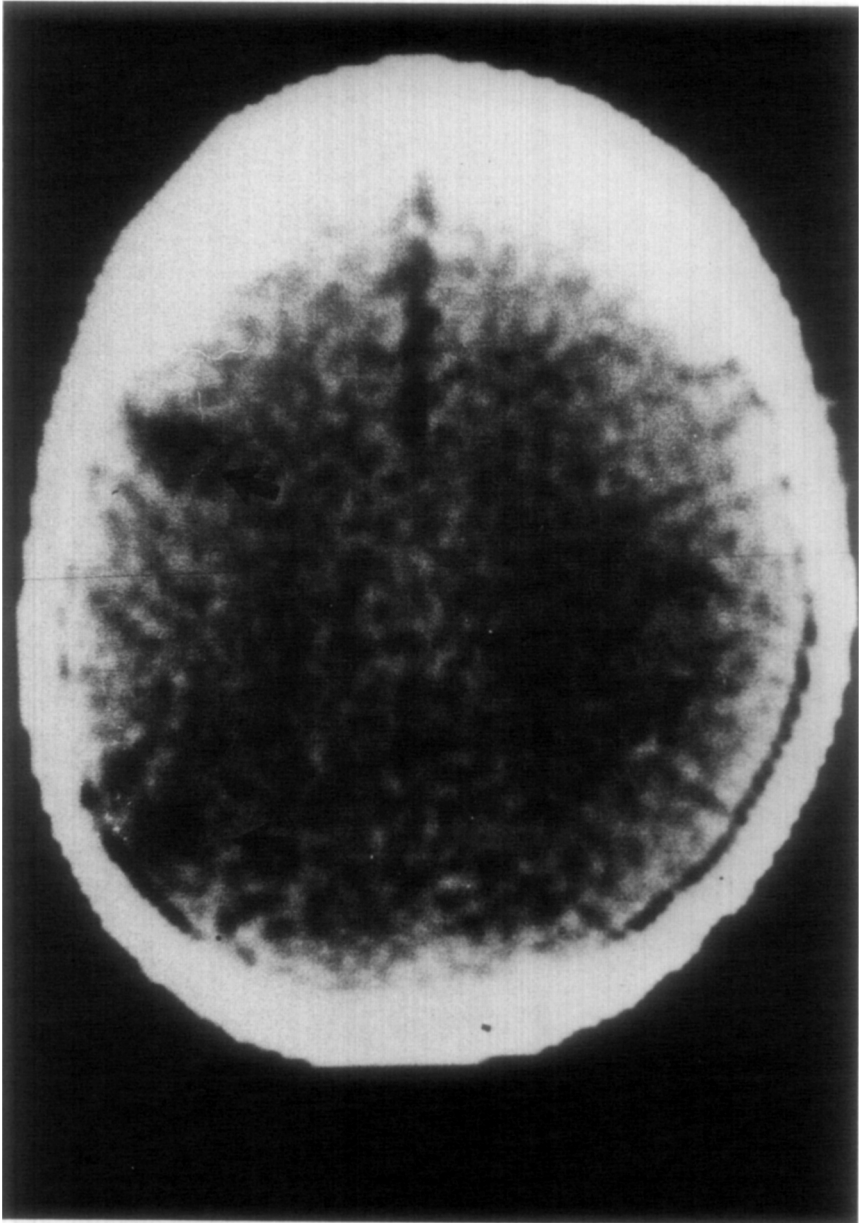


FIG. 5. This cut shows two lesions marked by arrows, the anterior one is probably in the second frontal convolution ("Exner's center of writing"). The posterior lesion is in or near the angular gyrus.

