LABORATORY-INDUCED SPEECH ERRORS IN HINDI

MANJARI OHALA

Linguistics Program
San Jose State University
San Jose, California 95192 (USA)

JOHN J. OHALA

Department of Linguistics
University of California
Berkeley, California 94720 (USA)

ABSTRACT

Although speech errors are claimed to be universal, we have observed no naturally-occurring errors in Hindi which break up words. We therefore tried to induce such errors in Hindi speakers using a laboratory method. Subjects saw printed word pairs which appeared in rapid succession and were randomly required to pronounce some of them out loud, occasionally in reverse order. Some trials resulted in errors. Approximately 3% of all trials yielded errors which involved fragmentation of words, considerably less than the 10 to 40% error rate reported for English. The reason for the lower error rate in comparison to other languages remains to be discovered.

INTRODUCTION

Although there has been scientific interest in speech errors for nearly a century, it is only in the past few decades that there has been a virtual explosion of studies by linguists interested in showing how such errors shed light on issues in linguistic theory [1, 2, 3, 4, 5, 6, 7]. There seems to be an implicit claim in much of this literature that speech errors should be found in all languages; Fromkin has made this claim explicitly (personal communication). To date, errors have been reported primarily for Western Indo-European languages, e.g., German [8], Dutch [6], English [5]. We are aware of a collection of Japanese speech errors (S. Hiki, personal communication). This still leaves the vast majority of languages--even language types--unaccounted for. Relevant to this is the impression of the first author of this paper, a native speaker of Hindi, that she has never encountered in her own Hindi speech or that of others speech errors of the type that break up parts of words, e.g., spoonerisms of the sort '...it is kistomary to cuss the bride' (for '...customary to kiss...').

A SKETCH OF HINDI PHONOLOGY

Hindi has a relatively large number of segments: 20 stops (including affricates), 4 fricatives, 9 sonorant consonants--of these 33 consonant types, 25 can be geminate as well--, 11 oral and 10 nasal vowels [9].

Although medial consonant clusters are abundant and quite complex, initial and final clusters tend to be few, especially in native vocabulary, amounting largely to #C + glide- and -st# or -homorganic nasal + stop#, respectively. Most Hindi words range from one to three syllables; four and more syllables per word are uncommon. The prosodic structure of Hindi is controversial and will be discussed further below.

Hindi words, like those of most Indo-European languages, may be morphologically quite complex, showing affixes (both prefixes and suffixes). In a few cases grammatical categories are marked by vowel ablaut.

EXAMINING THE ANECDOTAL EVIDENCE

What is the observation?

As mentioned above, the observation is that speech errors that involve divisions of words or morphemes into fragments (henceforth WF for 'word fragmentation') with, optionally, their rearrangement into 'erroneous' or unintended strings (whether these strings themselves constitute valid words or not) do not occur naturally in Hindi. The types of errors that seem to be relatively easy to find in other languages, e.g., anticipation: "a [mæt]... < a man's natural inclination", perseveration: "John gave the boy" -> "...gave the goy", transposition: "keep a tape" -> "teep a cape" [5].

Observational error?

What are the possibilities that this observation is faulty--that the errors are there but are overlooked for some reason? We believe this is unlikely for the following reasons.

1. The same observer (that is, the first author) has detected many grammatical errors (e.g., lack of concord) in the speech of Hindi speakers, as in / ləkṛi ko pəkəṛ kər kut̪:a ko maro / for /... kut̪:e .../ (literal translation: "stick (postpos.) hold (verb particle) dog (postpos.) beat", free translation: "Take the stick and beat the dog").

Further, this observer has had no trouble observing WF errors made by English-speakers speaking English and even by Hindi-speakers (including the first author herself) when they speak English, e.g., '...crogged freeways < ('clogged freeways').

2. The first author has also asked several other Hindi-speakers, including many trained linguists, if they have observed any speech errors in Hindi (providing them examples from English, if necessary) and their impressions have always coincided with hers: no such errors in Hindi.

