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Word recognition in individuals with left and right hemisphere damage: The role of lexical stress

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ABSTRACT
Lexical stress patterns appear to be important in word recognition processes in normal individuals. The present investigation employed a lexical decision task to assess whether left (LHD) and right hemisphere damaged (RHD) patients are similarly sensitive to stress patterns in lexical access. The results confirmed that individuals without brain damage are influenced by stress patterns, as indicated by increased lexical decision latencies to incorrectly stressed word and nonword stimuli. The data for the LHD patients revealed an effect of stress for real word targets only, whereas the reaction time data for the RHD patients as a group showed no significant influence of stress pattern. However, there was a great deal of individual variability in performance. The latency and error rate findings suggest that LHD patients and non-brain-damaged individuals are both sensitive to lexical stress in word recognition, but the LHD patients are more likely to treat incorrectly stressed items as nonwords. The results are discussed in relation to theories of the hemispheric lateralization of prosodic processing and the role of lexical stress in word recognition.

The neural substrates for the production and perception of speech prosody remain quite controversial, despite a renewed interest in recent years in understanding these complex processes (see Baum & Pell, 1999, for a review). Among numerous hypotheses, one theory contends that aspects of prosody that are more linguistic, along a linguistic–affective continuum, are functionally lateralized to the left hemisphere whereas affective or emotional prosody is a right hemisphere function – the so-called functional load hypothesis (Blonder, Bowers, & Heilman, 1991; Bowers, Coslett, Bauer, Speedie, & Heilman, 1987; Heilman, Bowers, Speedie, & Coslett, 1984; Ross, 1981; Van Lancker, 1980). Another position holds that the production of prosody (both linguistic and affective) is chiefly controlled in subcortical regions, notably the basal ganglia (Blonder, Gur, & Gur, 1989; Cancelliere & Kertesz, 1990; Speedie, Brake, Folstein, Bowers, & Heilman, 1990). A third view purports that the left hemisphere is specialized for the control of temporal parameters of speech whereas the right hemisphere is specialized for spectral parameters, particularly the processing of pitch (F0; Gandour, Petty, & Dardarananda, 1989; Robin, Klouda, & Hug, 1991; Robin, Tranel, & Damasio, 1990; Sidtis & Volpe, 1988; Van Lancker & Sidtis, 1992; Zatorre, Evans, Meyer, & Gjedde, 1992; but cf. Baum, 1998; Pell & Baum, 1997). Within each perspective, variations in performance due to task demands and the level of processing under examination were detailed.

Although a number of studies provided supportive evidence for all of these views based on the production and comprehension of prosody in both right (RHD) and left hemisphere damaged (LHD) populations, many questions remain (Baum & Pell, 1999). Little work was done to explore the role that prosodic processing impairments may play in syntactic parsing; even less research was devoted to the role of metrical stress in speech perception and word recognition by brain-damaged patients. It is essential that we achieve a better understanding of how listeners integrate and resolve these various sources of information in the speech signal and how deficits in such processing may affect higher level language comprehension. As a preliminary step in that direction, the present investigation focuses on the influence of metrical stress patterns on lexical access.

A number of recent studies posited an important role for lexical stress information in normal word recognition processes. Perhaps the most data were gathered in support of the position that lexical stress patterns influence listeners' identification of word onsets, the so-called metrical segmentation strategy (e.g., Cutler & Norris, 1988; Mattys & Samuel, 1997; McQueen, Norris, & Cutler, 1994; Norris, McQueen, & Cutler, 1995). This hypothesis proposes that listeners make the default assumption that strong (stressed) syllables represent new word onsets, permitting the decomposition of the continuous speech stream into identifiable lexical units (see also Grosjean & Gee, 1987). It was further proposed that stressed syllables may serve as the trigger for lexical access, irrespective of their position in the word (Mattys & Samuel, 1997); thus, if syllables are misstressed or if stressed syllables are mispronounced, word recognition may be hampered (Mattys & Samuel, 1997).