TABLE 1
SUBSCORES ON THE WESTERN APHASIA BATTERY^a

Comprehension	
Yes/no questions	57/60
Auditory word recognition	58/60
Sequential commands	56/80
Repetition	66/100
Naming	
Object naming	51/60
Word fluency	12/20
Sentence completion	10/10
Responsive speech	10/10
Reading	
Comprehension of single words	22/22
Comprehension of sentences	26/40
Comprehension of written commands	14/20
Spelling	
Recognition of orally spelled words	1/6
Oral spelling of words	1/6
Writing	
Name and address	6/6
Sentence to dictation	2/10
Dictated words	8/10
Spontaneous sentences	1/34
Copying	10/10
Praxis	57/60
Construction	
Drawing	30/30
Block design	9/9
Calculation	20/24

^a Scores are scaled so as to yield an Aphasia Quotient of 100 and are consequently different from those reported in the text.

length and grammatical complexity increased. Oral reading of these sentences was markedly telegraphic, paralleling spontaneous output. Recognition of orally spelled words was very poor (1/6), as was oral spelling of dictated words (1/6). Transcribing dictated concrete words was good (5/6). Copying of written sentences was excellent (10/10) as was writing individual letters to dictation (9/10). Writing of dictated sentences and spontaneous writing of sentences were both impaired. J. C. correctly wrote 2 words of a 10-word dictated sentence even though the sentence was repeated once and divided into smaller clusters of words. When asked to write a few short sentences in response to a picture of a picnic scene, J. C. only wrote "A boy." Praxis, drawing, block design and calculation were all adequately performed.

Further Tests of Reading and Writing

During standard language testing it became clear that J. C.'s writing of dictated words contained semantic paraphasias despite the absence

TABLE 2
 REPETITION, READING, AND WRITING TO DICTATION

Nonwords	N	Percentage		
		Reading	Writing	Repetition
Single-syllable four-letter stimuli	20	85	5	100
Polysyllabic eight-letter stimuli				
First-order approximations	6	83	0	100
Second-order approximations	6	—	0	100
Third-order approximations	5	—	0	100
Abstract nouns (Orth. Reg.)	20	100	45	100
Concrete nouns (Orth. Reg.)	20	100	75	100
Abstract nouns (Orth. Irr.)	15	100	33	100
Concrete nouns (Orth. Irr.)	15	100	80	100
Verbs	20	100	35	100
Function words	20	100	30	100

of similar errors in oral reading. On the assumption that these errors indicated the presence of deep agraphia without corresponding deep dyslexia, a series of word lists were compiled and administered to J. C. for writing, oral repetition, and reading. Stimuli were held constant between tasks.

Test 1: Single-syllable nonwords. Writing: Twenty single-syllable four-letter pronounceable nonwords were dictated individually. J. C. correctly transcribed 1/20 (see Table 2). The remainder were either omissions ($N = 6$), attempts to convert the nonword into a similar sounding word ($N = 6$) or confabulations bearing no resemblance to the stimulus ($N = 6$). The remaining response appeared to be the result of a semantic paraphasia for a word generated by J. C. to a nonword. Thus, BLOM was written as FLOWER. The etiology of the response is hypothesized to be BLOOM generated for BLOM and then FLOWER written for BLOOM.

Reading: Stimuli were printed in capital letters on white cards and were administered individually. Seventeen of twenty nonwords were correctly read. Three stimuli were converted into words that sounded similar to the target. Thus, SHAD was read as "SHADE without the E," DOSH as GOSH and CRED as SHRED.

Repetition: All nonwords were correctly repeated.

Test 2: Polysyllabic nonwords. Writing: An additional list of polysyllabic eight-letter nonwords were compiled from norms published by Hirata and Bryden (1971) which varied in the degree of approximation to English. Six fourth-order, six third-order, and five second-order approximations were dictated. These stimuli had no letter appearing more than once and were constructed so that second-, third-, and fourth-order approximations reflected digram, trigram, and tetragram frequencies of

English, respectively. Higher-order approximations more closely correspond to conventional English.