It would seem that the anecdotal evidence on the scarcity of Hindi WF speech errors is not marred by observational bias. Nevertheless, as in any issue of this sort, it would be highly desirable to augment our observations with experimental data. Our preliminary attempts to do this are given in the next section.

THE EXPERIMENT

Introduction.

Baars and Motley [1] have introduced a method--with several variants--for obtaining speech errors in abundance in the laboratory (see also [2, 3, 4, 10]). We decided to apply one of these variants to Hindi speakers to see if we could get speech errors in the same way they did. Their method has been applied successfully to speakers of languages other than English [7]. We chose to present stimuli orthographically (using the Devanagari script), requiring the occasional utterance of the stimulus phrases in original or reverse order, and using stimuli which would yield meaningful words if produced with initial consonants reversed.

The method.

A series of two word phrases were presented orthographically one after another to subjects (Ss) for a brief interval. At unpredictable times, Ss were given a signal to pronounce out loud the last phrase that they read (which was then no longer visible). Sometimes the signal required that they pronounce the two words in the same order and at other times in reverse order. Given the pressure of time, etc., Ss were liable to produce some of these spoken trials with speech errors. To present the Hindi words written in Devanagari to our Ss we used a 'memory drum', a device which advances a roll of paper (on which the stimulus words are written) a line at a time, for a controllable interval, such that only one line is visible at any given moment. We presented 145 two word sequences written in black ink with 40 randomly intermixed instructions ('same' and 'reverse') written in red ink to 11 adult male native speakers of Hindi (Indian students at University of California, Berkeley, who could read Devanagari). Ss were paid for their participation. With six Ss the inter-stimulus interval (ISI) was 1.8 second--twice as long as that usually used by Baars and Motley in their studies--but since Devanagari is graphically more complex than the Roman alphabet, this seemed justified. With 4 Ss we used a faster rate of 1.1 ISI. Ss were given 12 stimulus sequences including three instruction words as practice.

The two word sequences occasionally formed what might be construed as a meaningful phrase but generally they did not. The placement of the instruction words and whether they were to repeat the preceding sequence in the same order or the reverse, were randomly placed in the list, except that the instruction words never occurred more than seven trials apart. A portion of the list is given in Table 1, where the items (/sid̲^{h}a/) and (/ɑlṭa /) constitute the directions to repeat the last sequence in the same order or reverse, respectively.

Ss were told that this was part of a memory experiment and were instructed that when the words /sid̲^{h}a/ and /ɑlṭa/ appeared they were to say out loud, in the order indicated, the last two words that they had read. They were told to answer as quickly and as accurately as possible and that they

Table 1. Representative sequence of stimulus word and, where relevant, possible errors due to transposition.

Stimulus		Possible Error	
sal moči	*(year; cobbler)*		
p^{h}əl ǰoṛa	*(fruit; collected)*	ǰəl p^{h}oṛa	*(water; sore)*
ɑlṭa	*(REVERSE)*		
ǰel t̲ali	*(jail; key)*		
čəṛ^h pəla	*(climb; raised)*	pəṛ^h čəla	*(read; went)*
sid̲^{h}a	*(SAME)*		

could earn 25% more if their speed and accuracy exceeded an unspecified threshold. In fact, there was no such criteria and all Ss were paid the 'bonus'.

Ss were seated in a sound-treated room, facing the memory drum. The handwritten Devanagari characters were well illuminated and subtended approximately a .45 degree vertical angle in the Ss' visual field. A microphone was placed approximately 10 cm. from the subject's mouth and positioned in a way so as not to obscure the view of the slit showing the stimuli; responses were recorded on a high-quality analog tape recorder for later analysis.

Results.