Lexical stress patterns were shown to influence word recognition in other ways as well. For instance, Wingfield and colleagues (Lindfield, Wingfield, & Goodglass, 1999; Wayland, Wingfield, & Goodglass, 1989; Wingfield, Goodglass, & Lindfield, 1997) demonstrated that the set of potential word candidates is dramatically narrowed when metrical patterns are taken into account. When such prosodic information is made available to listeners in a gating task, word identification is enhanced relative to gated conditions in which only word onset information or word onset plus word length information is provided; moreover, the advantage is present even at the shortest gate (50 ms; Lindfield et al., 1999). These findings indicate that lexical stress information plays an important role in word identification.

Of primary relevance to the present investigation is a series of experiments conducted by Slowiaczek (1990), which explored the influence of consistent and inconsistent stress patterns on lexical identification, shadowing, and lexical decision tasks. The ability of young adult listeners to identify words presented in noise was not affected by incongruent stress patterns. However, in both shadowing (also sometimes referred to as auditory naming or repetition) and lexical decision tasks, response latencies to produce or make a decision concerning the lexical status of a target word were significantly slower in the incorrectly stressed conditions. Slowiaczek (1990) reconciles the differing results across the tasks by appealing to the on-line versus off-line nature of the tasks. That is, in the word identification in noise task, listeners are under no time pressure and may draw upon numerous sources of information or strategies to render a decision. In contrast, the shadowing and lexical decision tasks are both presumed to tap into lexical access processes at an earlier stage (despite probable differences across these two tasks). Although no specific claims are being made here concerning whether the stress effect is pre- or postlexical, it is clear that typically developing listeners do make use of lexical prosodic information during word recognition (Slowiaczek, 1990; see also Lindfield et al., 1999; Mattys & Samuel, 1997).

The objective of the present investigation is to determine whether individuals with left and right hemisphere damage are able to make use of lexical stress information in word recognition. To that end and following Slowiaczek (1990), a lexical decision task was designed in which the consistency or accuracy of metrical stress patterns was manipulated in multisyllabic words.

According to the functional load hypothesis of prosodic lateralization, lexical stress is processed in the left hemisphere. Numerous investigations supported this contention (e.g., Baum, 1998; Baum, Kelsch Daniloff, Daniloff, & Lewis, 1982; Emmorey, 1987), but few, if any, explored whether LHD patients are influenced by information contained in metrical patterns in the activation of lexical items, as in the Slowiaczek (1990) study described above. That is, although data were gathered that indicate that individuals with LHD are impaired in their ability to distinguish compound nouns from noun phrases in English that differ only in their stress patterns (e.g., *hot*dog vs. hot *dog*), it is not clear whether the deficit is due to impaired processing of (low-level) acoustic parameters in the signal or whether it emerges at the decision stage that requires associating the prosodic pattern with a specific lexical item or phrase. A similar distinction was drawn with respect to phonetic perception; certain investigators suggested that, although some LHD aphasic patients may be able to perceive phonetic contrasts, they may be unable to appropriately match the phonetic patterns to entries in the lexicon (Blumstein, 1998).

Relatedly, LHD aphasic patients were shown to display impairments in both speech perception (see, e.g., Blumstein, 1998, for a review) and lexical access (e.g., Blumstein, Milberg, & Shrier, 1982; Milberg & Blumstein, 1981; Milberg, Blumstein, & Dworetzky, 1988), suggesting that they rely to a greater degree than normal on context to assist in perceptual processing (e.g., Blumstein, Burton, Baum, Waldstein, & Katz, 1994; Caplan & Aydelott-Utman, 1994; but cf. Boyczuk & Baum, 1999). Moreover, it was demonstrated that LHD nonfluent aphasic patients may require a precise phonetic match to achieve word recognition, because in contrast to normals, nonword rhymes differing from a real word by a single phonetic feature (e.g., *gat*) failed to activate target words associated with the (unpresented) real word rhyme (e.g., *dog* via *cat*) for nonfluent (Broca's) aphasic patients (Milberg et al., 1988; but cf. Baum, 1997). Such findings may be interpreted as suggesting a lexical boundedness or constraint in processing by LHD nonfluent aphasics. In contrast, individuals with RHD tend to exhibit normal lexical access at least with respect to initial word recognition processes: there *are* deficits in RHD patients in terms of the breadth of semantic fields activated (e.g., Beeman, Friedman, Grafman, Perez, Diamond, & Lindsay, 1994) and the processing of ambiguous lexical items (e.g., Tompkins, Baumgaertner, Lehman, & Fassbinder, 2000; Tompkins, Baumgaertner, Lehman, & Fossett, 1997).