Part of each fourth-order approximation was converted into a similar sounding word when written to dictation. Thus, RINTOMBE was written as RUNTOM, CLIMPANY as BALCONY, EPONSTER as EPU-MONSTER, etc. For third-order approximations, fewer words were written and these bore less resemblance to the actual stimuli. One response was omitted while one bore no relationship to the dictated stimulus. An interesting error again suggests a semantic paraphasia for a word sounding similar to a nonword. Thus, LOBIGNER was written as OYSTER. The etiology of the word is presumed to be LOBIGNER = LOBSTER = OYSTER. For second-order approximations only two responses bore any resemblance to the dictated stimuli, one being TAIL written for TAYORGUC and another ATHYBUE written for ATHI-BUNG. The percentage of letters correctly written for each approximation, without regard to correct serial order of the letters is illustrated in Fig. 6. Performance is compared to that of a neurologically intact control subject matched with J. C. for sex, age, and educational level. Thus, both J. C. and the control subject were 21 years of age and had successfully completed high school up to and including grade 9. In computing the percentages, any letters that could substitute for the stimulus elements (e.g., I instead of Y) were counted as correct. Single vowels that correctly depicted the sound pattern conveyed by two vowels (e.g., I instead of IE) were counted as two letters correctly written.

Reading: Only fourth-order approximations were administered for reading. J. C. read 5/6 correctly. One nonword was converted into a word (CLIMPANY was read as CLIMAX).

Repetition: All stimuli in each group of approximations were correctly repeated.

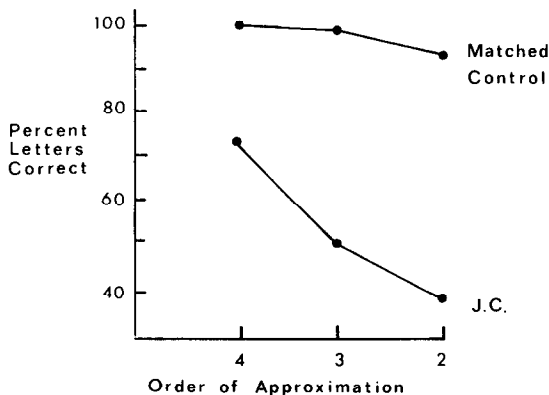


FIG. 6. Percentage letters correct for polysyllabic nonwords written to dictation. Higher-order approximations more closely correspond to English.

Test 3: Words. One hundred ten words were dictated to J. C. for writing and also for repetition. Subsequently, J. C. was required to read the words typed in capital letters on plain white paper. Since reading and repetition were flawless, only the results of the writing test will be discussed in detail. Results are shown in Table 2.

Orthographically regular abstract and concrete nouns. Twenty abstract and twenty concrete nouns were dictated. Mean frequency (Kučera & Francis, 1967) for concrete nouns was 111 ($SD = 126$) and for abstract nouns was 280 ($SD = 353$). Word length was approximately equal for the two groups. J. C. correctly wrote 17/20 concrete nouns and 9/20 abstract nouns. Semantic paraphasias were evident. For example, TIME was written as CLOCK, SKY as SUN, DESK as CHAIR, CHAIR as TABLE. J. C. appeared unaware of these errors while writing took place. Immediately after each paragraphic error, however, the discrepancy between the dictated stimulus and written output was noted, since J. C. was capable of reading the response.

Orthographically irregular abstract and concrete nouns. An additional 15 abstract and 15 concrete orthographically irregular nouns were dictated. Frequency was approximately equated between the two word groups with concrete nouns having a mean frequency of 124 ($SD = 144$) and abstract nouns having a mean frequency of 137 ($SD = 157$) per million. Twelve of fifteen concrete nouns and 5/15 abstract nouns were correctly written. It can be seen from these results that orthographically irregular nouns are not written more poorly than orthographically regular nouns ($\chi^2 = 0.19, p > .1$). In contrast, concreteness exerted a significant effect on accuracy when word groups are collapsed across regular and irregular spellings ($\chi^2 = 5.23, p < .025$).

Verbs. Twenty pure verbs (i.e., verbs without noun forms) were dictated. All words were high frequency (greater than 55 per million). Seven were correctly transcribed.