Table 2 presents the results in terms of number of successful responses and number of errors, the latter broken down (see indented columns) into no response, ordering error (reversing when not required to, failing to reverse when required to), errors attributable to probable misreading (due to graphical similarity of certain Devanagari symbols), errors attributable to probable intrusion of parts of words presented just prior to the target sequence (and thus more a memory error than a speech production error), ambiguous errors (cause unknown), and WF errors. A representative sample of the WF speech errors is given in Table 3.

Table 2. Correct and Erroneous Responses

Condition:	1.8 sec ISI	1.1 sec ISI	Total
Response Type:			
Correct:	235	103	38 (76.8%)
Errors:	45	57	102 (23.2%)
No Response	8	14	22 (5%)
Failure to follow instructions	8	9	17 (3.8%)
Probable misreading	5	13	18 (4.1%)
Influence of prior stimuli	4	4	8 (1.8%)
Ambiguous	13	9	22 (5%)
Word Fragmentation	7	8	15 (3.4%)

Table 3. Representative speech errors obtained; 'S' = words were to be in same order; 'R' = words were to be in reverse order.

Stimulus	Error
čəṛ^h pəla [S] *(climb; raised)*	čəl pəṛ^{h}a *(go; read)*
d̲er bag [R] *(delay; garden)*	bar d̲eg *(turn; nonsense)*
p^{h}ɛl moṛa [R] *(spread; turned)*	p^{h}oṛa mɛl *(sore (n); dirt)*
kaṭ k^{h}il [R] *(cut; puffed rice)*	k^{h}il k^{h}aṭ *(puffed rice; cot)*
nila ʃap [S] *(blue; curse)*	nali ʃap *(drain (n); curse)*
ḍal mori [S] *(branch; drain (n.))*	ḍar moli *(nonsense; nonsense)*
t̲əlaʃ pal [S] *(search; raise)*	pəlaʃ pal *(type of tree; raise)*

Discussion.

These results show at least that WF speech errors can be induced in speakers of Hindi in spite of the apparent lack of such in naturalistic situations. The rate at which such errors occurred however, 3.4%, or even the 5% for the shorter ISI, is far less than the 10 to 40% reported by Baars [10] and Baars and MacKay [3]. It is possible that lower ISI's would yield a greater error rate (although Baars [10] suggests that the errors are successfully elicited at ISI rates from about .5 to 3 sec) but we believe that the greater graphical complexity of the Devanagari script requires longer ISI in order to allow the stimuli to be accurately read by the Ss. A smaller ISI would no doubt yield an inefficiently high percentage of uninteresting errors (no responses, misreadings, etc.). This lower error rate, vis-a-vis those obtained for experiments involving English, is compatible with the anecdotal observation that WF speech errors are uncommon in Hindi.

The experiment was not designed to and thus did not give any clues as to why Hindi exhibits so few errors of this sort. Furthermore, as noted by Baars and Motley [2] we have no way of knowing whether speech errors elicited experimentally have all the properties of errors produced under natural situations. However, as in previous work with speech errors, whether gathered naturalistically or in the laboratory, the vast majority of errors resulted in real words [4].

The question arises: how can we be sure that what we counted as WF errors were genuine speech errors, i.e., unintended production errors (like typing mistakes) made after the process of correct planning of the lexical sequence and not failures of memory, etc., i.e., errors made before the planning of the lexical sequence? When the error was a nonsense word we can be fairly sure it was a speech error as this is usually defined. However, in other cases there is, in fact, some ambiguity in the interpretation. Baars and Motley [2] answered this question by operationally defining a slip 'as an error of output that systematically violates the target as presented to the subject'. We follow the same practice here but recognize the desirability of refining the notion of 'speech error' in this type of experiment. It might be advisable in future such studies to allow the subjects to indicate somehow when they detect an error in their own response.

GENERAL DISCUSSION

If it can be accepted that WF speech errors are scarce in Hindi, this immediately raises the question: how is Hindi different from other languages whose speakers exhibit numerous errors? We can examine several possibilities:

Tradition of Word Decomposition.