By assessing listeners' sensitivity to lexical stress patterns without requiring overt identification of a word or word-picture matching, as in most previous studies of lexical or phonemic stress in brain-damaged patients (e.g., Baum, 1998; Baum et al., 1982; Emmorey, 1987; Ouellette & Baum, 1993), we may be able to determine whether brain-damaged listeners are indeed extracting prosodic cues to aid in word recognition and whether they are doing so in a manner similar to normal. The findings will permit us to address some of the current models concerning the neural bases of prosodic processing outlined earlier.

METHOD

Subjects

Three groups of native English-speaking individuals participated in this experiment: 10 LHD nonfluent aphasic patients, 10 RHD patients, and 10 age-matched non-brain-damaged controls (NC). The brain-damaged patients had all suffered a single, unilateral cerebrovascular accident (documented by CT or MRI) at least 6 months prior to testing. The patients (all premorbidly right-handed, based on self-report) were diagnosed on the basis of a series of diagnostic tests and clinical reports. All participants underwent an audiometric screening for thresholds of <35-dB HL in the better ear at speech frequencies of 0.5, 1, and 2 kHz. Background information is provided in Table 1.

Stimuli

The stimuli consisted of 20 two-syllable, 20 three-syllable, and 20 four-syllable words, each containing at least two strong (full) vowels (following Slowiaczek, 1990). Each word was produced in two versions: correctly stressed (CS) and incorrectly stressed (IS). In the IS versions the stress was displaced by one syllable (generally later in the word, except in the case of bisyllabic words with second syllable stress). A parallel set of nonword stimuli was created by changing one phoneme within each real word; the position of the altered phoneme was at the beginning, middle, or end of the word in approximately one-third of the stimuli of each syllable length. The nonwords were also produced in CS and IS versions (corresponding, of course, to the stress of the associated real word). Examples of the stimuli are presented in Table 2.

The stimuli were recorded by an adult male native speaker of English using

Table 1. *Background information on participants*

Subject	Sex	Age (years)	Education (years)	MPO	Lesion site
LHD1	F	68	9	69	Left frontotemporoparietal
LHD2	M	75	12	40	Left MCA
LHD3	F	67	11	47	Left frontoparietal
LHD4	F	83	8	66	NA
LHD5	F	72	12	71	Left parietal
LHD6	F	47	14	92	Left frontoparietal
LHD7	M	74	16	24	Left MCA
LHD8	M	80	11	26	Left MCA
LHD9	M	51	14	139	Left parietal
LHD10	M	79	9	48	Left frontal
Means		69.6	11.6	62.1	
SD		12.0	2.5	34.4	
RHD1	M	78	11	25	Right frontotemporoparietal area
RHD2	F	59	13	112	Right posterior communicating artery distribution
RHD3	M	87	11	30	NA
RHD4	F	42	9	32	Right MCA territory
RHD5	F	65	13	53	Right internal capsule, right basal ganglia
RHD6	M	71	12	39	Right parietal
RHD7	F	87	5	82	Right MCA
RHD8	F	65	NA	35	Right MCA
RHD9	F	66	12	51	NA
RHD10	F	34	13	52	Right MCA
Means		65.4	11.0	51.1	
SD		17.3	2.6	26.9	
N1	F	67	12		
N2	M	63	11		
N3	F	87	15		
N4	M	71	9		
N5	M	66	9		
N6	M	55	11		
N7	M	70	9		
N8	F	76	8		
N9	F	72	11		
N10	F	63	13		
Means		69.0	10.8		
SD		8.6	2.1		

Note: LHD, left hemisphere damaged; RHD, right hemisphere damaged; N, normal controls; MPO, months postonset; NA, not available; MCA, middle cerebral artery.