Function words. Twenty function words were dictated. Six were correctly written. The remaining errors were omissions (i.e., no responses) or were incorrect functors (e.g., OUR was written as MY, THEY as THEIR). This bears a striking resemblance to the reading performance of deep dyslexics, who typically also preserve word class when incorrectly pronouncing written functors. Overall, writing performance for function words and verbs together was significantly poorer than for nouns ($\chi^2 = 4.22, p < .05$).

DISCUSSION

The high accuracy obtained for oral repetition of all dictated stimuli rules out the possibility that impaired perception is producing the errors in written performance. Instead, results indicate that for J. C., phoneme-grapheme conversion is impossible and that lexical and semantic processing is required for written output to occur.

The dependence of writing on lexical processing is illustrated by the results obtained for mono- and polysyllabic nonwords. For monosyllabic nonwords, responses were either omissions and confabulations or were an attempt to convert the stimuli into similar-sounding words. This provides evidence that a lexical-orthographic writing route is operating and mediates performance when words are written to nonwords. Writing via a phonological mechanism, however, is severely impaired since nonword responses (e.g., SEP, MOOY, CASD) did not resemble stimuli in any meaningful way.

This is further indicated by the results obtained with polysyllabic nonwords (see Fig. 6). For stimuli closely resembling English, a high percentage of responses consisted of single words or two words combined that corresponded quite closely to the sound pattern of the target syllables. As the resemblance between stimuli and English words decreased, response accuracy for writing deteriorated and omissions or confabulations were evident.

In addition to the inability to correctly transcribe nonwords, written performance for words was influenced by semantic aspects of the stimuli. Concrete nouns were written more accurately than abstract nouns, regardless of orthographic regularity, while performance for function words and verbs was very poor. Semantic paraphrasias were present. APPEAR is written as MAGIC, TIME as CLOCK, GIVE as TAKE, etc. This pattern of results corresponds closely to that obtained in deep dyslexia and provides strong support for writing via higher-order semantic processes without recourse to phonology.

In contrast to these results, reading of all words tested was performed flawlessly, while reading of pseudowords, though slightly impaired, was vastly superior to written performance for the same stimuli. This functional disconnection between grapheme-phoneme and phoneme-grapheme conversion processes extends the distinction offered by Beauvois and Derouesne (1981). Both phonological and orthographic systems are at least partially dissociable in reading and writing. Furthermore, the fact that for J. C., deep agraphia occurs without deep dyslexia indicates that two functional "lesions" must have occurred in cases showing parallel deficits in both modalities, consistent with the model offered by Newcombe and Marshall (1980).

Writing without Phonology

The nature of the processing deficits shown by J. C. is depicted in diagram form in Fig. 7. It should be noted that whereas phonological analysis, phoneme-grapheme and grapheme-phoneme conversion are separated spatially in the figure for convenience, anatomically these processes may well be subserved by closely related neural systems.

As indicated, reading systems involving grapheme-phoneme conversion and lexical-orthographic processing are intact. J. C. correctly read

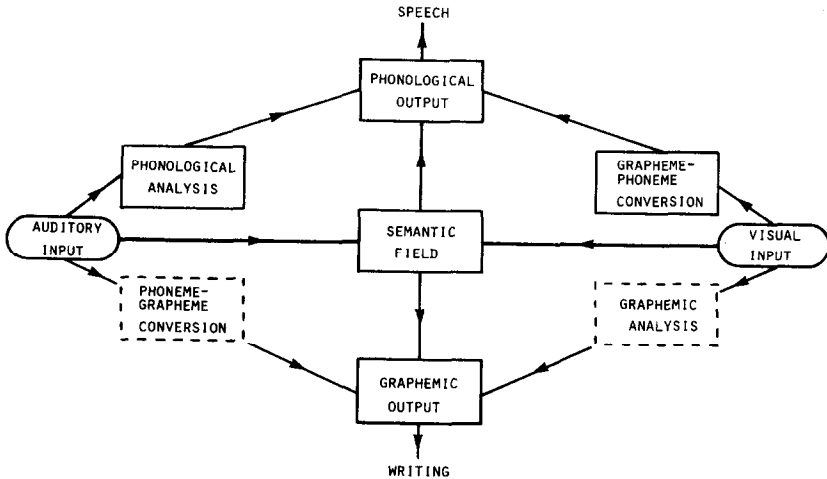


FIG. 7. Input and output systems that are intact and impaired for J. C. Dotted enclosures indicate impaired processing.

pseudowords and orthographically irregular words. Word class had no effect on performance.