Could it be the case that the Hindi-speaking community has no tradition which involves analysis of words into parts? The answer would seem to be 'no'. Poetic devices (rhyme, alliteration), certain word games, and many regular phonological processes all require speakers to be able to break words up into syllables and phonemes (for details, see [11]).

The Devanagari script.

Could the Devanagari script somehow account for the scarcity of WF errors? It has been demonstrated in psycholinguistic studies with English speakers, that orthography can have a major influence on native speakers' phonological knowledge [12]. One of the 11 Hindi vowels, /ə/, has no overt symbol when forming part of the CV syllable but is an understood part of each consonantal symbol. If this were the general orthographic practice it might suggest that Hindi speakers (if influenced by the script) would be less able to dissociate C from V in CV sequences and thus would be less likely to break up such sequences. However all the other ten vowels are represented overtly and this would imply that the script presents no bar to the native speaker's analysis of words into their phonemic constituents.

Prosody

There is one aspect of Hindi, however, which may be a good candidate to account for its odd behavior with regard to speech errors, namely its prosodic structure. Although it is disputed whether Hindi has stress or not, even those writers who claim it has stress agree that it is much weaker phonetically than in English and plays little role functionally (differentiates few, if any, minimal pairs; see [13]). Research by the first author [13] seems to indicate that in Hindi stress probably only involves pitch, unlike languages like English, German, and Russian, where stress correlates include pitch, duration, intensity, and vowel reduction. Furthermore, rather than being an immutable property of a word, as generally true in English, stress assignment shows considerable mobility in Hindi since more than one phonetically eligible syllable in polysyllabic words (i.e., strong syllables) can receive stress under different circumstances.

The existence of strong word stress seems necessarily to imply some kind of hierarchical structure

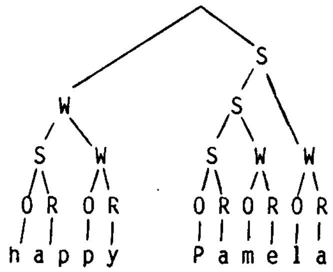

Fig. 1. Hypothetical structure determining stress.

to words and, possibly, phrases, i.e., some structure which clumps syllables into feet, marking one syllable in the clump as dominant (strong) and the others subordinate (weak) [14]. MacKay [15] (and others) have noted that speech errors typically involve segments from the same position in adjacent feet, i.e., syllable initial segments in stressed syllables usually interchange with (or anticipate or perseverate) syllable initial segments in the adjacent stressed syllables, etc. Thus in the phrase 'happy Pamela', with the hierarchical structure indicated in Fig. 1 (where 'S', 'W', 'O' and 'R' stand for 'strong', 'weak', (syllable) 'onset' and (syllable) 'rhyme', respectively), the hypothetical (perhaps improbable) speech error, 'pappy hamela', could occur if the similarly labeled S-nodes /pæ/ and /hæ/ got mixed up but, given the constraints, 'correctly' fitted into eligible positions within the hierarchical structure, i.e., next to low-level W branches.

If stress is not very strong, as is the case in Hindi, such hierarchical structure may either be absent or functionally less important. Then, if speech errors occur primarily at these lower levels of the prosodic hierarchy (one may speculate that this hierarchical structure is cognitively 'costly' and may therefore be more subject to break-down), the lesser salience of this level in Hindi--or its absence--might account for the scarcity of WF speech errors in the language. This, of course, is speculation and needs further investigation.

CONCLUSION

Speech errors which involve breaking up words into parts are scarce in Hindi: they have not yet been observed under naturalistic conditions and occur under laboratory conditions with much less frequency than has been found for comparable studies with English. Hindi, therefore, must be different in some way from those languages exhibiting numerous errors, e.g., English, Dutch, German. A different prosodic structure seems to be a good candidate for the factor giving rise to this difference. This issue is worth pursuing (a) for its typological interest and (b) the light it could shed on the mechanism of speech errors and, in that way, on how speech is produced.

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