Table 2. *Sample two-syllable, three-syllable, and four-syllable stimuli in all conditions*

CS Word	CS Nonword	IS Word	IS Nonword
REScue	BEScue	resCUE	besCUE
esTABlish	esTAGlish	establLISH	estagLISH
conSECutive	conSECulive	consecUtive	consecUlive

Adapted from Slowiaczek (1990).

a Sony TCD-D100 DAT recorder and a head-mounted directional microphone (AKG Acoustics C420). The associated CS and IS words and nonwords were recorded sequentially to preserve the stress and allophonic variation patterns. The speaker was given ample time in advance of recording to review and practice pronouncing the stimuli. In addition, the recording was monitored by the experimenter, who requested repetition of stimuli that were not pronounced as intended.

The final selected stimuli were digitized at a rate of 20,000 samples with a 9-kHz low-pass filter and 12-bit quantization using the BLISS speech analysis system (Mertus, 1989). The stimuli were organized into two lists, such that half of the CS words of each syllable length occurred in each list. The other half of the real word stimuli occurred in their IS versions. If a CS real word appeared in a list, its IS nonword counterpart appeared as well; similarly, if an IS word appeared, its CS nonword counterpart was included.

Procedure

Each of the two lists of stimuli was presented to listeners in random order over closed headphones with a 4-s interstimulus interval (ISI). The two lists were presented in individual sessions separated by at least 1 week. Listeners were seated in front of a response board with buttons labeled "yes" or "no" and were required to indicate as quickly and accurately as possible whether the presented stimulus was a real English word.[1] Subjects responded with their (currently) dominant hand, resting their hand equidistant from the yes and no buttons between stimulus presentations. Responses and reaction times (RTs) measured from the onset of the target word were recorded by the computer.

RESULTS

Error rates were computed for each condition, and the group mean values (collapsed across lists) are illustrated in Figure 1. As is evident from the figure, all groups had relatively high error rates for nonword targets, which differed only minimally from their real word cognates. The LHD patient group also produced a large number of errors in the IS word condition, suggesting that these individuals had more difficulty accepting an incorrectly stressed item as a word. A Group (NC, LHD, RHD) × List (A, B) × Lexical Status (word, nonword) ×

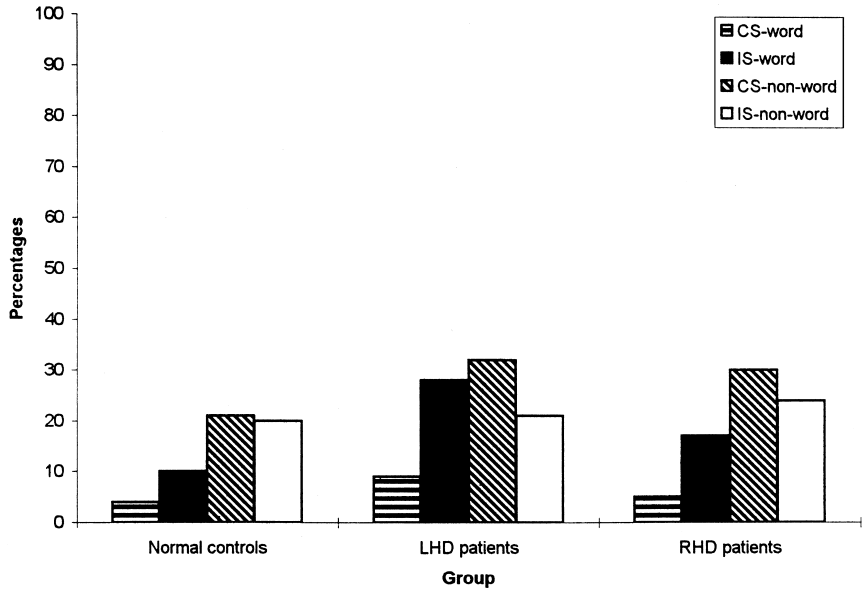

Figure 1. Group mean error rates for each condition, collapsed across lists.