In contrast, writing via phoneme-grapheme processes is impaired, so that J. C. is forced to access lexical and semantic information to transcribe to dictation. Superior performance for concrete nouns compared to abstract nouns, function words and verbs is due to the fact that translation of semantic information into graphemes is impaired for certain items or that the semantic representations themselves are compromised. Evidence tends to support the first alternative since reading comprehension was relatively good compared to the writing of even the most elementary abstract noun. In addition, comments supplied by J. C. during writing suggest that she understood the word but could not generate a graphemic representation for the stimulus. For example, when asked to write MIND, J. C. commented, "Mind over matter, but I can't write it."

An additional interesting aspect of J. C.'s writing, besides the absence of phonological processing, concerns her inability to spell orally. Oral spelling, though not tested in great detail, was markedly impaired relative to writing (see Table 1). In this respect, J. C. differs from cases reported of intact oral spelling but poor writing ability (Kinsbourne & Rosenfield, 1974; Rothi & Heilman, 1981). Thus, while J. C. correctly wrote words like TELEPHONE, HAMMER, and DOCTOR to dictation, she was incapable of orally spelling words like CAT, POND, or PENCIL, or of synthesizing words from spelling patterns like D-O-G or N-O-S-E, in spite of the fact that individual letter naming was performed accurately on visual confrontation (cf. Kinsbourne & Warrington, 1965).

Oral spelling presumably occurs via both phoneme-grapheme conversion and by means of access to internally generated visual codes (see Fig. 7). Evidence supports the conclusion that J. C. is capable of writing even though these processes are no longer intact. Writing to dictation could still occur, however, if lexical units are converted directly into graphomotoric code (cf. Weigl & Fradis, 1977), without visually processing the individual letter components of the word. Thus, J. C.'s performance points to the functional independence of a number of systems within the writing process. Phoneme-grapheme conversion takes place separately from the more direct route which converts semantic and lexical information into graphemic units. In addition, writing appears to involve an analytic (and probably visual) processing of letter components and a more unitary translation of lexical items into graphomotor acts.

APPENDIX: EXAMPLES OF WRITING RESPONSES

Single-Syllable Nonwords

Oral stimulus	Written response
BIST (bɪst ^h)	BROD
CRED (krɛd ^h)	R
HUFT (huft ^h)	FACT
SOOM (sum)	MOOY
SNEP (snɛp)	CASD
DOSH (dɔʃ)	HEIF
SHAD (ʃæd)	FOWE
ROSK (rɔsk)	NR
BESH (beʃ)	BASH
HAFE (hef)	F
WABE (web)	WADE
MAFE (mɛf)	NR
DANT (dænt ^h)	NR
FESS (fes)	FESS
MUNT (munt ^h)	NR
BUME (bjum)	PUMP
TESH (teʃ)	SEP
DEET (dit)	TOP
FOGE (fog ^ɪ)	FOG
BLOM (blɔm)	FLOWER

Polysyllable Nonwords

Oral stimulus		Written response
Fourth order		
POLICKET	(pə 'i:kət ^h)	POLYAKE
RINTOMBE	(rɪntomb ^h)	RUNTOM
SURFINDO	(sə'fɪndo)	SURFTON
OMENTACK	(ɔ'mantæk ^h)	ONETAC
APONSTER	(æpənstə)	EPUMONSTER
CLIMPANY	(k 'ɪmpəni)	BALCONY
Third order		
PERABOSI	(pə'rəbɔsi)	PAIRUBOE
ALKINGER	(ælkɪŋə)	ALKING
STABOURN	(stə'bɔ:n)	STOBURN
LOBIGNER	(lɔ'bɪgnə)	OYSTER
GANDEOPL	(gændi'ɔpl)	B
CALFROVE	(cafrov)	RUNSTOP
Second order		
EMICHANS	(əmi'ʃænz)	MARTRAS
ATHIBUNG	(æ'θi'bʊŋ)	ATHYBUE
UNDECHIV	(ʊndə'ʃɪv)	BU
DOWACLIS	(daʊ'wɑklɪs)	CATCY
TAYORGUC	(teɪ'ɔ:gʊk ^h)	TAIL

Orthographically Regular Nouns

Concrete		Abstract	
Oral Stimulus	Written Response	Oral Stimulus	Written Response
SKY	SUN	TIME	CLOCK
DESK	CHAIR	AMOUNT	AROUND
BOAT	BOAT	LIFE	LIFE
BIRD	BIRD	EFFORT	NR
FOOD	FOOD	ACT	ACT
MOON	MOON	MIND	NR
TELEPHONE	TELEPHONE	HOPE	HOPE
NOSE	NOSE	CARE	CARE
CHAIR	TABLE	NAME	NR
TREE	TREE	FACT	FACT
RIVER	RIVER	FUND	FUND
METAL	METAL	GAME	GAME
HORSE	HORSE	END	NR
DOCTOR	DOCTOR	PRIDE	NR
GRASS	GRASS	JOB	JOB
GIRL	GIRL	EVENT	NR
CLOCK	CLOCK	METHOD	NR
APPLE	APPLE	CHOICE	NR
HOUSE	HOUSE	CRIME	CRIME
BOOK	BOOK	FUN	NR

Orthographically Irregular Nouns

Concrete		Abstract	
Oral stimulus	Written response	Oral stimulus	Written response
LIGHT	LIGHT	HEIGHT	NR
FRUIT	FRUIT	SCIENCE	SCIECE, SCEINE, SCEICE
FLOOD	FLOOD	GUESS	NR
POET	PE PEAT PE PA POET	DOUBT	NR
FLOOR	NR	SIGHT	NR
SCHOOL	SCHOOL	LEAGUE	NR
YACHT	BOAT	EIGHT	EIGHT
BLOOD	BLOOD	FIGHT	FIGHT
SIGN	SIGN	HEALTH	NR
GUEST	NR	DEBT	DEED
CASTLE	CASTLE	WORD	NR
CIRCLE	CIRCLE	SOUL	SOUL
DOOR	DOOR	BIRTH	BIRTH
COMB	COMB	WORK	NR
KNIFE	KNIFE	MONTH	MONTH

Verbs		Function words	
Oral stimulus	Written response	Oral stimulus	Written response
READ	READ	THE	THE
EAT	EAT	THAN	NR
ASK	NR	FROM	FROM
CARRY	CARRY	INTO	INTO
FIX	FIX	AFTER	NR
TAKE	NR	THEM.	NR
SPEAK	NR	WHAT	NR
GIVE	TAKE	AROUND	NR
BEGIN	NR	THEY	THEIR
SEND	SAID	ME	ME
LEND	NR	WHO	WHO
LEARN	NR	WHERE	WHERE
LIVE	LIFE	AT	TH
CHOOSE	CHOOSE	ALSO	NR
GROW	NR	OUR	MY
SEEK	NR	YOURS	OUR
HAVE	NR	WHY	NR
APPEAR	MAGIC	HERE	HERE
STOP	STOP	WHEN	NR
ENTER	ENTER	YOU	NR

Examples of Semantic Paragraphs

Oral stimulus	Written response
HAPPY	FUNNY
YACHT	BOAT
SKY	SUN
TIME	CLOCK
DESK	CHAIR
CHAIR	TABLE
APPEAR	MAGIC
GIVE	KIND
LAUGH	SMILE
GIVE	TAKE
GIVE	KEEP

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