Stress Condition (CS, IS) analysis of variance (ANOVA) on the errors yielded one interaction of greatest interest – that of Group × Lexical Status × Stress Condition, $F(2, 27) = 5.06$, $p < .02$, confirming the varying group patterns shown in the graph.

Mean lexical decision latencies for correct responses only were calculated for each individual. The RTs that were more than 2 standard deviations from the mean for each condition were excluded from the analyses. Group mean RTs for each condition (collapsed across the two lists) are displayed in Figure 2. As may be observed, it was not surprising that the NC participants' responses to word targets tended to be faster than to nonword targets and RTs to CS targets were faster than to IS targets. LHD participants also exhibited an influence of stress pattern but only for real word targets, whereas the RHD patients displayed only a small increase in latencies for the incorrectly stressed word targets. Group (NC, LHD, RHD) × List (A, B) × Lexical Status (word, nonword) × Stress Condition (CS, IS) ANOVAs were conducted with both subjects (F_1) and items (F_2) as random factors. The ANOVAs revealed main effects of lexical status, $F_1(1, 27) = 45.304$, $p < .001$; $F_2(1, 231) = 204.984$, $p < .001$, and stress condition, $F_1(1, 27) = 10.410$, $p < .003$; $F_2(1, 231) = 21.187$, $p < .001$, as well as an interaction of these two variables, $F_1(1, 27) = 50.950$, $p < .001$; $F_2(1, 231) = 30.936$, $p < .001$. Of greatest interest to the present investigation was a three-way interaction of Group × Lexical Status × Stress Condition, $F_1(2, 27) = 3.732$, $p < .05$; $F_2(2, 462) = 10.479$, $p < .001$. It should also be pointed out that no effect of list emerged, nor did the list factor interact with any other variables.

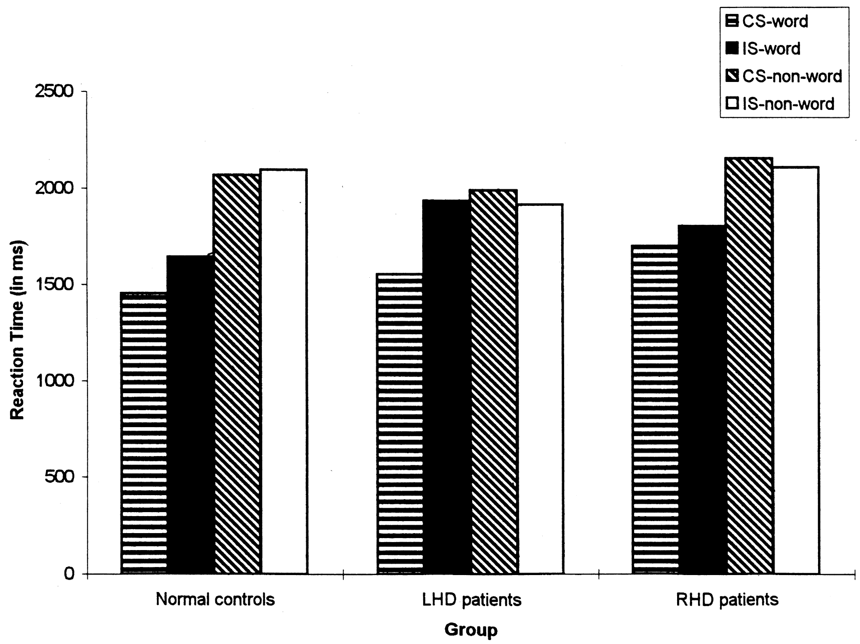

Figure 2. Group mean RTs for each condition, collapsed across lists.

A post hoc analysis of the three-way interaction using the Newman–Keuls procedure ($p < .05$) confirmed that within the NC group, the RTs to CS word and nonword targets were significantly faster than to their IS counterparts. In addition, RTs to word targets (both CS and IS) were significantly faster than to nonword targets. Within the LHD patient group, latencies in the CS condition were significantly faster than in the IS condition for real word targets only; RTs to CS and IS nonword targets did not differ significantly. The LHD patients also demonstrated a lexical status effect for CS conditions alone; that is, RTs to CS words were faster than to CS nonwords, but no RT differences were found between IS words and nonwords. Finally an analysis of the RHD patients' data showed a lexical status effect for both CS and IS conditions (i.e., RTs to word targets were faster than to nonword targets). However, the influence of stress failed to reach significance for this group; that is, RTs in the CS and IS conditions (for both word and nonword targets) did not differ.

The RT patterns were also examined for each individual to determine how well the group data reflected individual performance, and these data are presented in Table 3. Within the NC group and across the two lists, two individuals (N1 and N7) did not demonstrate an influence of stress for the nonword stimuli, in contrast to the group pattern. Thus, despite some minor variability, the group results mostly mirror those of the individual participants. Within the LHD patient group and across the lists, only a single individual (LHD2) displayed a

Table 3. *Mean reaction times for each individual participant for each condition, collapsed across lists*

Subject	CS Word	IS Word	CS Nonword	IS Nonword
N1	1422	1576	2345	1888
N2	1348	1509	1516	1472
N3	1090	1281	1998	2093
N4	1360	1635	1658	1806
N5	1453	1650	1942	1901
N6	1614	1749	2459	2604
N7	1289	1480	2489	2285
N8	1511	1796	2068	2062
N9	1752	1818	2304	2599
N10	1690	1913	2292	2344
RHD1	1775	2156	2434	2320
RHD2	1124	1258	1565	1559
RHD3	1105	1272	2359	2054
RHD4	2025	2259	2247	1944
RHD5	1382	1627	2134	1950
RHD6	1438	1597	1837	1961
RHD7	2041	2156	3579	3597
RHD8	2404	2283	3246	2377
RHD9	2508	3030	2908	2916
RHD10	1420	1469	1554	1701
LHD1	1599	2457	2898	2742
LHD2	1608	1959	1853	2125
LHD3	1458	1868	1635	1498
LHD4	1361	1505	1885	1743
LHD5	1540	1915	1681	1676
LHD6	1510	2046	1985	1800
LHD7	1664	2253	2171	1900
LHD8	2432	2728	2873	2557
LHD9	1184	1297	1510	1424
LHD10	1467	1903	2022	2010

Note: N, normal controls; RHD, right hemisphere damaged; LHD, left hemisphere damaged.

pattern closer to normal than that of the remainder of the group, who consistently exhibited a stress effect for real words only. Finally, within the RHD group the group mean data represented a less adequate reflection of the patterns of performance of each individual. That is, although as a group, no significant RT differences emerged across the CS and IS conditions, only two individual RHD listeners failed to show an influence of stress for each list (list A: RHD4, RHD10; list B: RHD8, RHD9). The remaining participants tended to display a stress effect for real word targets only, similar to the LHD patients. There were no obvious differences across these individuals in terms of etiology, lesion site, or language characteristics.

DISCUSSION

The present investigation examined the role of lexical stress in auditory word recognition by both normal and brain-damaged individuals. The objectives included addressing current hypotheses concerning the cerebral lateralization of prosodic processing and the nature of lexical access in LHD aphasic patients. As will be clear, the findings also address models of the normal word recognition process.

The results of the single word auditory lexical decision task revealed that non-brain-damaged participants are strongly influenced by metrical stress patterns, as reflected in significantly faster lexical decision latencies to correctly stressed targets relative to incorrectly stressed targets. These data are consistent with those of Slowiaczek (1990) that were gathered from young normal subjects, and they support theories of word recognition that incorporate an important role for lexical stress (Cutler & Norris, 1988; Grosjean & Gee, 1987; Mattys & Samuel, 1997). One interesting finding that emerged in the present results that differs from those reported by Slowiaczek (1990) is that in the current study a significant effect of stress was found for both word and nonword targets, whereas in Slowiaczek's (1990) investigation a stress effect emerged only for real word targets. Clearly, a major difference between the studies is the age of the participants – college-aged individuals in Slowiaczek's (1990) study and older individuals in the present investigation (mean age for the NC group = 69 years). A number of previous investigations suggested that elderly normal individuals are more influenced by prosody in language processing than are younger subjects (e.g., Wingfield, Lahar, & Stine, 1989; Wingfield, Wayland, & Stine, 1992). It is therefore possible that the age-matched normal subjects in the current study displayed just such a pattern of increased reliance on prosodic cues; because no young normal group was tested, this claim must remain somewhat speculative. However, if older individuals do rely on prosodic information to provide additional support in decoding a potentially impoverished signal, it is not surprising that the inconsistent stress pattern would affect nonwords, as well as words. Because the older normal participants attempt to reconcile the incoming signal with stored representations, they may take into account all available information (including stress patterns) prior to rejecting a stimulus as a nonword.

Turning to the results for the brain-damaged patients, both the accuracy and RT data yielded interesting findings. Of particular note were the results for the LHD nonfluent aphasic patients, who made a surprisingly large number of errors on the IS word targets, erroneously rejecting these stimuli as nonwords. Evidently, if a stimulus was incorrectly stressed, the LHD patients had difficulty accepting the item as a word. This pattern suggests that the LHD patients were in fact sensitive to the stress cues; the accuracy data further support the hypothesis that the LHD nonfluent aphasic patients require a more precise match than normal to achieve word recognition (see, e.g., Milberg et al., 1988). Such a requirement may be due to overall weakened lexical activation on the part of these patients, rendering it more difficult for word candidates to reach the recognition threshold (e.g., Aydelott Utman & Blumstein, 1995).

With respect to the RT data, two interrelated patterns of interest emerged.

First, in contrast to the findings for the normal controls, a lexical status effect was found for CS targets only. This finding is parallel to the accuracy data just discussed, in that for incorrectly stressed items (IS conditions) the real word stimuli produced patterns just like those of the nonword stimuli. Even when their lexical decisions identified the IS stimuli as words (recall that the RT data were based on correct responses only), the LHD nonfluent aphasic patients' response latencies produced patterns in a manner comparable to that for nonwords.

The second interesting pattern to emerge for the LHD patients was an influence of the stress pattern for real word targets only. These data further support the claim that the LHD patients were sensitive to the lexical stress patterns, and thus that stress played an important role in lexical access for these individuals. The absence of a stress effect for nonword stimuli may again reflect the strong role of lexicality in this patient group. The findings also support the contention that such stress effects are lexically mediated (i.e., due to the activation of metrical patterns associated with lexical representations; e.g., Mattys & Samuel, 1997; Slowiaczek, 1990).

One aspect of the outcome for the LHD patients is initially quite surprising. As noted in the Introduction, LHD patients were frequently shown to display impairments in the identification of words and phrases that are differentiated by stress placement (Baum, 1998; Baum et al., 1982; Emmorey, 1987). These deficits were attributed to the functional lateralization of linguistic prosodic processing to the left hemisphere and/or to the left-lateralized processing of temporal cues to stress (Baum, 1998; Baum et al., 1982; Emmorey, 1987; Van Lancker, 1980). Although the LHD patients in the present investigation did not behave exactly like the non-brain-damaged controls, they appeared to show sensitivity to the lexical stress patterns in the stimuli. The discrepancy between the current results and those of previous studies may be partially due to the nature of the task requirements. That is, most earlier experiments entailed word–picture matching, which requires not only the extraction of prosodic cues but also semantic interpretation of the stimuli. In contrast, in the present investigation the subjects were not required to activate word meaning or map the activated lexical item to a pictorial representation; they simply had to determine whether a lexical candidate matching the incoming stimulus was being activated. It is therefore possible that the LHD patients in previous studies were able to perceive the stress contrasts but not map them onto linguistically significant, meaningful representations in a manner comparable to normals. However, we cannot rule out the possibility that the patients in the present study were somewhat impaired in extracting temporal prosodic cues (as suggested elsewhere, e.g., Baum, 1998; Van Lancker & Sidtis, 1992), but the additional acoustic cues to stress remained salient enough to influence the patients' response patterns. An alternative explanation for the differences across studies is that the lexical stress information in the present investigation is all presumably represented in the lexicon, because single words comprised the stimuli. In many previous studies, at least some of the stimuli required the processing of stress patterns across lexical items (i.e., in noun phrases). The ability to process stress within a word may rely on a different mechanism than the ability to integrate stress patterns across words (to derive a phrasal intonation contour; see, e.g., Baum & Pell, 1999, for a discussion of the notion of processing across different prosodic domains). Regardless of the explanation for the disparate findings, the LHD patients in the current investigation were influenced by the lexical stress patterns, indicating that at least this aspect of prosodic processing may be unaffected by left hemisphere damage.

As a group, the RHD patients exhibited a lexical status effect for both correctly and incorrectly stressed items but no significant influence of lexical stress pattern. These results are surprising in light of the functional load hypothesis of prosodic lateralization (Van Lancker, 1980), which would predict normal performance on this *linguistic* task for RHD subjects. However, it must be pointed out that, despite the absence of a statistically significant stress effect for the group as a whole, 8 of the 10 individual RHD patients did produce lexical decision latencies in keeping with an influence of stress. The individual variability within the group may have precluded the effect from reaching significance in the statistical analyses. Thus, the RHD patients may not be as impaired on this task as an initial review of the statistical data would lead one to think.

It must also be noted that the majority of individual RHD patients who did show an effect of stress did so only for the real word targets (like the LHD patients). Therefore, it is possible that the lexical boundedness described for the LHD patients in this discussion may not be restricted to individuals with LHD, but it may be a function of brain damage more generally. However, one remaining difference between the results for the LHD and RHD groups militates against this interpretation. Specifically, the RHD patients exhibited an effect of lexical status, irrespective of stress pattern (i.e., for both CS and IS conditions), whereas the LHD patients only showed a lexical status effect for CS stimuli. This discrepancy suggests that the LHD patients may indeed require a closer (or exact) match than the RHD patients (and normals) to activate a word candidate and make an accurate lexical decision.

In summary, the results of the current investigation are consistent with word recognition models that highlight the importance of lexical stress (e.g., Cutler & Norris, 1988; Grosjean & Gee, 1987; Mattys & Samuel, 1997; McQueen, Norris, & Cutler, 1994; Norris, McQueen, & Cutler, 1995). The findings further support the hypothesis that LHD nonfluent aphasic patients are less apt to accept an altered or impoverished stimulus as a word, perhaps because of a weak activation of lexical candidates (Aydelott Utman & Blumstein, 1995; Milberg et al., 1988). With regard to theories of the neural substrates for prosodic processing, the results are somewhat equivocal but suggest that the ability to process metrical stress patterns may be largely spared subsequent to either left or right hemisphere damage. Finally, an interesting additional finding (unrelated to the primary goals of the study) supports the claim that normal elderly adults may rely on prosodic cues in language processing to a greater extent than younger individuals (e.g., Wingfield et al., 1989, 1992).

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NOTE

1. In the present investigation, incorrectly stressed words were considered real words requiring a "yes" response on the lexical decision task. However, it should be noted that this assumption is not without controversy in that identification of stress patterns may, in fact, be critical in normal word recognition processes. Nonetheless, for the purposes of the current study, rejecting an IS real word was considered an error.

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